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Automotive industries


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CIRCUMSPICE

The AUTOMOBILE

VOL. XXXIV NEW YORK—JANUARY 1, 1916, TO JULY 1, 1916—CHICAGO NOS. 1 TO 26

Index to Volume XXXIV

REGISTRATIONS

MISCELLANEOUS

ROSTRUM

TRADE NEWS

The Class Journal Company

231-241 West 39th Street
NEW YORK CITY

HOW REVIEW PRICE 25 CENTS

The AUTOMOBILE

Vol. XXXIV, No. 1

NEW YORK, JANUARY 6, 1916

Twenty-five cents a copy
Three dollars a year

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MOTOR WORLD

Buy Right.

ONE of the unfortunate features of the handling of accessories by dealers and garagemen is that many of them find themselves stocked up with goods which seem to be unsalable. These include all sorts of things, from rinky-dink attachments to make the car do this or do that to compounds and quack prescriptions that have a bad case of shivers every time they see a blue sky law.

The garageman and dealer has bought unwisely The question of price does not enter into the situation at all. He has been "stuck" by a clever salesman or has let his enthusiasm run away with him. In all probability he has bought from a company of which he knows little or nothing and whose product is in the same class.

The garageman and dealer should be careful. He should stick to goods he is pretty sure he can sell—well-advertised goods— *Motor World, Dec. 1, 1915.*

The Stewart Speedometer is the most widely advertised and fastest selling speedometer made. It is the safest to buy and the easiest to sell.

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Vol. XXXIV New York—Thursday, January 6, 1916—Chicago No. 1

The AUTOMOBILE

Switching Off the Spotlight

For the First Time in Sixteen Years the New York Show Discloses Attention Centered Upon Whole Car Rather Than Upon a Part

By A. Ludlow Clayden

NEW YORK CITY, Jan. 1.—A new régime in automobile shows began last night when the sixteenth annual automobile show was opened in Grand Central Palace. When the doors opened there was ushered in a régime wherein the spotlight, which has dominated all past shows, was switched off.

In the great public spectacles that the development of the automobile has staged since the birth of the twentieth century there have been many acts and many scenes. Through all of these the spotlight has been busy flicking from one mechanical feature to another, from four-cylinder motors to sixes, from bevel drive to eight-cylinder motors, from motors to starters, from starters back again to motors. Each successive annual show had its star performer of the mechanical company, fit subjects for the spotlight, but to-day we have reached a point where the full cast, linked arm in arm, bursts into a general chorus, where each member is singing the same song. The scenic and the physiological effects depend no more upon the principals than upon the supers.

It is no final curtain, the last stage of development, for the last act lies far away, but we have reached a period in the great play that marks an epoch in the making of the story. That this was so needed not the declamation of the show to establish it as fact, but the show itself removes all doubt, all argument. It is the first automobile show in history displaying automobiles acclaimed for what they are and what they will do, instead of for how they are made and for what pieces are used in their construction. In a word, engineering development seems to have reached a stage where it is taken for granted. The buyer need no longer exercise judgment so much as taste.

Engineering Quality High

That the average engineering quality of the chassis exhibited would surpass all previous shows was a foregone conclusion, yet it is surprising how great has been the advance from the high standard set a year ago. In 1915 the critical visitor, admiring the general progress, was ever and anon, brought to a stand before some relic of the past; some clumsy, ill-conceived, ill-executed car. To-day there is scarcely one such to be found on the four floors of the Grand Central Palace show with its 326 cars and chassis on exhibition.

Last year the leaders of development set the standard high, but the followers have made the leap required and the assembled ranks present the most solid front yet seen, not only in America, but in the whole wide world.

It was not in any one particular that the standard was raised. To-day we do not see the limelight on motors, on transmissions or on springs. The perfect automobile is a collection of perfect parts, and all parts are of equally great importance in the ultimate. For the first time, so it seems, this is realized, and it is especially to be noticed that the show visitors exhibit no curiosity about any particular feature. True, there are some new cars that all are anxious to see, there are some stands which are continuously thronged, but the people have gone there to see the *car*—not to see a portion of it.

General view of the central court on the main floor of the sixteenth annual New York automobile show being held in Grand Central Palace. The entire scheme of decoration consists of dark-colored draperies between the dual Corinthian columns which in themselves are a feature of the building. Overhead is a generous hanging of flowers and foliage on the cornices and chandeliers. The exhibits illustrated above bring out the variety of body styles which is a feature of the exhibition. The columns on the second floor are treated in Renaissance figures and pergola effects. The third floor where the accessory exhibits are for the most part situated is designed to give a Japanese garden impression, an idea of this scheme of decoration being given in one of the other illustrations showing this great accessory division with its aisles bordered by exhibits of all sorts

As a sight to attract the eye the show is a good one, but the feeling cannot be avoided that there is a lamentable lack of sensibly colored cars. It cannot be good merchandising to fill a stand with somber black, it does not catch the eye, but is it not equally poor business to use as an attraction some glaring monstrosity of color? The all-black stand the visitor may pass by, at the one with the brilliant car he halts, but he is seldom so impressed from a buying viewpoint as by a stand with two or three different colored cars which are of hues suitable for use. There are more chassis than ever before, mostly finished in a quiet paint which shows them off far better than any other method—actually of the 326 cars fifty-six are stripped chassis— and there is hardly a maker of importance who does not show all detail of his car.

Accessory Field Consolidating

In accessories it is to be observed that those shown are mostly of a more solid character and mostly exhibited by reputable firms. There is a notable absence of cheap devices of the tin can order, which have been prevalent at many former exhibitions—especially, perhaps, is evidence of this settling down process to be noticed in the Ford accessories, most of them being of the really useful sort.

One misses, however, the majority of the leading component makers. Axles and transmissions, clutches and starters are used extensively as selling arguments for the assembled car, and the show provides the opportunity for the manufacturers of these essential parts to show why their names are renowned. The maker of parts derives his success from the public, indirectly if you like, but it is from the public that it comes, and the public is interested in what the parts makers are doing. Ignition is well represented, carburetion well displayed; why not all the other sections of automobile makeup?

Bodies for Every Taste

Apart from generalities, undoubtedly the great feature of the show is the wide choice of bodies. Hardly a manufacturer but has a half dozen styles to choose from; the quality of his chassis established, he has turned to the study of the public's multifarious tastes. Last year one noticed the streamline touring body, the smooth outline, the spacious interior; this year the finest group of touring bodies ever gathered together in America can be seen, yet they do not impress the mind so much as the many other varieties which have grasped places of prominence.

Leaders among the newcomers are. of course, the small four-seated car, the large three-seated body and the inexpensive closed machine. All are easy targets for criticism since all have their faults as well as their virtues. Many a man who sighs for the cosiness of a clover leaf, four-passenger will find it hard to select one wherein cosiness is not obtained at the expense of knee cramp, or where leg room has been fashioned with detriment to the appearance or to some other feature. A few there are that seem well nigh perfect, but as yet it is but a few.

Then with the cheap closed cars. and the convertible types especially, the excellent examples stand out clearly from the rest. These things are natural, they are not noticed at first glance, they appear only on close examination, the faults will vanish in another year; on the whole, so far as the clover-leaf bodies are concerned, it is remarkable that so many good ones have grown up in a single year.

In body quality the greatest variations are to be found among the convertibles, the touring cars that will inclose completely. Of these a few can, when in the closed state, hardly be distinguished from a real closed car; some would be quite indistinguishable when on the street, but others look all of the makeshift that they are, clumsy, ill-designed and badly made. The good examples show what *can* be done. The rapid adaptability of the American manufacturer will soon raise the average to the height of the present peak, and the future of this body style depends entirely upon whether the car owner will treat the convertible body as he does his home, regarding the task of attaching the top much as he looks upon that of getting the furnace into service for the winter.

And here a mild grumble on the fully closed car that is not meant to open, this being that not infrequently the comfort of the interior depends upon the scope remaining *after* the outer lines and form have been fixed. A prettily curving roof may easily so meet the back panel that a passenger can only wear a hat by adopting a crouching attitude. This is very far from being usual, but it is noticeable in a sufficient number of instances to make this comment really deserved.

Folding Seats in Transition

Not so long ago the folding seat of a seven-passenger touring car was always rather in the way, rather ugly and rather liable to rattle. To-day we see many bodies in which the presence of the seat when folded is difficult of detection. Iron bars and brackets lying about the floor or walls of a tonneau are out of place; they do not harmonize with soft upholstery and velvety carpets. A piano would give as sweet music without its polished case, just a bare skeleton of frame and wires, but it would be out of place in a living room. It is now about twelve months since the automobile body designers woke up to this, and how busy they have been is easy to see. As usual some have been successful to a much greater degree than others, but on the whole the congratulations of the public are due unstintedly.

More Rigid Chassis

Hand-in-hand with body development has gone relief of body strains, this being sought by so increasing the strength of the chassis frame that it will protect from injury the more delicate structure that it supports. Deeper and wider sections are the rule, and more frames have been widened so as to bring the side rails almost as far apart as the sides of the body at their widest. This is supposed to prevent racking strains, by broadening the base of body platform, and putting the rear springs beneath the side rail instead of outside it removes some twisting stress. The wide frame is not universal by any means, but it is being largely used in the attempt to overcome the tendency to the development of body squeaks after a long period of use.

Better Springing

Spring mounting has undergone a great change, having, it is obvious, become a study of mechanics instead of an accident of assembly. It is not so much the type of spring as the details of its shape and the brackets which attach it. Engineers have closely studied the forces involved and schemed to meet them to best advantage. The subject is a wide one, far too wide to discuss within the limits of a show review, but it should be noticed by the mechanically intent. In a nutshell, the 1916 car is better balanced.

Not the least remarkable thing is the decreased interest in motors. With the finest selection ever got together before their eyes, the show visitors evince a marked interest in neatness of design, in convenience of arrangement, but far less than last year in the number of cylinders or the main mechanical features. A strikingly designed four attracts as much attention as a twelve, a well constructed six draws a bigger crowd than a poor eight. The thing is impressive only to one who saw the shows of years ago, especially, perhaps, that of last year. Then to have an eight was to block the surrounding aisles all day, but the twelves in the present show, while drawing many, have nothing like the same magnetism. They are, of course, not so new as was the eight a year ago, but the impression persists that there is more than this in it; that no mystery now lurks in multiplicity of cylinders. The V motor of however many cranks and pistons is an accepted thing whose virtues are known and realized just as widely as those of the six or four.

New York Show Statistics

	Grand Cent. Pal. 1916	Grand Cent. Pal. 1915	Grand Cent. Pal. 1914	Garden and Pal. 1913
Total exhibitors	391	317	349	424
Car exhibitors	84	80	78	89
Accessory exhibitors	306	223	259	320
Motorcycle exhibitors	1	..	12	15
GASOLINE CARS (including stripped chassis)				
Two-cylinder	0	0	2	0
Four-cylinder	108	96	132	169
Four-cyl. (piston valve)	0	0	1	0
Four-cyl. (sleeve valve)	8	10	8	6
Six-cylinder	136	105	98	86
Six-cyl. (sleeve valve)	0	1	2	4
Six-cyl. (crescent valve)	0	2	0	0
Six-cyl. (rotary valve)	0	0	1	1
Eight-cylinder	39	7	0	0
Eight-cyl. (sleeve valve)	3	0	0	0
Twelve-cylinder	13	0	6	0
Total	307	221	244	266
TOTAL GASOLINE PASSENGER CARS				
Touring cars	117	124	143	162
Roadsters	77	48	50	49
Demountable top	15	2	0	0
Limousines	11	18	15	23
Berlines	1	2	6	*
Coupés	6	7	17	*19
Sedans	11	6	14	0
Cabriolet	5	4	5	0
Town cars	5	0	0	0
Landaulet	3	1	1	0
Phaeton	0	1	2	1
Brougham	0	4	0	0
Raceabout	**	3	2	2
Total	251	221	264	266
Air-cooled cars	3	3	6	5
Water-cooled cars	248	218	258	261
Total	251	221	264	266
STRIPPED CHASSIS—GASOLINE CARS				
Four-cylinder	19	20	21	27
Four-cyl. (sleeve valve)	3	4	0	0
Six-cylinder	19	26	15	21
Eight-cylinder	8	1	0	0
Eight-cyl. (sleeve valve)	1	0	0	0
Twelve-cylinder	4	0	0	0
Total	54	51	36	48
ELECTRIC CARS AND CHASSIS				
Stripped chassis	2	†	†	†
Coupé	11	1	2	7
Brougham	4	9	13	0
Roadster	1	3	1	3
Cabriolet	1	1	0	0
Town car	0	0	1	0
Limousines	0	1	0	0
Total	19	15	17	10
Grand total cars and chassis on display	326	286	318	325

*Includes cabriolet. **Raceabouts included under roadsters. †Not recorded.

In the making of the automobile, in the changing of it from a mechanical toy to a necessity of civilization, we first sought effectiveness, and it was obtained. Next reliability was the goal, only to be won after years of hard struggle. Then came docility—quietness, flexibility, ease of handling, and to this many years were given. Then came the more petty things which may, when lumped together, come under the head of convenience. Ease of starting, protection against weather, luxury of appointment in all their ramifications come under this classification.

For a time this last became a madness, robbing the car of engineering qualities, adding to it new possibilities for trouble, but now; now we see a proper balance struck. Whatever price we may choose to pay for an automobile we can write the check with confidence that we are buying our full money's worth in automobile service to our desires and expectations.

The spotlight is out for this scene. The footlights are burning at full power, the whole stage, the chorus and the leaders make one great picture complete in itself and dependent upon no single, glittering figure for its effect.

The Year to Come

What is to be read in the show of to-day as an augury of the future? The question is none too easy to answer; it may be that this removal from special prominence of any particular feature of a chassis is but temporary, that next year we shall find the spotlight very much in evidence. But it seems more probable that this will not be the case. To review the past, the earlier things of outstanding remark, such as six-cylinder motors and, afterward, starters, were things that really made for better motoring. Because of the six-cylinder motor we were able to obtain certain refinements at reasonably low cost, because of the starter we were able to increase the comfort and convenience of motoring to a substantial degree.

But the later parts of prominence have been of much smaller actual importance. The eight and twelve-cylinder engines have not made a tithe of the difference that was caused by the starter, and it is difficult to foresee anything which could again break right away from the standard practice of the times. Perhaps a two-stroke motor boom year may be in store for us. Perhaps an electric transmission year is scheduled by the fates, possibly we may even live to see a year in which two wheeled cars will have a vogue, or cars with front wheel drive. Perhaps the gearbox will be abolished for something better, but the greater probability is that development henceforward will be gradual—that we have done with the spotlight.

Above—The first view of the show that every visitor entering the Palace obtains, with Overland and Buick in the best exhibit spaces.

Below—General view of accessory division on fourth floor of Grand Central Palace show. The pillars are inclosed with bamboo matting.

Many New Cars—Few Surprises

While Show Affords First Opportunity for Examining Many New Cars, No Novelty of a Startling Nature Was Reserved Till the Show Was Opened

IF the New York show, 1916, contains less of novelty in chassis design than did its immediate predecessor, there are none the less plenty of interesting new cars to be seen there for the first time. Most of the twelves are new models entirely. There is the Marmon six with its light weight construction and aluminum motor. There is the Moline with the same type of frame as the Marmon and also a motor almost all aluminum. The Hudson Super-Six is the newest of all, perhaps, but the Peerless eight, the Scripps-Booth eight and the Cunningham eight are also cars which have been announced quite recently.

Similarly the Paige company has a new six and there is a new model Case and in fours we have the Briscoe, the Sterling and the S. J. R., the former with a new model, the last two named with entirely new cars. Other companies new to the industry exhibit the Lescina cars and the Sun six, while the one foreign car in the show, the Irish Fergus chassis is especially interesting from the engineering viewpoint. Of this list the majority have been described in THE AUTOMOBILE within the past few months, and redescribed briefly in last week's show number. It remains to add the details of the few which are left outstanding.

Hudson Super-Six Has Unique Motor

THERE has been much speculation as to the details of the new Hudson six, which makes its appearance at the show. Interest especially centers in the motor, which is the first to be built by the Hudson company itself under its own roof, and it is evidently destined to mark a new epoch in Hudson development, for with the same bore and stroke as that of the previous model it develops 80 per cent more power. That is, whereas the Six-40 was considered a good example of six-cylinder practice, delivering a maximum of 42 hp., the new engine with the same displacement of 288.6 cu. in. and the same bore and stroke of 3½ by 5 in., develops a maximum of 76 hp.

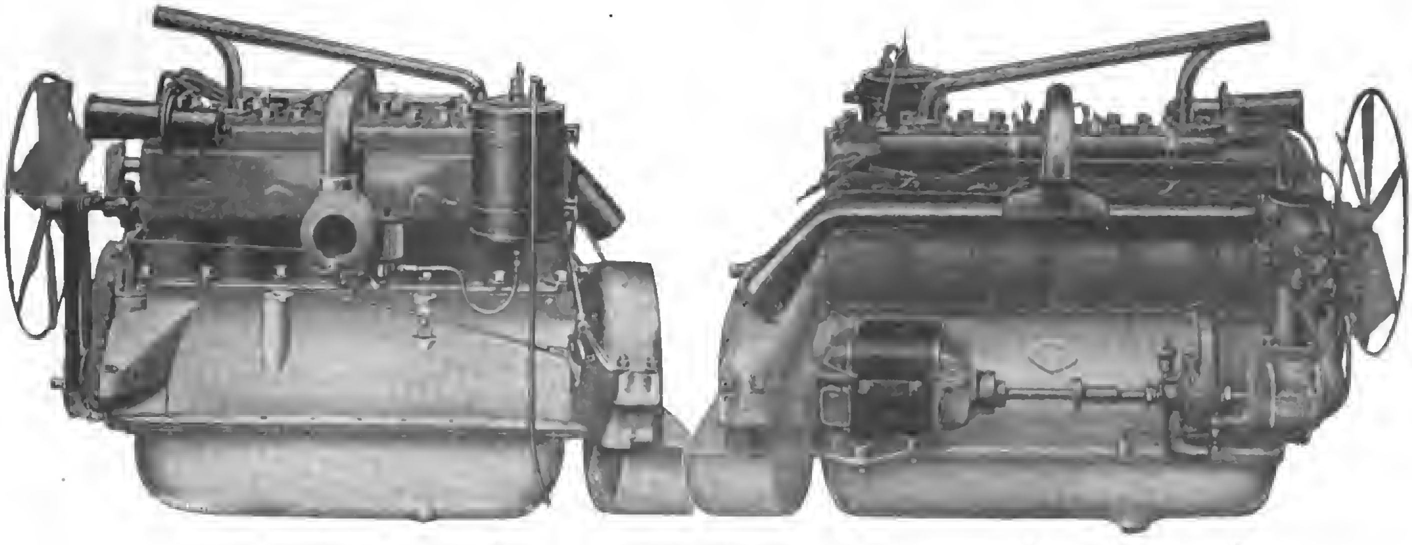
Of course, the engine is a higher-speed type than the previous design, running upwards of 2600 and 3000 r.p.m., this having to do with the added power. The main point of attack seems to have been the crankshaft, and recognizing that vibration has been a limiting factor in high-speed engines, the Hudson engineers set about to get rid of the trouble by revising the shaft construction, the result being a patented system of eliminating vibration so as to get an engine of high mechanical efficiency.

General practice is adhered to throughout the other details of the engine, although, to take care of the higher speed, the valve openings have been increased considerably, and the four crankshaft bearings have been enlarged as compared with those of the Six-40.

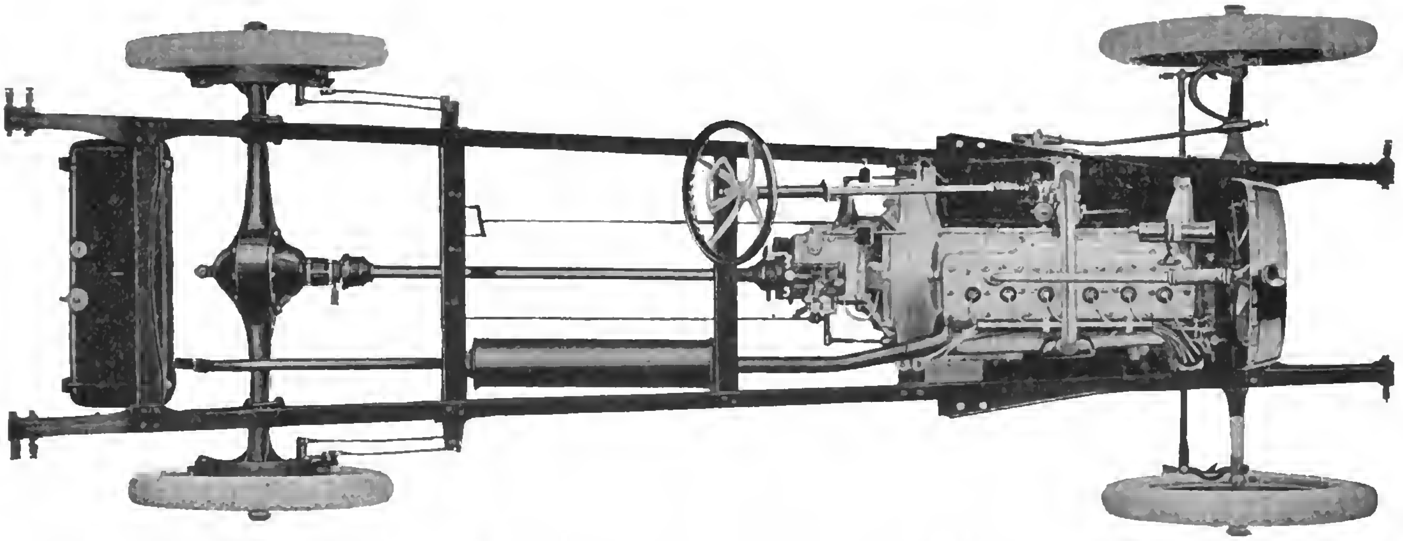
Tests Show Unique Acceleration

That the new designing ideas of the Hudson company have proven fruitful is evidenced from the fact that the new car, under supervision of the A. A. A. has broken all stock car records up to 100 miles, its official weight without passengers, but with tanks full, being 3164 lb. For the hour it covered 75.689 miles with two passengers, and with five passengers and top and windshield up the distance covered was 70.742 miles. The fastest laps of the 2-mile Sheepshead Bay track, where the tests were made, were during the hour trial above referred to, and these laps were both made in 1 min. 33.8 sec., which figures to an average speed of 76.75 m.p.h. These tests therefore give to the new Hudson all the stock car records from 5 to 100 miles for machines with motors of from 231 to 300 cu in., displacement, and they further present it with the hour record regardless of class.

The official A. A. A. report also shows the accelerative possibilities of the car to be remarkably good. From a standing start, the touring model carrying three passengers attained a speed of 60 m.p.h. in 23 sec., and reached a 50 m.p.h. gait in 16.2 sec. Starting from 5 m.p.h. in high gear, it reached 30 m.p.h. in 10 sec. and 50 m.p.h. in 19.4 sec. The chairman of the Committee on Tests of the A. A. A. has



The Hudson motor which develops exceptional power for its size has nothing external to disclose the fact. In the above views the excellent valve accessibility and the peculiar carbureter are well shown



Cleanliness of outline characterizes the Hudson Super-Six chassis. Aft of the motor the 1916 car is very much like the 1915 model, except that the rear end of the frame is shaped somewhat differently

certified that the car used was a stock model in every detail, and it is very evident from the figures above given that the engine is destined to upset many ideas that the maximum horsepower per cubic inch displacement was attained with sixes heretofore produced.

Car Is But Little More Costly

Although the new car is vastly superior to anything before built by Hudson, it sells at about the same price as before in the open models, the figure being $1,375, which is $25 more. There are four attractive closed-body types at figures ranging from $1,675 to $2,500. Body designing has not been lost sight of in the attention that has been paid to the engine, and the body lines are entirely new, departing from the yacht-line idea of the former Six-40. The radiator is higher, and the body lower with more room, especially in the front compartment. As compared with the Six-40, the wheelbase is 2⅛ in. greater, being 125⅛ in. The passengers sit lower in the car, and there is the popular double cowl effect. That is, there is a sort of modified dash, finished the same as the body sides, in place of the seat backs formerly constituting the division between the two compartments, this construction having numerous advantages.

Carbureter Is Hudson Design

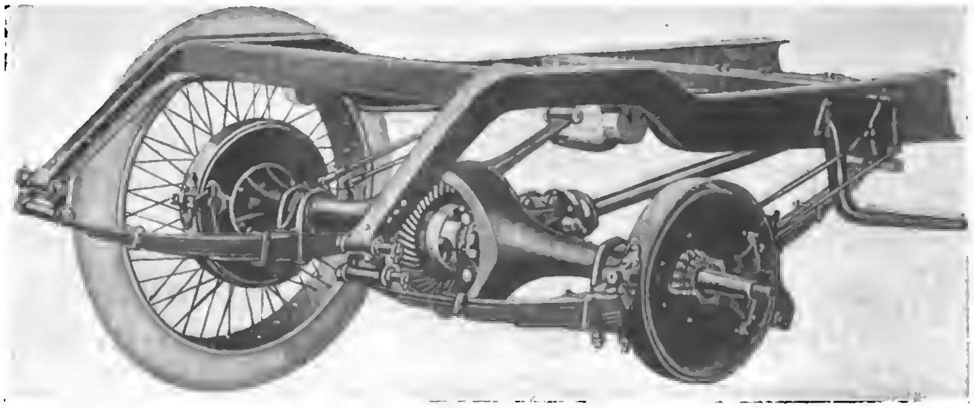
Among the other differences in the car as compared with the previous model are, in addition to the entirely new design of motor, a new carbureter designed by Hudson, which is a type operating pneumatically. The Delco starting and lighting system is new, the gasoline tank is removed from the cowl and located at the rear in connection with Stewart vacuum feed and there is a new rear spring suspension of semi-elliptic type instead of three-quarter elliptic, with a corresponding change in the rear of the frame. Such details as the three-speed gearset in unit with the engine, the multiple-disk clutch and the Hotchkiss type of drive remain practically the same as in the previous model.

Accessibility Is Noteworthy

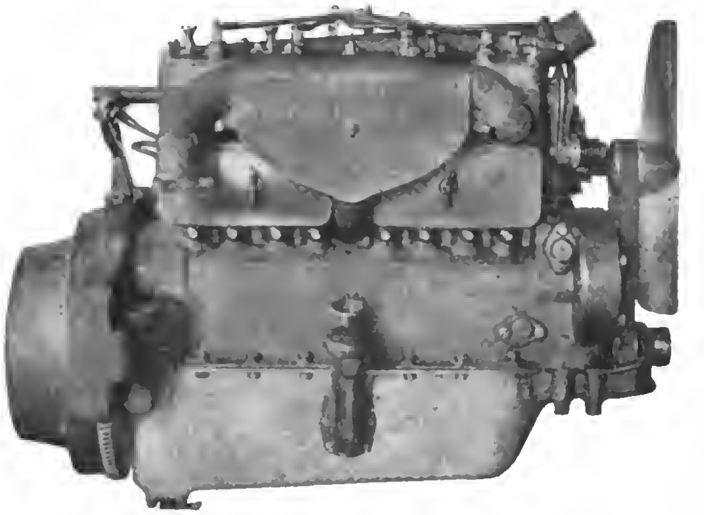
Special attention has been paid to the accessibility of the engine, the arrangement of the units being with this in view. The engine is a conventional L-head poppet valve type in outward appearance, and it has a feature new to Hudson construction in the removable cylinder head, although the usual practice (where the head is detachable) of casting the upper half of the crankcase with the cylinders is not employed. Hudson gives two reasons for the detachable head: it facilitates cylinder casting and gives better cooling which is required by the large valves. It is pointed out that it would not be practicable to use port plugs of a conventional type without sacrificing much valuable cooling efficiency through the increased area of the walls and reduction of the water spaces.

Oiling System New

Naturally, an entirely new oiling system had to be developed for this engine, due to its greater speed and power. This is termed a circulating, constant-level splash arrangement and the capacity is very large, totalling over 3 gal. The reservoir is at the bottom of the engine, the pressed steel pan being quite large, and exposed so as to afford good cooling to the lubricant. The oil pump, mounted at the front of the engine, draws the oil from the reservoir through a screen and delivers it to the front compartment containing the timing gears, and from here it flows into the first oil trough under the first cylinder. The large splasher on the end of the connecting-rod practically empties this trough at every revolution, throwing the oil into suitable channels on the side of the reservoir and crankcase. The upper channels feed the main bearings continuously, and the lower conveys it to No. 2 trough, from which it goes on back suc-



In order to accommodate the long, semi-elliptical springs the ends of the Hudson frame are dropped much lower than usual. This construction interferes very little with the body fitting cessively through the other troughs to the last cylinder, and thence to the reservoir again.



The motor of the most recent Case chassis has the carbureter on the off side, and an extra large muff or hot air collector embraces the exhaust manifold

As the connecting-rod dippers would splash more oil at high speeds than at low, it was necessary to control the stroke of the pump so that the flow might be increased proportionately to cope with the more rapid circulation. To take care of this, the carbureter throttle is interconnected with the pump in such a way as to regulate the pump plunger stroke. The action is simply attained by means of an eccentric and a very large pump plunger. At low speeds the eccentric holds the plunger away from the operating cam, but it allows the plunger to come closer to the cam as the speed increases. Thus the pump has a short stroke when the engine is operating slowly, but when the throttle is opened the stroke is lengthened accordingly.

Water Pump Bolts to Cylinders

In the cooling system, aside from the refinements such as the increasing of the fan diameter and the making of the radiator core and shell separate, there is one especially notable feature. This is the construction of the water pump so as to eliminate any pipes or hose connections between the pump and the cylinder casting. The pump bolts directly to the face of the cylinders and the water passage leading to the jackets is cast integral with the cylinder block. The cylinder outlet connection, with two branches leading from the head, reverts to the brass pipe form so as to insure a certain amount of flexibility and unrestricted water passage, along with quicker repair possibilities than would be obtainable were the water outlet cast as a part of the head.

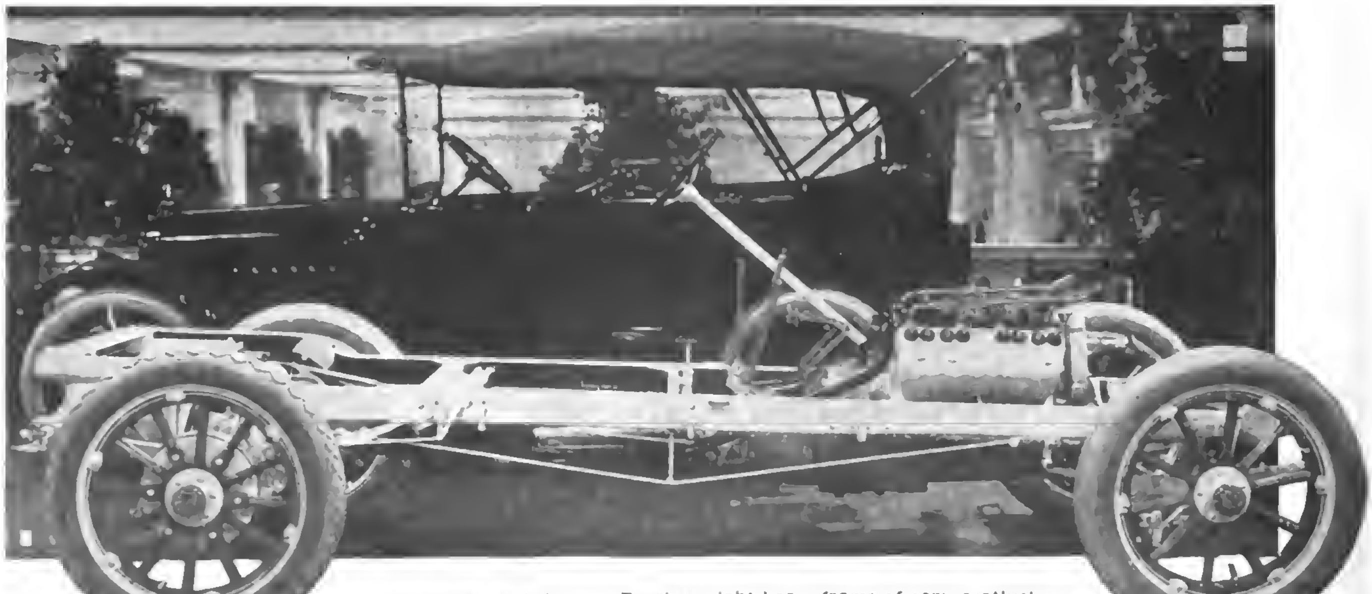
Delco ignition, as well as starting and lighting, is still used, but distributer is placed vertically on the right forward side of the engine and is entirely independent of the motor-generator. There is an automatic governor controlling the operation of the ignition advance, as on Hudson cars for the past 2 years, and by it the manual control is given a spark advance range from full retard to a position which would correspond with firing on dead center under normal road conditions. But from this point on to full advance the spark control is automatic, taking it out of the hands of the driver. The motor-generator occupies the right rear side and is driven from the pump shaft. To facilitate the lining up of the generator, it is piloted in the crankcase supporting arm.

Reverting to the chassis, the characteristic Hudson simplicity is found, and with practically no design alterations in the gearset, the tubular driveshaft or the rear axle with its spiral-bevel gears, the new rear suspension claims special attention. The springs, semi-elliptic in form, are in direct line with the side members and taper toward the front, affording a direct support for the body and frame. It is explained that the half-elliptics are employed because they permit of greater length and that means practically a flat spring which affords great flexibility with minimum weight.

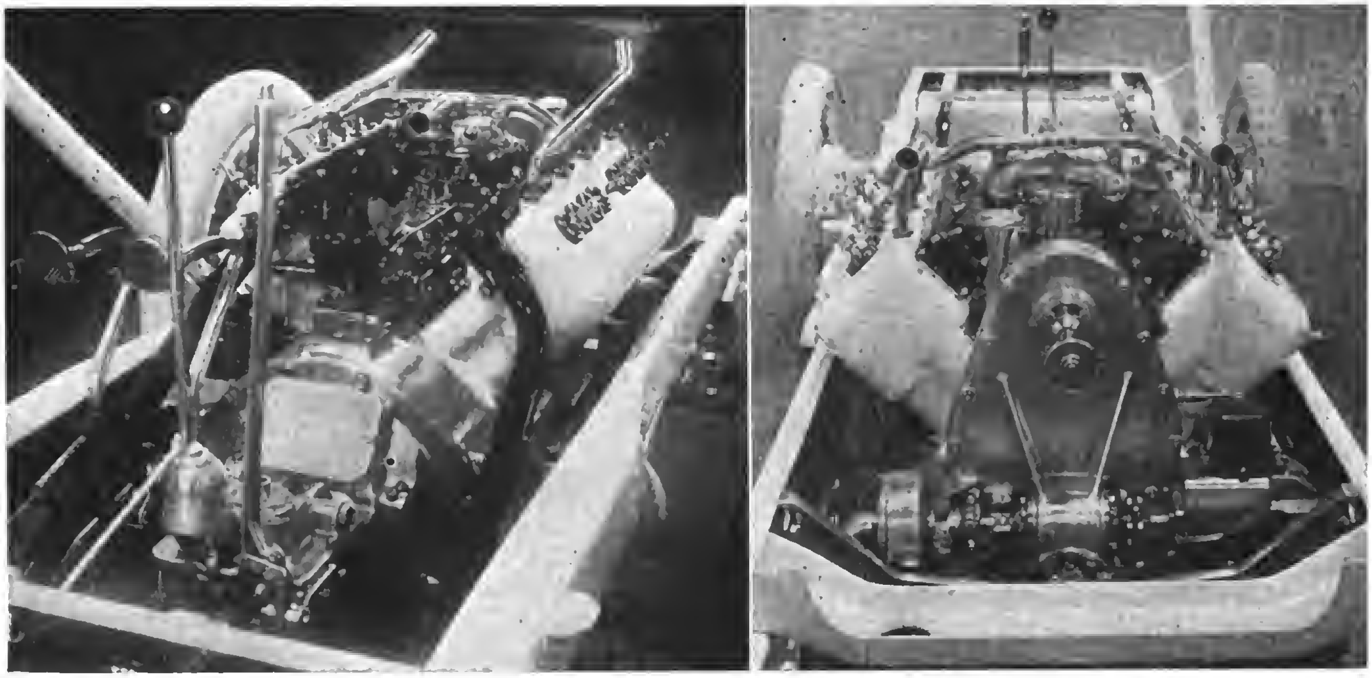
Springs of such length could not be three-quarter elliptic as they would have excessive side sway.

An outward noticeable point is the rearward inclination of the windshield at an angle of about 30 deg. This gives better appearance, reduces the length of the top, and kills reflections. It is also claimed that the vertical shield centers the draft and the dust on the back of the driver's head, whereas the slanting shield seems to carry it over the car, and offers less resistance.

A production of 30,000 of the Super-Sixes is planned for the year, and deliveries have already begun. The name



The chassis of the new Peerless eight has a frame of comparatively light section, the necessary strength being given by a truss rod and post stay bracing. The peculiar water outlet pipe with four branches is shown in this view and it can be seen that each branch attaches to the cylinders adjacent to an exhaust valve.



A noteworthy feature of the Peerless eight motor is the good arrangement of the accessories. The generator and water pump occupy opposite ends of a cross shaft in front, the distributer is well placed at the rear end of the V and the tire pump is at the other end, where it does not interfere with the valves

Super-Six, by the way, has been registered in the patent office.

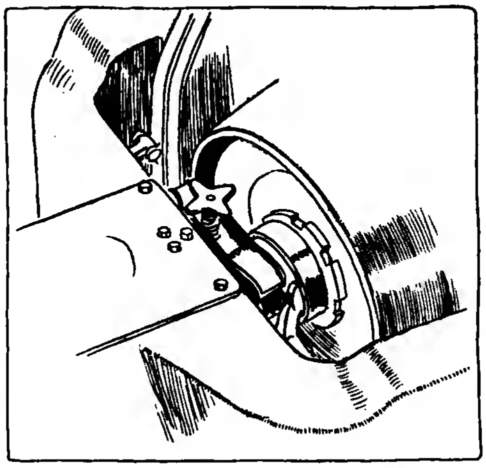
Peerless Is Thorough Design

IN the last issue of THE AUTOMOBILE some general particulars of the new model Peerless were given. It is a 3¼ by 5 in. eight with 125-in. wheelbase and the touring car sells for $1,890. Broadly, the design is not conspicuous for any departures from conventional good engineering, but the detail is worked out with much care and a great deal of skill. The engine is that type of eight in which the cylinders are staggered just enough to permit the use of side-by-side connecting-rod bearings, has a three-bearing crankshaft with exceptional bearing area, and L-head cylinders, its most impressive feature being the spaciousness of everything about it. There is ample room for everything, no accessories are crowded together, and every essential part is really accessible.

In the V is the carbureter, of course, and just in front of it the tire pump, as this is a small enough part not to interfere with the valve tappet accessibility. The pump has a very simple clutch, as its spindle carries a hexagon head and the back end of the fan spindle has a hexagon cup to match.

The oil filler cap stands on the right well to the front of the motor, and the water pump and generator are situated at right and left ends respectively of a cross shaft, which is driven from the crankshaft and lies low across the front end of the crankcase. The cranking motor is on the side of the crankcase, at the right, engaging the flywheel with a Bendix pinion.

The carburetion system is rather interesting, and the instrument itself is a duplex pattern of special design, and feeds into manifolds that are also duplex, there being four ports in each cylinder block which are divided across the center, the upper passage going to the exhaust valves and the lower to the intake. The manifold has thus two parts, the upper for exhaust and the lower for intake, and the gases are kept well warmed without the need for any waterjacket for the intake system. Battery ignition is employed, the distributer being at the rear end of the V on a vertical spindle driven off the camshaft.



Proper functioning of the clutch brake is of great importance for easy gear shifting. The new Case has the hand brake adjustment shown here

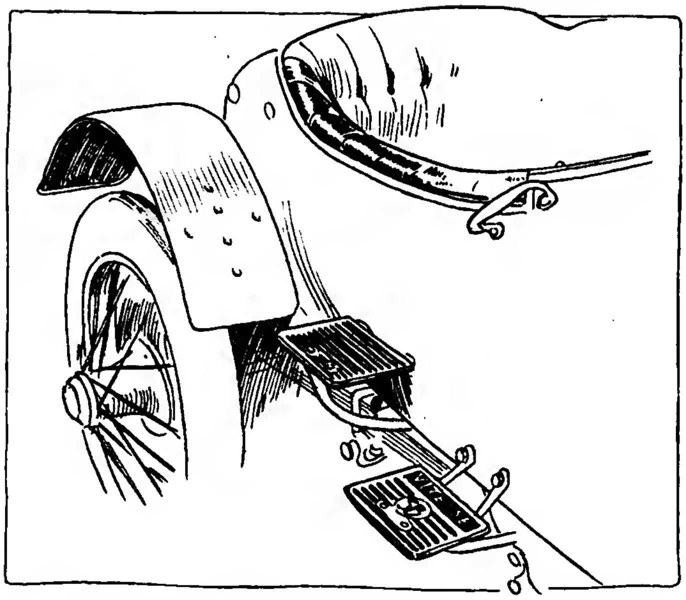
Lubrication is by pressure, all the bearings having a forced feed. Another feature of the power plant, which combines the three-speed gearset, is the remarkably light pedal pressure needed to release the dry disk clutch, since there is a multiplying system of levers between the pedal and the actual clutch striking fork.

Peculiarity is also noticed in the frame of the car, as this is a fairly light section, strengthened by a king post and truss rod on each side. This system of construction gives great strength with little weight, and it is surprising that it has not been used more extensively. The rear axle, with a pressed steel casing and spiral bevel gears, is quite conventional, as is the brakework, but the latter is noteworthy for the care with which the operating rods have been laid out so as to give ample rigidity. None of the pedal pressure is lost anywhere through whip or spring in the connections.

The body of the touring car emphasizes that the car is the product of a firm of repute and long standing. It is an entirely modern type of flush side design but free from any extremes of fashion. As would be expected of a Peerless car, the finish is everywhere thoroughly excellent.

Cunningham Has Fine Body

THE Cunningham eight, designed and built in the parent factory, is the product of a firm who prides itself upon the handsome bodies it can build, and the main feature of the exhibit is a small touring car of unique exterior. There is nothing freakish about the job which is easiest described as a combination of the streamline type with the boat body. All horizontal lines seen in side view are straight, and a light



The body of the Scripps-Booth "Vitesse" model is entered by aluminum steps attached to the side. The passenger has two of these and there is a single one on the driver's side

bead runs from end to end about 5 in. below the top of the side wall. From this point upwards the sides "tumble home" to use the marine expression, that is they are rounded over so that they curve smoothly into the cross section of the front and center cowls. The seats are not divided, but the backs are molded slightly to make a division between driver and passenger, and between the rear seat occupants. Finished in dark, dull gray and with wire wheels the car gives a good impression of power and solidity.

The Cunningham eight-cylinder motor is 4¼ by 5 in., it has detachable cylinder heads and is set rigidly in the frame, the aluminum crankcase having four stout supporting arms. The Brown-Lipe transmission, which is bolted to a bell housing on the motor carries the Westinghouse starting motor on its side and the tire pump is set high up on the fan bracket, so the V is fairly clear of parts and the valve mechanism reasonably accessible. There is a particularly wide center bearing, the cylinder castings being provided with a large waterway between the middle bores, and the oil is put in through fillers located on the heads of the cylinders midway of their length. Altogether the engine is extremely robust and in keeping with the rugged chassis.

The rear axle is a heavy pattern Timken, and is provided with a massive pressed steel torque arm which is anchored to the frame by a short leaf spring, and the frame itself has an exceptional section. Three-quarter rear springs are used. With touring body the price of this new eight is $3,750.

Scripps-Booth Features Bodies

OF the Scripps-Booth eight particulars were given a week ago and the exhibit is designed to feature the complete cars rather than the chassis. The eight is but little larger than the four having the compact Brush-Sterling motor which is the same type as the Ferro and was illustrated by sectional drawings in THE AUTOMOBILE review of 1916 motors of Nov. 4.

Having overhead valves with very simple adjustment for the tappets, the space between the cylinders is not required for any adjusting process, and it therefore serves as an ideal place for the single unit lighting and starting apparatus. The complete eight still looks a quite small car, though a trifle greater in height than the four, and it has the same style of body.

Among the types exhibited there is a particularly striking speed model called the "Vitesse." It is rounded, high sided roadster, with the usual Scripps-Booth staggered seating, and has no doors, a couple of aluminum steps on the side giving access to the seats over the side. With very small mudguards front and rear and no running boards the car has a most rakish look.

Of the other cars, different body styles of less unconventional design are shown, and these differ little from the 1915 type. One alteration is abandonment of the quilted leather finish of the cowl board in favor of the more customary polished wood. In all the car has been improved considerably in both appearance and comfort by changes of small detail.

Haynes Twelve Neat Design

THE Haynes twelve-cylinder engine differs from the six considerably. The crankcase is similar and is interchangeable with that of either six, so far as fitting in the frame is concerned, but the valves are overhead, being operated from a central camshaft and long push rods. Each cylinder block has its valves in a detachable head, and the rocker mechanism is inclosed by aluminum covers, there being four of these in all. Tappet adjustment is on the ends of the rockers and is therefore very easy to make. A Delco distributer and ignition unit of much the same horizontal type as that used on the Packard engine, is mounted at the rear end of the motor, driven off the camshaft and the Leece-Neville generator is in tandem with the water pump on the crankcase side, just as on the Haynes six. The starting motor is located somewhat differently, being provided with a flywheel engagement.

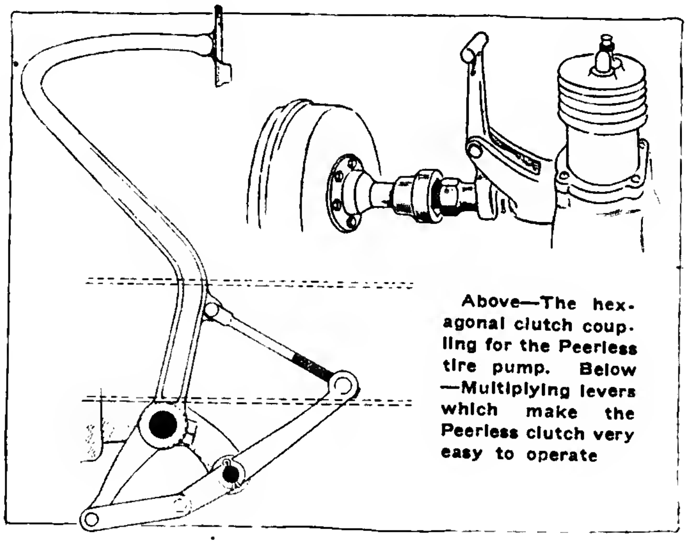
Oiling is by pressure throughout, and the pistons are aluminum alloy, the engine being intended for high speed. With bore of 2¾ and stroke of 5 in., the displacement is 356 cu. in. and the stroke to bore ratio 1.62, much above the average of American practice. The engine can be supplied instead of the six in either of the two Haynes chassis the specifications of the complete cars being otherwise unaffected.

H.A.L. Has Weidely Motor

THE second new twelve at the show is exhibited in touring car form and has the Weidely motor which is precisely similar to the engine as originally made. The body is a spacious seven-passenger type with high, straight sides and the radiator high and narrow with a squarish top, the impression given being distinctly speedy. Full specifications and other details are not yet in sufficiently definite shape to permit a more extended description.

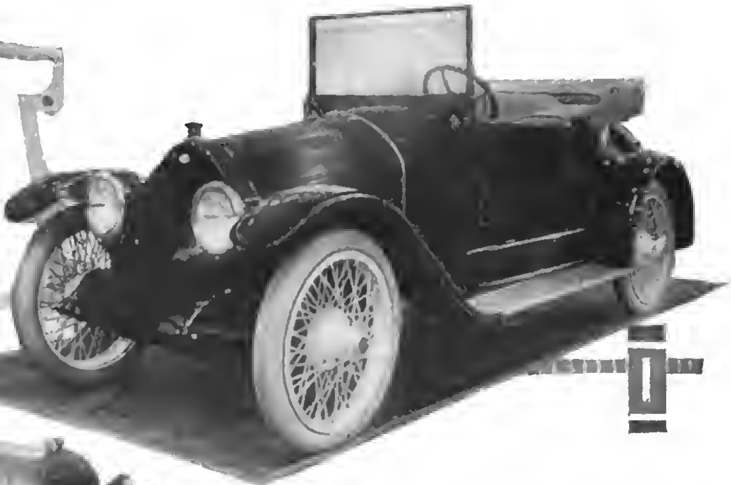
Sun Makes Own Motor

SINCE the announcement of the formation of the Sun company during last summer, a design has been developed, and the model car is shown for the first time. It will be built



Above—The hexagonal clutch coupling for the Peerless tire pump. Below—Multiplying levers which make the Peerless clutch very easy to operate

SAMPLES OF SHOW BODY WORK

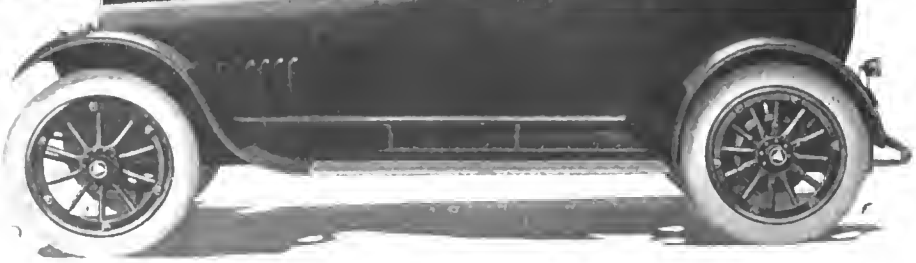


The roadster in which the driver sits slightly forward of one or two passengers who are accommodated side by side is almost as popular as the clover-leaf type. This Mitchell gives a good idea of the neat proportions obtainable

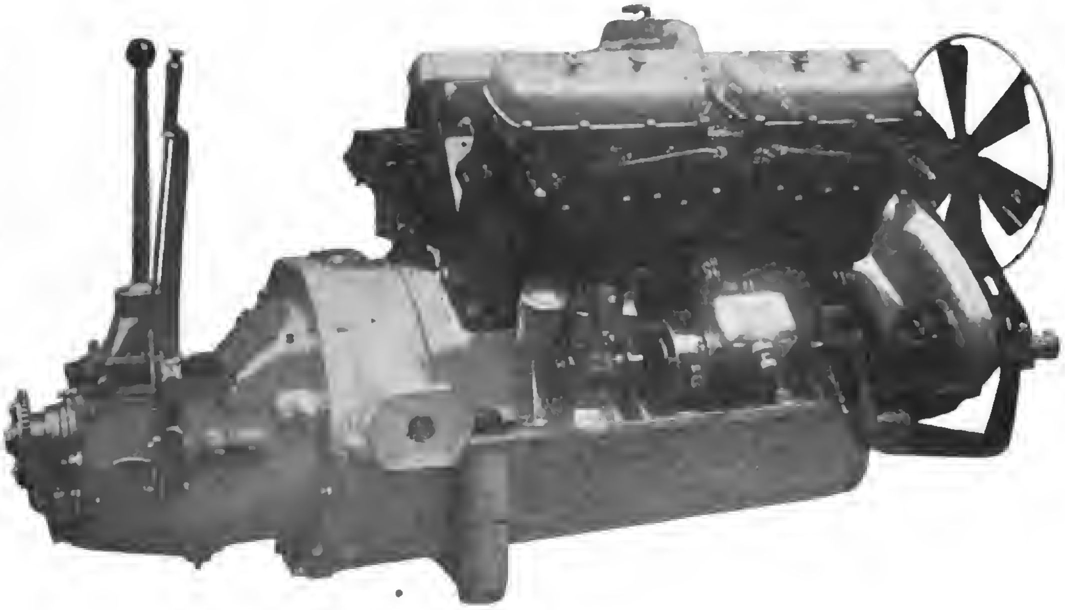
The Cunningham boat-shape body on the new eight-cylinder chassis. Note that the sides of the body are rounded inward at the upper edges so as to bend smoothly into the center cowl

The Scripps-Booth "Vitesse," a much admired speed body in bright yellow coloring. Entrance is obtained by means of the cast aluminum steps on the side

The recent craze for black and white decoration was seized upon by several manufacturers desiring an original finish. This example was one of the best and was exhibited by the Paige company. The paint is dead white, even to the wire wheels



The Hudson Super-Six is shown with several styles of body. This town car is quite typical of modern bodies of its class and is one of the best designed in the show from the combined viewpoints of appearance and comfort



The Haynes twelve is a motor interchangeable with the sixes. It is an extremely neat overhead valve design with a long stroke and small bore. It may be observed that the exhaust manifold discharges into the pipe at its center and not from the end

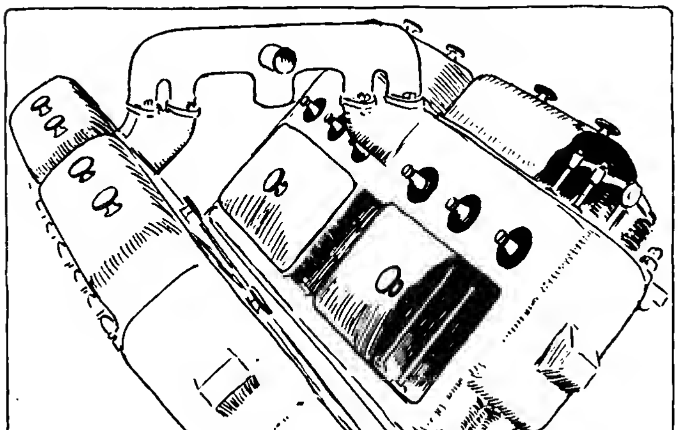
at Elkhart, Ind., and production will commence almost at once. The price of the five-passenger touring car will be under $1,000 but is not yet settled definitely.

The motor is a 3 by 5-in. six made in the Elkhart plant and having several special features. It is a block-cast job with crankcase in unit with the cylinders, and its chief outside peculiarity is that the exhaust manifold discharges into the pipe midway of the cylinders instead of at the end. At the center of the manifold a special part of the casting takes care of the hot air supply to the carbureter, which bolts to the cylinders direct on the opposite side of the block.

For the valves a finger tappet is used, something like that of the small Overland, and all the valve mechanism is thus both inclosed and lubricated. Oiling is by a flywheel system in which the lubricant is forced into the pipes by the centrifugal action of the wheel. It is stated that this motor has the highest compression of any stock motor.

Cooling is thermo-syphon and fuel feed the Stewart vacuum system, while the electrical equipment is to be Remy two-unit, the distributer being mounted in combination with the generator.

Another novelty is the use of a pressed steel "banjo" which is bolted between the crankcase and the gearbox in the middle of the bell housing, the ends of the banjo making the rear motor support on the frame. The rear axle is a floating pattern with pressed steel casing, springs semi-elliptic all around and the tires 34 by 4 in. Production will commence with a neat five-passenger touring car like that exhibited, and a roadster will be added very shortly afterwards.



The Haynes twelve has the valve rockers inclosed by aluminum covers and the push rods are also protected by cover plates of the usual kind. Note the accessibility of the spark plug

Lescina Fours and Sixes

SEVERAL of the Lescina fours and sixes are exhibited, these having been assembled in Chicago, but it is the intention of the company to open a factory in Newark, N. J. The cars will be assembled from good quality components, the precise make of which is not yet settled. The program calls for ten different types of bodies including touring, roadster and clover leaf passenger cars and a light delivery or express wagon. The frames are very wide so as to give the best possible support to the bodies.

The seven-passenger six is listed at $1,212 and the five-passenger four at $888, roadster bodies being alternative at the same prices. Ward Leonard lighting and starting is used.

Sterling Four Very Clean Chassis

SELLING for $595 with roadster equipment the Sterling is a new car in which low cost has been obtained by studied simplicity. The powerplant is a Sterling 3 by 4¼ in., with overhead valves and well lubricated rocker arms. A detachable head gives ready access to the valves.

Carburetion is taken care of by a Zenith instrument which is carried on the right side of the motor. The intake gases flow across the top of the head of the cylinder to the valve openings which are on the opposite side of the head from the intake port. Ignition is by the Wagner battery system in which the current is furnished from the storage battery and the balance of the system is made up of the Wagner distributer mechanism and a high-tension coil. The distributer drive is from the forward end of the timing gears which provides an accessible location. The high-tension coil is mounted on the side of the motor, giving very short connections between the breaker distributer mechanism and the coil.

Splash lubrication is employed, the oil being carried in the bottom half of the crankcase.

The clutch is a leather cone, and the gearset, which has ball bearings, is bolted to the crankcase by two arms that embrace the flywheel. Starting and lighting is performed by a two-unit system, the generator being driven by silent chain, and the motor making engagement by a Bendix pinion.

The frame is very wide, so that the cantilever springs at the rear can be mounted directly beneath it, thus giving direct support to the body. A neat rear axle is employed, this having wide brake drums with two sets of shoes in each, so there is no external brake, both service and emergency being expanding.

Anti-Rattle Devices For Quietness

Many Factors Aid — Coil Springs Popular for Brake Link Support

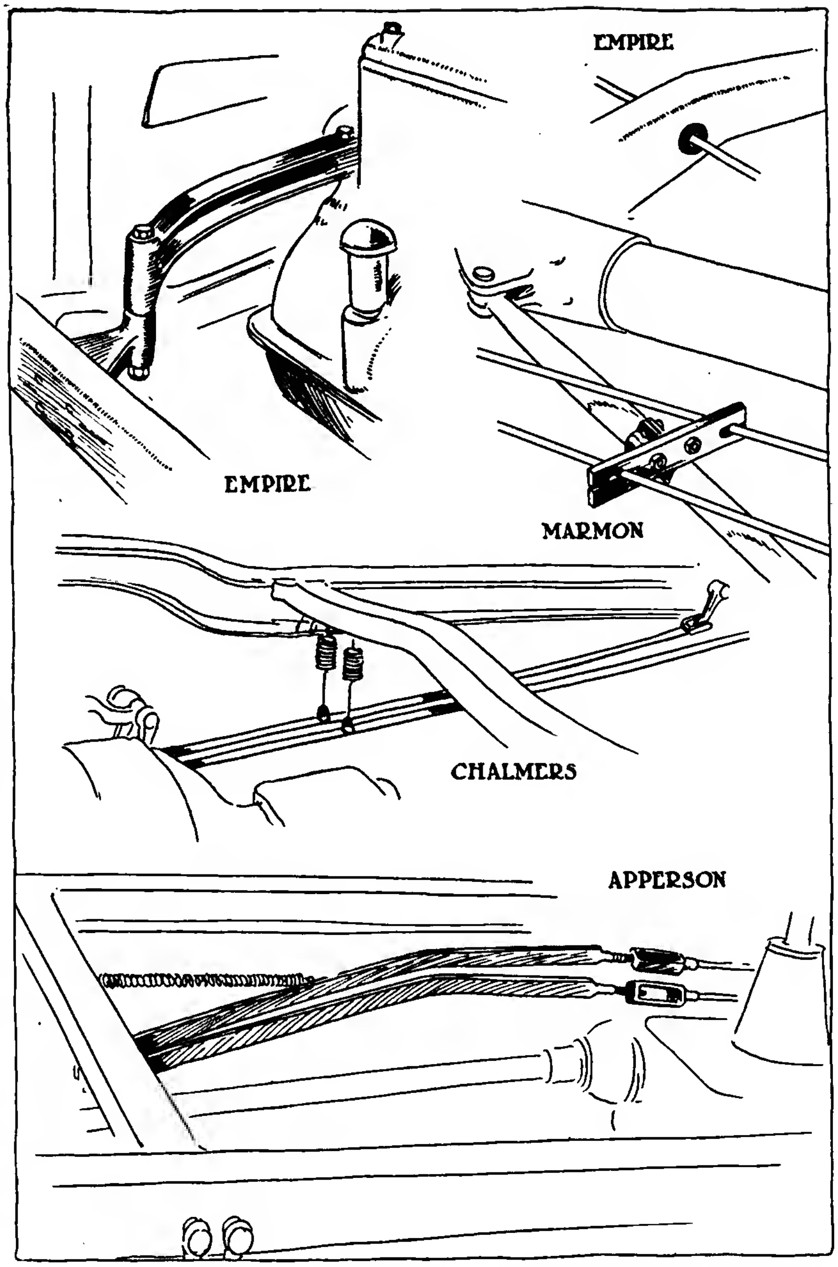
QUIETNESS in the motor would be unavailing unless provisions for quietness are made throughout the entire chassis. A study of the cars at the show reveals the fact that great strides have been made this year in cleaning up the little details which tend to develop rattles after the car has been in use for a time.

The result of this concentration on quietness is that the chassis of 1916 is cleaner than that of 1915, because it has fewer links and material better disposed in every particular. What few links there are are all provided with anti-rattling attachments, generally in the shape of coil springs which are always under tension and which prevent the motion of the car setting up a swinging or vibrating action in the links, causing noise.

Some good examples of how these coil springs have been applied to the links are in the Peerless, Cunningham and Hupmobile chassis. The Peerless makes use of springs which are quite lengthy to hold the brake links from moving while the car is in operation. On the Cunningham eight chassis there are double coil springs on the links.

Rectangular Link Rods

On some of the cars instead of using links and rods of ordinary circular section the sections are rectangular and either carried with the long axis horizontal or vertical. Apperson uses a link of oblong section with the long axis carried vertically, giving a very rigid connection for the brakes and at the same time these are rendered proof against rattling by the installation of very stiff springs. Chalmers has the bar link carried horizontally. The continuous rod which runs from the brake lever directly to the rear axle, where an equalizing attachment is located, is quite popular on many of the 1916 cars. These straight rods either pass backward clear of all the constructional detail on the frames or they may, on the other hand, pass through one of the cross members by means of a hole drilled for the purpose. When the latter method is used the rods are sometimes insulated from the cross member of the frame by a rubber ferrule which prevents the rod from striking against the cross member. In the majority of instances this long rod will pass below the cross member a considerable distance and there is no danger of any clash between the rod and the frame member.



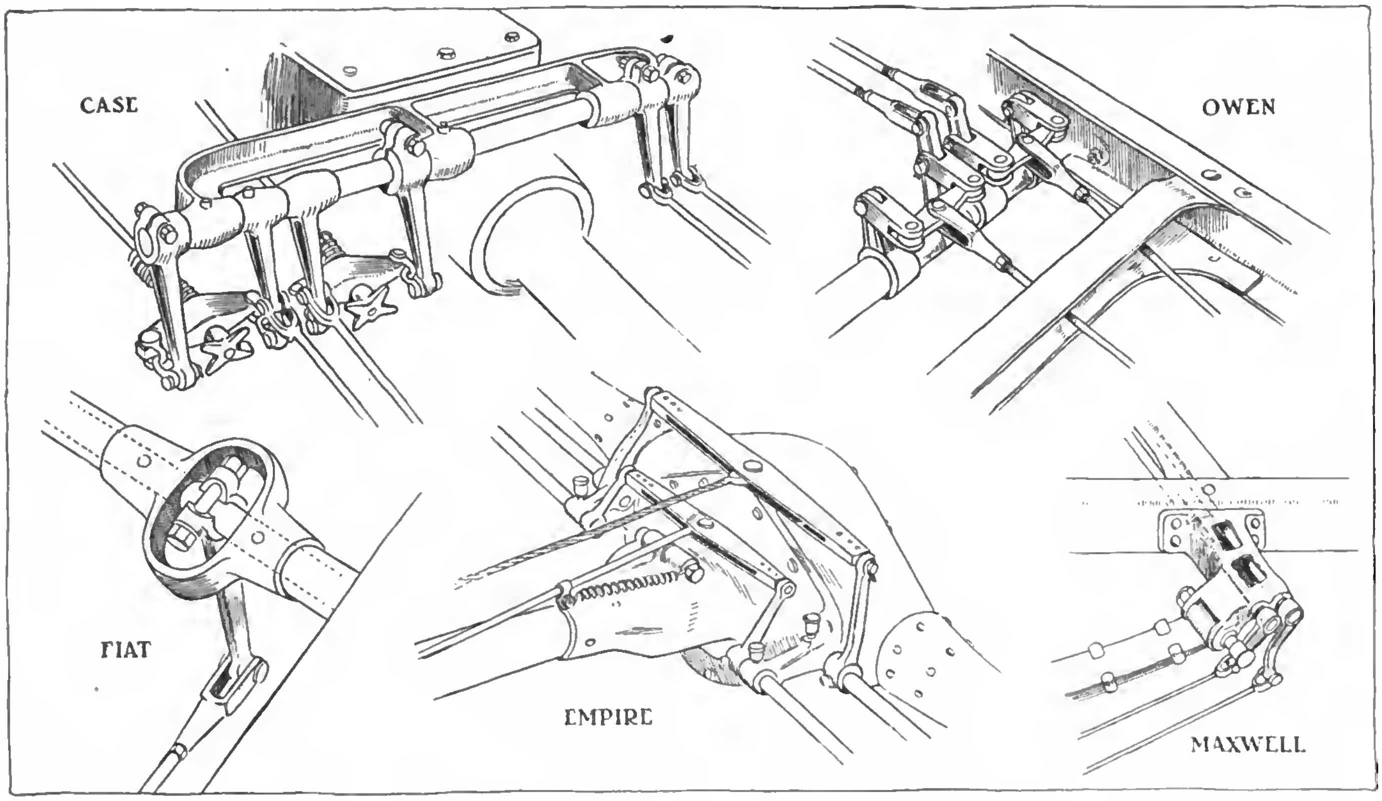
ANTI-RATTLING devices selected at random from miscellaneous cars at the show. The Empire motor support, Empire rubber insulated brake rod, Marmon wiring support, Chalmers coil spring link supports, Apperson rectangular section brake rods with coil spring. These are a few of the means taken to prevent the linkages of the car from developing noise after a few miles of travel.

Rigid Motor Mountings

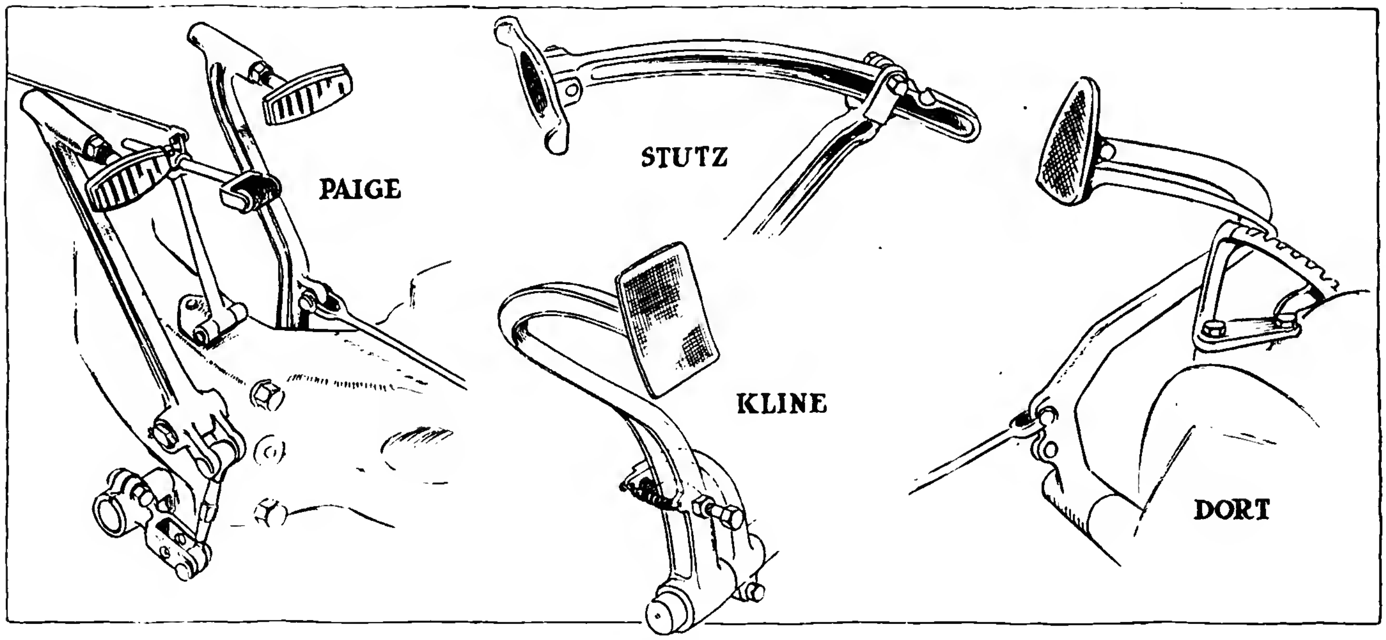
One of the interesting examples where minute detail has been taken care of will be noted on the Velie chassis, where any danger of the gasoline line rattling against the frame or other parts of the car is guarded against by means of small double eye-clips. The double-eye serves a two-fold purpose, one eye taking care of the gasoline line and the other providing a rigid fixture for holding the electric wire conduit in position.

Rigid motor mountings for the rear support, even in the three point suspension jobs, are important in the prevention of squeaks and rattles which are apt to develop if there is any working action between the supporting arms and the frame. The rear support of the motor is quite frequently anchored inside the channel beam on the 1916 cars instead of resting on the upper flange. With the unit power plant the rear supporting arms can be carried back further than on the separate unit jobs.

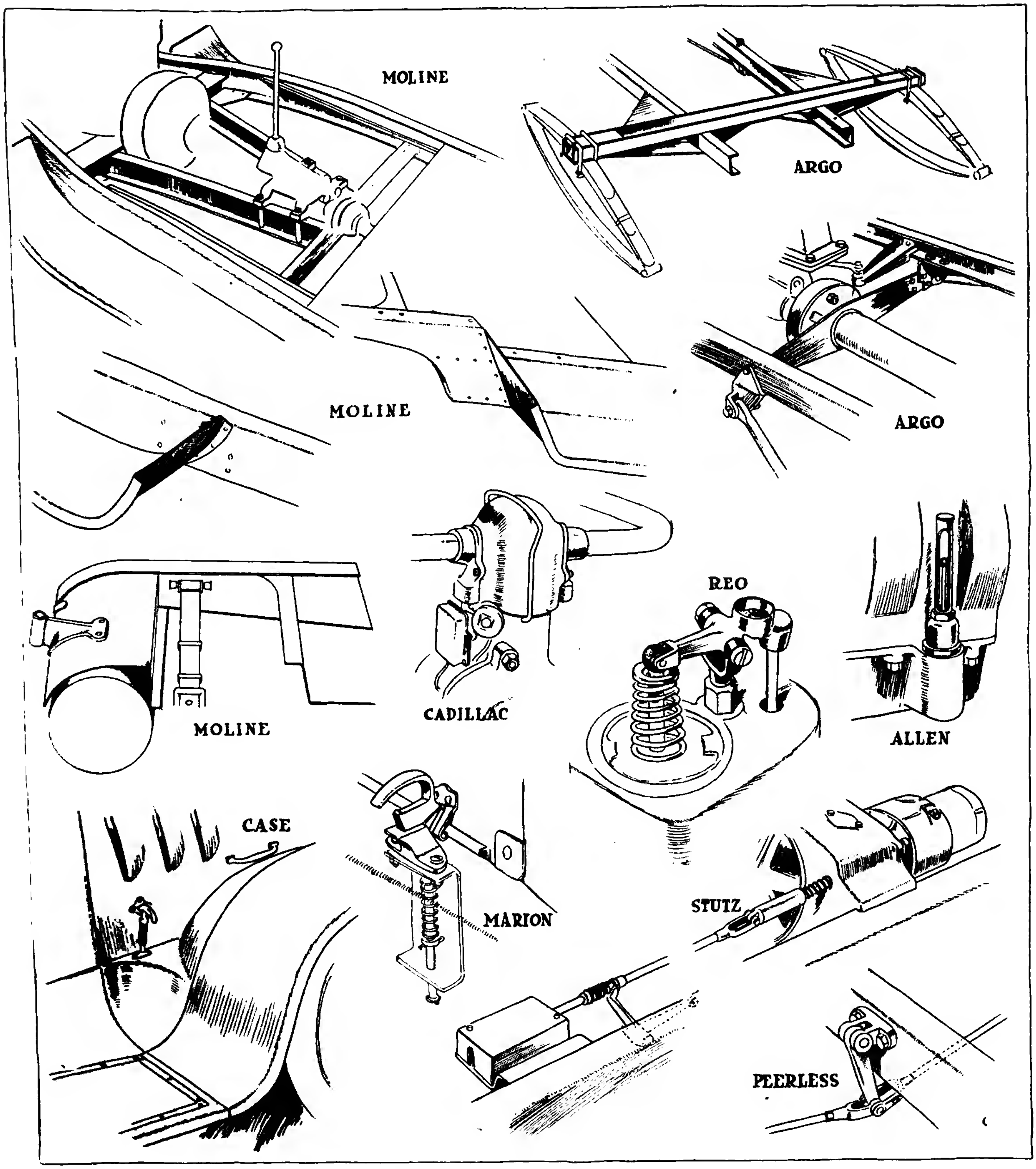
In connection with anti-rattling design the wide frames should be noted. These allow the body to be mounted directly over the side members of the frame and avoid the overhang which is frequently one of the causes of body squeak. The new Marmon car is a good example of this type of construction and the Hupmobile is also wide in the frame to take the body supports directly over the side members. Linings of woven fabric between the chassis and the body are also used to prevent the squeak which develops when the wood sill bears directly against the metallic frame structure.



BESIDES anti-rattle devices on brakework there are many different equalizing mechanisms to be studied. The Case has the equalizer beams mounted on the back of the gearbox, and takes advantage of this position to provide a convenient hand adjustment. Owen has a rather complicated, but efficient assembly on the countershaft. Empire was one of the first to use the rear axle location for the equalizers, and it may be noted that one pull rod and one stranded cable are used. Fiat uses an ingenious method for making the countershaft, the outer tube having a bridge piece to allow the lever from the rod to protrude. Maxwell makes use of the rear spring bracket to carry the brake countershafts, thus eliminating a pair of special brackets that otherwise would be necessary.



IT is customary now to find that a car has an adjustment for the brake and clutch pedals. The brake pedal usually can be set as to position by the forward end brake adjustment. These four sketches show different ways of giving adjustment for the clutch pedal. Paige threads the pedal piece itself and screws it into the end of the lever, and also goes to the trouble of providing an adjustment for the accelerator pedal, this being of a more simple nature. This is a very useful adjustment seldom thought of. Stutz uses a device fully explained by the cut, and this gives a very wide range of position to the pedal. Kline has a particularly neat adjustment, using a set screw and lock nut, the coil spring preventing the pedal from rattling. Dort has an original notion, and effects adjustability by providing a second hole at the bottom of the pedal, into which the brake-rod pin can be put.

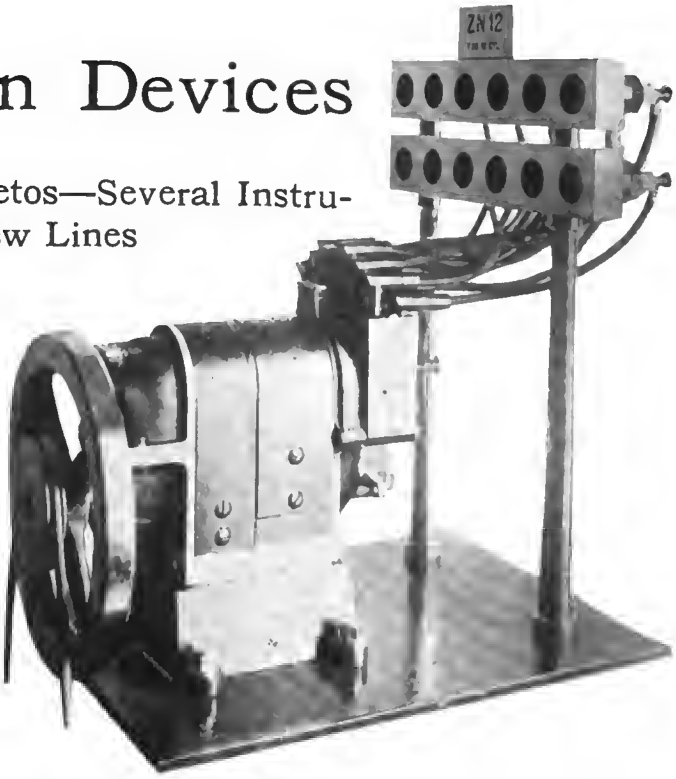


IN these sketches are shown two extremes of frame construction. The little Argo has the narrowest frame ever used, the side rails being parallel and a stout cross member is attached at either end, the full elliptic springs being clipped to the extremities of these cross rails. It is inexpensive, and simple and is quite effective for a small car, though it is difficult to see how such a system could be applied to anything much larger as the bending stresses are considerable. The other cuts show the details of the Moline-Knight frame, which is highly scientific and uses thin sheet steel in peculiar sections. In this the running board is used to provide stiffness to the side rails to which it is riveted.

Other details shown are a dirt excluding cover with a wire clip over the Cadillac distributor, the Allen oil gage, the fiber roller and felt oil pad on the Reo valve rocker, and the link which connects the Stutz starting motor to the switch. The Case sketch is of a strengthener between the fender and frame to prevent rattle, the Peerless shows a means of carrying the brake operation beneath a cross member of the frame and the Marion is of a new hood catch which, by sliding down the wedge shaped socket is self-locking.

Surprises in Ignition Devices

Two New Twelve-Cylinder Type Magnetos—Several Instruments for Eights—Some New Lines



Bosch Z-N 12 magneto for twelve-cylinder cars; new at show

TWELVE-CYLINDER magnetos are the high spots in the ignition exhibits at the show. The Bosch Magneto Co. is showing for the first time the Z-N 12 and also the Z-N 8, which are new designs particularly adapted for twelve- and eight-cylinder motors. The K-W Ignition Co. is also showing a twelve-cylinder magneto, while the Ericsson Magneto Co. is exhibiting a new line of automobile types.

While the Bosch magnetos are entirely new they do not radically depart from previous Bosch design. The distinguishing features are the offset pole pieces and the novel arrangement of the high-tension distributer bridges. The series for eights and twelves is known as the Z-N and it very closely parallels the N-U series in that the current is gathered on a slip ring in the rear of the instrument and carried forward by current bridges. On these instruments there is a double slip ring which in construction resembles the result which would be accomplished by placing two of the regular Bosch slip rings against each other.

Double Distributer Used

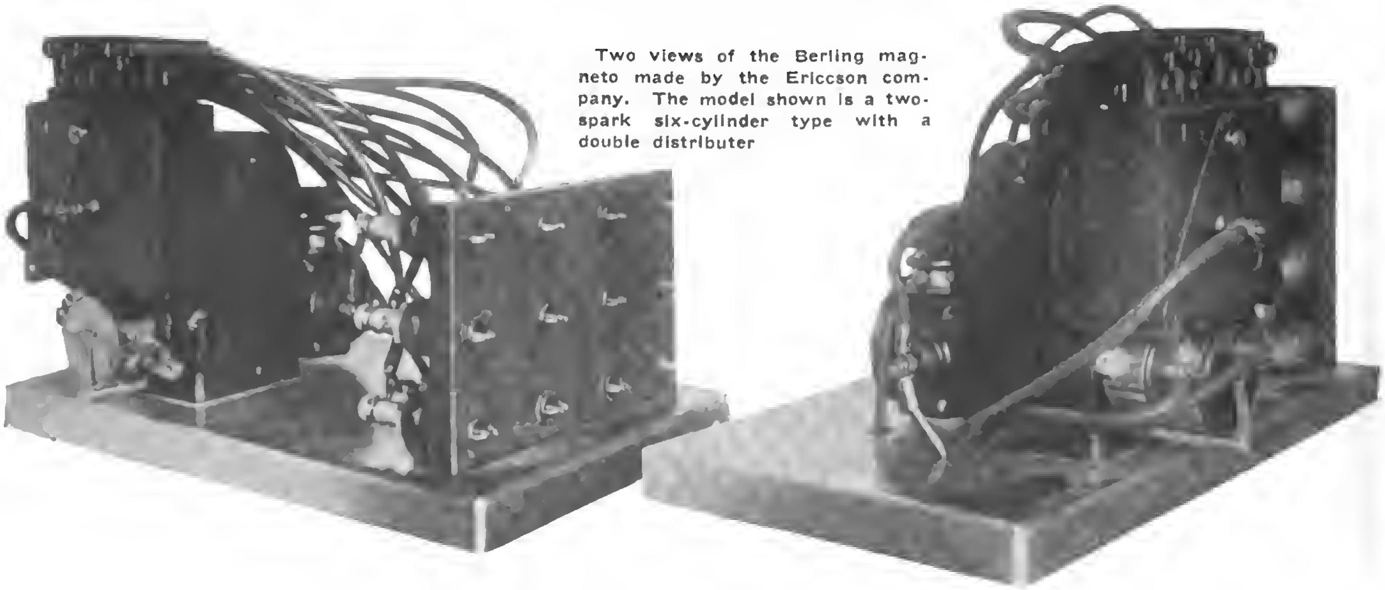
The distributer is double, as it has not been considered feasible to attempt to arrange the twelve distributer points around the circumference of one circle. Two distributer circles are used with the points so disposed that the current is taken alternately from each. In carrying the current from the lip rings to the distributer the forward unit in the slip ring is connected with the high-tension bridge which passes directly through the center of the magneto. The current from the rear slip ring is taken by a cable which passes out around the side of the magneto to the exterior distributer. Of course all this construction is within the magneto unit and is not visible on the exterior.

In order to take care of the current requirements of the twelve-cylinder magneto it is necessary that four sparks be produced in a revolution instead of two, as is ordinarily the case. This result has been accomplished by the use of offset fields, the pole pieces are so arranged that instead of two current waves being created in a revolution there are four, the field being in the form of a cross, so that at each quarter revolution the current attains its maximum. At first glance it might seem as if there was less field area than with the poles arranged to create two sparks in a revolution. This has been offset, however, by the use of higher magnets and the result is that although double the number of sparks are created the intensity of each individual spark is as great as in the previous Bosch models.

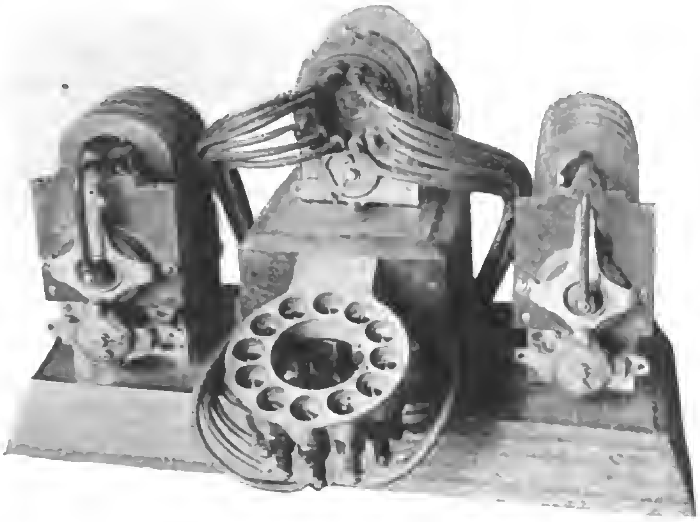
At the Bosch exhibit one of the twelve-cylinder models is shown mounted on a Packard twelve motor by means of a standard fitting which the Bosch company is marketing.

K-W Magneto for Twelves

The K-W magneto for twelves is constructed along the same lines as the larger machines put out by this concern. In producing the ignition requirements for the twelve-cylinder motor four sparks are given in a revolution, due to the use of cross poles. The twelve-cylinder magneto is driven at 1½ times crankshaft speed and the eight-cylinder magneto at engine speed. The visible distributer is one of the interesting points



Two views of the Berling magneto made by the Ericcson company. The model shown is a two-spark six-cylinder type with a double distributer



K-W magneto for twelve-cylinder motors. This is new at the show

of this magneto. The distributer box is provided with a mica cover whch permits of observing the action of the distributer while the magneto is running. This instrument is now manufactured for two-, three-, four-, six-, eight-, ten- and twelve-cylinder engines, and it is provided either with or without the K-W impulse starter as desired. This impulse starter operates on a set figure arrangement which is released when the engine is cranked, giving momentarily a high armature speed to create a good spark for starting.

Heinze Magnetos for Eights

Heinze magnetos are now made in eight-cylinder units under the model name of B-8. With these magnetos two ignition sparks are produced during each revolution of the armature. The eight-cylinder magneto does not vary from the regular Heinze product except in the number of distributer points. The magneto is featured by the round section magnets and the round armature. The object of using the circular construction is to permit of the minimum amount of wire length in the primary and secondary circuits in order to cut down internal resistance.

The Price company is showing a combined ignition, lighting and starting unit which promises to be of interest, as the unit not only includes the lighting outfit and generator parts but also the breaker mechanism, high-tension distributer, coil and condenser. These are combined in a compact unit which weighs comparatively little in consideration of the large number of functions taken care of. As the exhibits are not yet complete, due to the non-arrival of samples which are promised during the week, a complete technical description is not as yet available.

Auxiliary Ignition by Battery

The New York Coil Co., New York City, is showing a battery ignition system which is designed to cause any high-tension magneto to deliver a vibrating spark for starting.

The device consists of a low-tension vibrator coil which is in series with the battery and low-tension circuit of the magneto. The coil is a specially wound mechanically operated device, including a circuit breaker and condenser somewhat resembling a Master vibrator in principle. With this is supplied also a kick switch which when turned to the battery position places six dry cells in series with the vibrator and low-tension winding of the magneto. When the magneto is revolved, to the position where the breaker points on same separate, a rapidly made and broken battery circuit flows through the armature. This induces a vibrating spark in the secondary winding of the magneto and this spark is distributed to the proper cylinder by the regular distributer mechanism of the magneto.

Gives Magneto Advantages

When the switch is turned to the opposite side marked magneto, the magneto operates in the usual manner and is in no way connected to the battery. This gives all the advantages of high-tension magneto ignition.

As the switch is furnished separate, with wires attached, it may be located at the driver's side of dash allowing the vibrator mechanism to be installed on the engine side of the dash in any position or location most convenient.

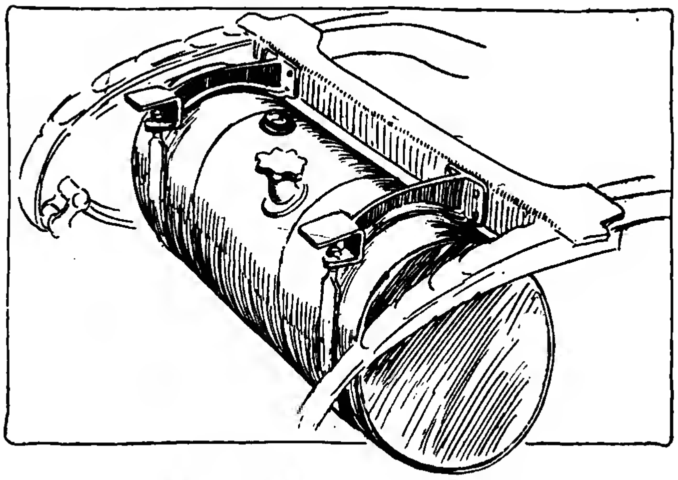
The price of the outfit is $8 and it is especially designed to fill the wants of those who desire easy starting in connection with single magneto ignition.

Circular Gasoline Tanks Increasingly Popular

WITH the coming of vacuum feed and the abolition of the cowl tank we find many low-priced cars with the tank at the rear of the chassis. The tank shaped to fit the frame must necessarily be a special product and costs much more to make than a plain cylindrical tank, while weight for weight the cylindrical pattern should be the stronger. Thus it is noticeable that many of the cars in the show have rear tanks of round section, clipped in stout brackets that are riveted to the end of the frame.

These brackets often serve as tire carriers also, so things are developing toward a sort of "tire and tank assembly" as a unit for frame attachment. If the coming of the round tank continues, and the use of tanks made by specialists increases, as seems likely, the situation offers an opportunity for standardizing work. Tanks at the end of the frame are always a little liable to damage and two or three standard diameters should meet all requirements.

Another advantage of the round tank, is the ease of removing it from the frame. This is a job that is seldom necessary, but when a car has run a whole season it is usually a good thing to clean out the tank so as to remove any accumulated dirt, rust or moisture, and so save the necessity for cleaning out the carbureter from time to time. Old cars are much more liable to suffer from dirt in the carbureter than are new ones, and this is largely because of the gradual deterioration of the inside surfaces of the tank. To clean out a tank efficiently it needs to be shaken thoroughly when partially filled with some cleansing substance and this is much more easily performed with the tank detached.



Marion tank and combined brackets

Valve Accessibility Improved Considerably

Many Factors In Problem

THE accessibility of valves is now less important because they are far less liable to give trouble than used to be the case, but accessibility of tappet adjustment becomes important in direct ratio with increase in motor efficiency. A slack tappet can seriously impair the power output of a motor of the high-speed type. Thus it is natural to find that makers of high-efficiency engines are doing all they can to render the adjustment of a tappet an easy job that can be performed by anyone.

To set a tappet needs usually, two spanners, one to hold the lock nut and the other to turn the tappet till it clears the valve by the right amount, so a fair amount of space in the vicinity of the valve stem is necessary.

Remove Accessories from Valve Side

There is a marked trend toward the removal of accessories from the valve side of the motor, so that removal of the valve inclosing cover lays bare the tappets and the spanners can be got to work without trouble. On the most modern sixes this quality can generally be found, developed to a high pitch of perfection. The V motors, with the exception of those with overhead valves which are the easiest of all to handle, are mostly open to criticism. In but few instances could any man other than an expert mechanic adjust *all* the tappets without first detaching some accessory or other. Usually it is easiest to remove the carbureter, but this generally comes away very easily with the intake manifold. There are some V engines, however, where even this step is not necessary.

The most powerful influence for good on vertical motors, either fours or sixes, has been the trend to the use of the offside mounting for the carbureter which leaves only the exhaust manifold on the valve side.

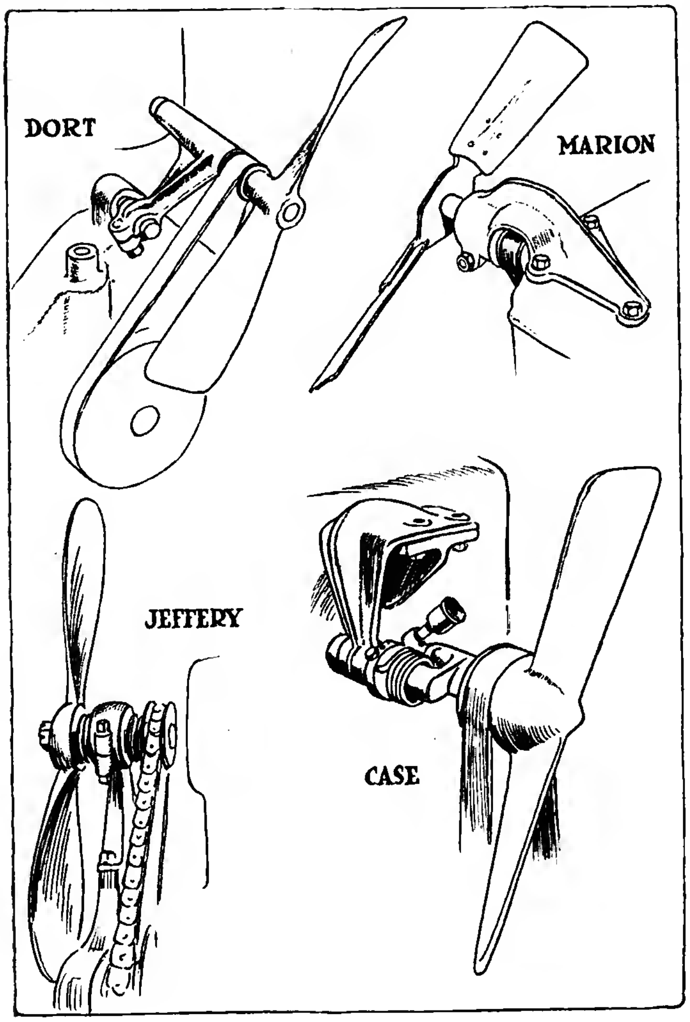
Electrical equipment is being mounted lower than before, and the generators are actually smaller, which reduces the interference that they may create. In very many cases the generator also is on the carbureter side which leaves the valve side completely clear.

The growing importance of keeping tappets well set up brings to the fore consideration of the possiblity of devising something better than the customary set screw and lock nut. It does require some skill to make the adjustment properly however much room may be given, and it ought to be pssible to find some self-locking device that wculd require only one nut to be turned. With overhead valves the simplest setting is obtainable by an adjustment on the fulcrum of the rocker and something similar should be discoverable for the L-head engines.

With Detachable Cylinder Heads

Ease of removing or grinding in the valves is greatest, usually, in detachable head motors and the only criticism that can be levelled against the latter is that some of them seem to have a needless number of nuts and studs. There is a good deal of difference in practice in this respect, but the minimum number that will serve is the best from the car owner's viewpoint.

It is noteworthy that few manufacturers consider it worth while to break the detachable head of a six-cylinder motor into two portions, the block head generally going with the block casting, but the owner is rather inclined to prefer handling the divided type as the ease of making a proper joint is certainly greater when the head does not cover more than three cylinders. Still, the block head is simpler, and it is also better from the point of view of proper water circulation and cooling, so the makers are probably right in their preference.



Two Blade Fans in Vogue

Many New Examples at Show

THE number of cars at the show with two bladed fans is quite remarkable, considering the comparative rarity of this type a year ago. A fan with two blades, properly made, will draw more air than any other type, but the cheap construction given by the pressed steel fan with four blades or more seemed till recently as though it would drive the more efficient pattern from the field.

The four examples of two-blade fans shown in the accompanying illustration have been picked at random as showing the difference in makers' ideas. The Dort design is a simple aluminum casting with thin blades and not a very steep pitch which remarks apply with equal force to the Jeffery fan. The Case, on the other hand, has very wide blades of an extremely steep pitch, and must be capable of creating a perfect gale of wind. The steel blade, which is practically as effective for automobile purposes and is less costly, is seen in two blade form on the Marion. It is not quite so pretty in appearance as the aluminum type, but the latter has no advantage on the score of weight.

How Many Horsepower to Run a Fan?

It would be interesting to make careful experiments as to the amount of power required to drive some of the bigger fans, at the high speeds to which they are geared to run. There are a few examples which, if the detail shape of the blades is correct to aeroplane practice, must easily need 4 or 5 hp. at a couple of thousand revolutions per minute.

S. A. E. Debates Important Matters

Annual General Meeting of the Society Elects Russell Huff President for 1916—Members to Discuss Papers on Magneto Versus Battery, on Steel and on Electrical Equipment—Many New Standards Adopted

WITHOUT doubt the great attraction of the S. A. E. meeting this year is the argument staged for Thursday, Jan. 6, when the opposing factions will take the floor in debate on the momentous questions arising from different ignition systems.

It is a triangular duel that has been arranged, between magneto, closed circuit battery and open circuit battery. The papers are given by Francis B. Hoyt for the magneto, Frank Conrad and Alexander Churchward figuring as protagonists of the battery.

Another paper of equally great importance, though more deeply scientific is by Dr. Unger on the sulphur content in steel.

Joseph Bijur will also deal with the electrical equipment of another sort, taking as his sphere the construction of lighting and starting apparatus, and Henry Schroeder will describe the design and manufacture of small electric lamps. Abstracts of these first four papers are to be found hereunder and the discussions of all the papers will be given fully in the next issue of THE AUTOMOBILE.

Standards Committee Active

During the whole of Monday, Jan 3, sundry of the standard divisions met and finally discussed their reports to be presented to the full Standards Committee meeting to be held next day. On Tuesday morning proceedings commenced in the Society's offices and the report of the day's work is given on page 21.

Ignition Papers Controversial

The discussion on the ignition question is sure to be very hot indeed, and to give a fair view of the leading off position it is better to review the three papers than to publish them in full previous to the discussion, which it is to be hoped will be successful in actually settling some part of this vexed question.

The Magneto Argument

Mr. Hoyt has prepared the longest of the three papers, and he gives a summary at the end which may be quoted.

For the best results the spark in an engine cylinder must occur at a time depending on the speed with which the gas can burn.

Spark advance, while necessary, is often (though inefficiently) used as a substitute for spark heat.

The unavoidable errors nearly always present in spark timing can be compensated for to a great extent by increasing the spark heat.

The open circuit battery system relies entirely on spark advance for meeting varying engine conditions.

In the closed circuit battery system the spark grows weaker as the speed increases, which is wrong.

The larger the spark the faster the flame spread and the greater the efficiency.

A prolonged spark is necessary for advanced positions owing to vapor variations in the cylinder.

The magneto spark, increasing in intensity with the speed, is directly suitable to the requirements of an engine.”

Russell Huff

Russell Huff, president-elect of the Society of Automobile Engineers, is chief engineer of Dodge Bros., which position he assumed Nov. 1, 1915. Previous to that date President Huff was connected with the engineering department of the Packard Motor Car Co. It was on June 25, 1900, that he associated himself with the Packard organization in the drafting department. In 1905 he became chief engineer of the Packard organization. In 1907 he joined the Society of Automobile Engineers and since that time has been one of the active members both in general policy work and also in committee work. He was vice-president in 1913. Previous to his active connection with the S. A. E. work, President Huff was lending his best efforts to the mechanical department of the Association of Licensed Automobile Manufacturers, which maintained an experimental and testing laboratory at Hartford, Conn. President Huff has several thoughts in mind for his terms as president, one being increasing the membership very materially; another is the encouragement of an engineering digest of American and foreign literature; and the third is devoting more attention to the finances of the society.

Battery Viewpoint Is Different

Such statements cannot go unanswered, but neither Mr. Conrad nor Mr. Churchward have made positive statements in their papers which can be used as answers to the accusations made by Mr. Hoyt. Both have tackled the subject from somewhat different angles. The former author states positively that the long enduring spark has no value, because directly the small body of gas surrounding the spark plug points has been burnt any continuance of sparking can have no effect upon the rest of the gas in the charge. He also states that a shortcoming of the magneto is that the voltage of the spark is limited, whereas the battery spark can be of any voltage desired.

Broadly the view taken by the two battery protagonists is that the remarkable success of the magneto compared with that of early battery systems lay in the superiority of magneto breaker mechanism. That to-day the battery systems have improved breakers till they equal or excell those of the magnetos. In other words that the battery ignition has been brought to perfection by following mechanical development rather than electrical.

Taking a quick impression from the

three papers a study of the many diagrams and photographs of sparks taken with elaborate scientific instruments suggests that the battery ignition spark can be made to do pretty much the same as the magneto spark except to last longer and longer as the speed increases. That there will be a very hot discussion goes without saying, and it is impossible to even guess what way the feeling of the meeting will trend. The three papers are each able expositions of different aspects of the electricity and the mechanics of ignition, yet they cannot all three be right in their conclusions. Perhaps the discussion will enable the balance to be struck, and if it does those who take part will have reason to be proud of having aided to settle the most burning question of the day.

Sulphur Content May Be Raised

Tests Show Open-Hearth Steel Little Affected by Reducing Sulphur Below 0.1 Per Cent.

By Dr. J. S. Unger*

THAT the sulphur content of basic open-hearth steels has been given a fictitious importance is the opinion of so great an authority as the author of this paper. It is Dr. Unger's contention that if sulphur is held down to 0.1 per cent that is low enough for all purposes for which basic open-hearth steel is commonly employed. To test his theory Dr. Unger had a series of steels prepared, containing various amounts of sulphur from 0.025 up to well over 0.2 per cent. These steels were manufactured in the ordinary way and from them many sorts of articles were made by ordinary processes, the idea being to not only test the strength of the steel as first made, but to test it after it was in the finished form. All sorts of things from sheet steel stove pipes to automobile crankshafts were made and in a fairly lengthy paper Dr. Unger tells what happened to the various steels in manufacture of the sample parts and in the testing machine afterward.

The results go to prove that the results are not noticeably improved in any way by cutting down the sulphur below 0.1 per cent. Below is the introduction to the paper which explains Dr. Unger's ideas, which was followed by an account of the detail adopted in making the steels and finally, a series of tests are quoted with their results. Of these, one table, characteristic of the whole, is given below.

Introduction to Paper

During the last fifteen years the proportional tonnages of steel manufactured by the Bessemer and open-hearth processes have undergone a great change. During 1900 about 65 per cent of the total tonnage of steel made was Bessemer and 34 per cent open-hearth. In 1914 about 26 per cent was Bessemer and 73 per cent open-hearth. Of the latter 94 per cent was made by the basic process.

As the low phosphorus ores became scarcer, higher phosphorus ores supplanted them. The latter produced a pig iron too high in phosphorus to be used in the acid Bessemer process; consequently the basic open-hearth process, with its attendant purification, grew rapidly.

Wherever Bessemer steel has been used, the sulphur content has varied from 0.050 to 0.080 per cent, or even higher, depending on whether the iron was used direct from the blast furnace or remelted in a cupola. Millions of tons of Bessemer steel, containing an average of 0.070 sulphur, have been used for almost every purpose. The greater part of such steel is still in service, giving an excellent account of itself, and furnishing us with the best possible evidence that steel may contain a reasonable amount of sulphur without being injured in quality.

With the advent of basic open hearth steel the consumer found that from 0.040 to 0.050 per cent sulphur, or about two-thirds that of the Bessemer, was the usual sulphur content of such steel. Believing that high sulphur always indicated that the steel was bad, he naturally insisted on the lower limit, or below 0.040 per cent sulphur in his steel.

Sulphur in steel, whether justly or unjustly, is in many cases held responsible for the bad working of steel. As a result the specifications covering the allowable amount of this element have been gradually lowered until in certain cases below 0.030 per cent is the limit demanded. It is very difficult to reach this limit by the basic open hearth process, and when reached there is a grave doubt in the minds of many whether the quality of the steel has not suffered by the excessive purification required to produce such results.

It became almost the universal practice when steel showed a tendency to work badly or become red short to make an analysis of the steel. If this analysis indicated that the steel had the proper or permissible amounts of the usual elements but happened to be a few thousandths of a per cent higher than the permissible amount of sulphur, the sulphur was held responsible for the trouble. Such decisions are made without considering other causes occurring in the manufacture of the steel; such as the heating and rolling and subsequent operations in working it up into a finished product.

The manufacture of steel in quantities of several tons at one time began when the Bessemer process was introduced about fifty years ago. Chemical analyses at that time were crude, or not made at all. Failures due to poor raw material or improper metallurgical treatment were common. Sulphur was largely blamed for such results, and a strong prejudice against it was established. This belief was handed down from one person to another. Rarely has it been questioned, nor have many efforts been made to establish the truth, until at the present time few are ready to believe that Sulphur up to a reasonable amount, say under 0.100 per cent, does not affect or at the most only slightly influences the working properties during manufacture, or the quality of the finished steel.

Effect of Low Sulphur on Steel

Some steel making processes have been brought forward which produce a steel lower in sulphur than the basic open-hearth process, but where the author has had an opportunity to compare such steel with open-hearth steel having the same physical properties, no difference could be detected in the surface produced or the hot working properties.

The subject of sulphur in steel has been studied by others. Results have been published in which soft steel and wrought

Carbon Content	Sulphur Content	Elastic Limit, Lb. Per Sq. In.	Tensile Strength, Lb. Per Sq. In.	Elongation in 2 In. Per Cent	Reduction of Area, Per Cent
.32*	.032	48,650	80,250	30.5	70.1
.32*	.068	48,550	75,550	32.8	68.8
.32*	.108	46,400	75,800	30.2	68.7
.32*	.146	46,700	73,350	31.5	67.3
.32*	.190	45,450	71,550	33.2	66.3
.32*	.230	45,850	70,100	31.5	65.0
.51†	.025	70,400	111,900	20.3	56.8
.51†	.055	76,300	120,800	19.7	51.3
.51†	.095	73,950	119,400	19.5	51.5
.51†	.135	76,800	120,600	18.3	49.2
.51†	.167	73,200	111,750	17.5	45.4
.51†	.230	66,350	106,550	20.5	44.7

*Heated to 830 deg. C., held for 20 minutes, quenched in water drawn at 600 deg. C., for 30 minutes.

†Heated to 816 deg. C., held for 20 minutes, quenched in water drawn at 565 deg. C., for 30 minutes.

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*Extracts from a paper presented at the annual meeting of the S. A. E., Jan. 6. 1916.

iron containing 0.300 to 0.600 per cent sulphur have been successfully forged. The details are lacking, but it is my belief that such material would stand very little heating to a high temperature for forging without cracking or crumbling during the forging operation. I have in mind an investigator who has recently studied the effect of sulphur in different heat treatments of steel, with sulphur ranging from 0.032 to 0.157 per cent. Another studied its effect in rivet steel, containing from 0.042 to 0.105 per cent sulphur; a third in drop forgings containing from 0.028 to 0.190 per cent sulphur. Their results agree in this point: When other conditions are equal, no marked differences were observed in the working properties or in the quality of the finished material.

Headlight Glare Defined —New Standards

Recommendations of Spring Division and Resolution on Headlight Glare Adopted—Solid Tire Standards

NEW YORK CITY, Jan. 4—The standards committee of the S. A. E. met this morning to consider a large number of reports presented by different divisions. The reports accepted by the committee will be submitted to the general meeting of the society to-morrow. Foremost among the work of the day is the adoption of a resolution proffered by the electrical equipment division on the subject of headlight glare which reads as follows:

> *Wherever there is not sufficient light within the limits of the highway location clearly to reveal all persons, vehicles or substantial objects within said limits for a distance of at least 150 feet, the headlights of any motor vehicle in motion shall give sufficient light to reveal any person, vehicle or substantial object on the road straight ahead of such motor vehicle for a distance of at least 150 feet.*
>
> *The headlights shall be so arranged that no portion of the reflected beam of light, when measured 75 feet or more ahead of the lamps, shall be over 42 inches above the level surface on which the vehicle stands. Such headlights shall also give sufficient side illumination to indicate any person, vehicle or substantial object 10 feet to the side of said motor vehicle at a point 10 feet ahead of the lamps.*
>
> *The term "beam of light" as used in the above provision shall be construed as meaning the approximately parallel focalized rays gathered and projected by a reflector, lens or other device.*

The division further reported that it had had the subject under consideration for over two years and that almost every anti-glare device on the market had been examined. The report continues:

"It will be noted that the fundamental idea is the securing of adequate illumination, and the direction of the light in such a way as to render it unobjectionable to users of the highway. In view of the widespread approval which this provision in substantially its present form has received from legislators, municipal executives and safety organizations, and in view of the sound engineering foundation underlying it, the Division bespeaks for this provision the serious consideration of all interested in the securing of adequate and unobjectionable illumination."

Before the passing of the resolution there was a vigorous discussion in which several members of the committee voiced the opinion that the definition was not close enough. It was suggested that the actual spherical candle power of the light at 150 ft. ought to be stated and stress was laid upon the different degrees of visibility of different colored objects. The supporters of the resolution, however, answered this criticism effectively by pointing out that its object was to provide something easy to test, and simple to operate that might serve as a basis for the many different bodies who are just now trying to define headlight glare.

Another recommendation of this division adopted by the standards committee was in connection with the detail dimensions of insulated wires of different sorts intended to assist the manufacture and purchase of wiring suitable for automobile work. A third recommendation, also accepted was the following.

Location of Slots in Headlight Receptacles

"The Division recommends that the standard position of the slots in headlight bulb receptacles be so fixed that the anchor pins of the bulb when installed shall lie in a horizontal plane.

"Compliance with the above recommendation will improve very materially the situation so far as half-frosted or other partially opaqued bulbs are concerned. This may not result immediately in a definite disposition of the filament with respect to the anchor pins but it is hoped that the removal of this one variable will encourage the bulb-maker to bring about the best possible relation between those bulb elements involved in the proper direction and distribution of the light."

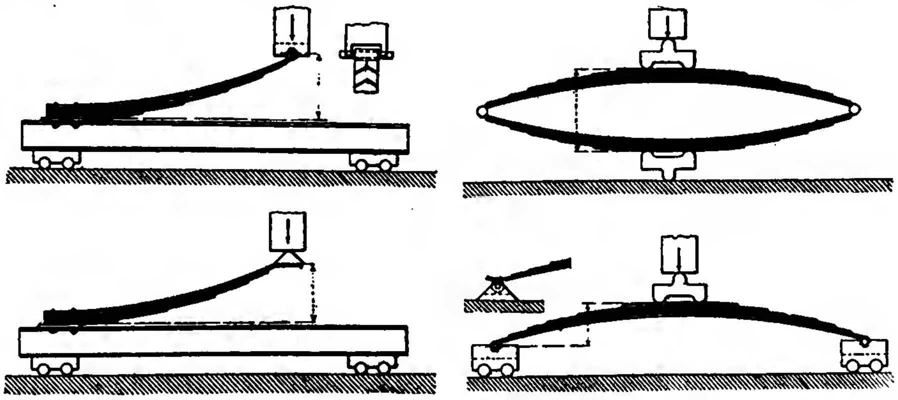
Iron and Steel Report Voluminous

The report of the Iron and Steel division of the standards committee deals entirely with details of testing of materials. It is proposed to substitute this fresh report for the whole of the "notes and instructions" appearing under the head "Carbon Steel" in the last published list of S. A. E. steel specifications.

A second portion deals with the details and dimensions of the standard test specimens and the object of both revisions is, in the main, so as to conform more closely to the practice of the Society For Testing Materials. The committee accepted the whole of the report without discussion and, since it is of considerable importance, the text is reproduced at the end of this account of the meeting.

New Solid Tire Standard

It is well known that for several months past an endeavor has been made to prove that two sizes of solid tires, namely 36 in. and 40 in. nominal, to fit on two standard S. A. E. wheels would be sufficient for all needs. But it has been ascertained that the demand for a 34-in. solid tire is so large



Diagrams of standard methods for spring testing for quarter-, semi- and elliptic springs that to neglect this size is impossible. Therefore the standards committee has adopted as S. A. E. standards the three sizes of 34 in., 36 in. and 40 in.

Also accepted for approval of the general meeting on Thursday is a new standard for the tires of industrial trucks, this specifying four sizes, 10 in., 16 in., 22 in. and 27 in. Both these matters are in the sphere of the truck standards division, and this body asked for a return to the use of ¼ in. felloe band for 4 in. section tires as this had proved adequate. The present standard calls for ⅜ in. This also the standards committee approved.

Pump Bases and License Tags

The subject of pump bases and brackets for license tags was the main theme of the report of the miscellaneous division. These standards were dealt with at the Chicago meeting and fully described in the report of that gathering. The only new standard to be added under this head is one for water hose as used in motor and radiator fitting. The table below shows the new standard as adopted by the committee.

The miscellaneous division reported that it was working on the matter of standard piston rings and hoped to be able to announce something definite before long.

Spring Tests Standardized

Another report accepted as printed was that of the springs division. This specifies methods for testing springs and lays down what shall be fair tests, specifying what the consumer may demand of the spring maker. The diagrams herewith are taken from this report and show the variety of test considered, and the report contains the fullest possible instructions for testing.

Other Business Done

Other divisions reported progress and indicated that the work of the standards committee is in a very healthy condition. First it was stated by Chairman K. W. Zimmerschied that the work in connection with the nomenclature of automobile parts was going forward, the assistance of many manufacturers and service men having been enlisted. The list of names for motor parts was complete and that for the remainder of the chassis in good shape, so that it is hoped a full set of names may soon be in fit state to present to the society.

The electric vehicle division reported as follows on the subject of speed and mileage ratings for electrics:

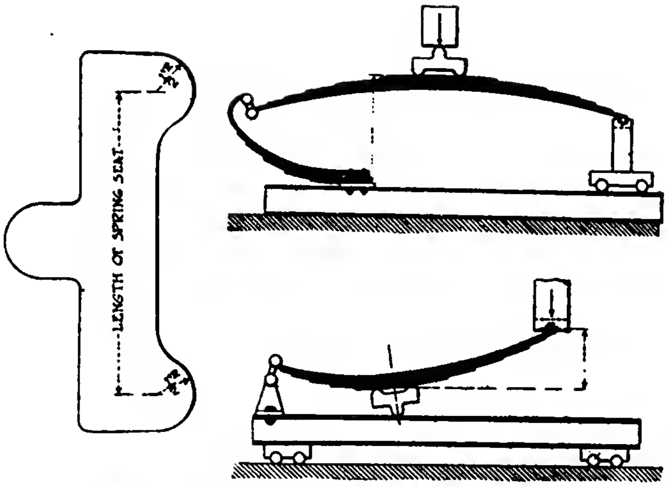
"Electric vehicle speed ratings shall be based on continuous operation with one-half load over hard, smooth and level roads or pavements at the actual average battery voltage.

"Electric vehicle mileage ratings shall be based on a continuous run at the S. A. E. rated speed with one-half load over hard, smooth and level roads or pavements.

Table I—Sizes of Hose-Clamps and Hose-Fittings

Inside Hose Diameter	Outside Diameter of Hose and Extended Inside Diameter of Clamps: Single-ply	Two-ply	Three-ply	Four-ply	Length of Fitting for Lap of Hose
3/16	7/16	½	9/16	⅝	1
¼	½	9/16	⅝	11/16	1
5/16	9/16	⅝	11/16	¾	1
⅜	⅝	11/16	¾	13/16	1
½	¾	13/16	⅞	15/16	1
¾	1	1 1/16	1⅛	1 3/16	1
1	1¼	1 5/16	1⅜	1 7/16	1¼
1¼	1½	1 9/16	1⅝	1 11/16	1¼
1½	1¾	1 13/16	1⅞	1 15/16	1¼
1¾	2	2 1/16	2⅛	2 3/16	1¼
2	2¼	2 5/16	2⅜	2 7/16	1¼
2¼	2½	2 9/16	2⅝	2 11/16	1¼
2½	2¾	2 13/16	2⅞	2 15/16	1½
3	3¼	3 5/16	3⅜	3 7/16	1½

Limits on inside diameter of hose ± 1/64. Limits on thickness of hose (not measured at lap) ± 1/64. All dimensions in inches.



Three-quarter and cantilever test and pressure block

"The above recommendation covering speed ratings has been previously submitted several times and approved by the Standards Committee. The recommendation submitted on electric vehicle mileage ratings has been modified materially from that previously submitted and referred back to the division of the society. Both definitions are in the simplest possible form, but it was found impossible to secure any unanimity of opinion among the vehicle manufacturers.

"This report has been submitted for consideration to ten members of the Electric Vehicle Division, which consists of nineteen members (including chairman of the Standards Committee), of whom ten have voted affirmatively, none negatively and none have refrained from voting."

The engine and transmission division reported progress with the collection of data on motor performance characteristics. They said that there had been encouraging results of inquiry as to the possibility of standardizing poppet valves in some sizes, hand starting cranks and V belts for fans. They stated, however, that they had found the suggested standard base for water pump mounting would be impracticable and disadvantageous.

A report from the research division, including a suggested form for testing cars for gasoline economy, was discussed and will be brought forward again at some future date, and brief progress reports were also put in by the chairman of the foreign co-operation division and the lock washer division.

Proposed Eighth Report of Iron and Steel Division

Revision of "Notes and Instructions"

IT is recommended that the text of the seventh report of the iron and steel division be revised by deleting all that occurs on page 160 of the June, 1915, Bulletin, before the title, Carbon Steels, and inserting the following:

Regarding Specifications, and Notes and Instructions

The notes and instructions following the specifications given below are not to be considered in any way a part of these specifications. They are added solely for the information of the user of the steels and the guidance of the purchaser in the selection of proper materials for his different purposes. They should not be incorporated in the specifications when ordering steel, except under such conditions as are noted in the body of the specifications themselves.

The compositions listed below include practically all the steel materials which the division believes are necessary for the production of the great majority of automobile parts, in grades which have been found commercially available and technically adequate to perform the service encountered in these parts. In cases where very special duty or exceptional quality is demanded, grades containing less phosphorus and sulphur and narrower ranges of carbon and manganese are available, but these special grades should be made the subject of special agreement between buyer and seller.

Specifications for Automobile Steels

Basis of Purchase

1. Automobile steels shall be purchased on the basis of the requirements as to chemical compositions specified in sections 5, 6 and 7. It is not recommended that tension and bend tests shall be specified for the material as shipped, except when physical requirements are specified. When steel is bought on physical properties, requirements as to carbon shall be omitted.

Steel Castings

2. The standard specification No. 1235 for steel castings, adopted by the Society of Automobile Engineers, shall cover the purchase of automobile steel castings.

Manufacture

Process

3. The steels shall be made by the Bessemer, open-hearth, crucible, electric, or any other process approved or specified by the purchaser.

Discard

4. A sufficient discard shall be made from each ingot to secure freedom from injurious piping and undue segregation.

Chemical Properties and Tests

5. The steel shall conform to the requirements as to chemical composition specified in the appended lists of carbon, nickel, nickel-chromium, chromium, chromium-vanadium, and silico-manganese steel.

Ladle Analyses

6. An analysis shall be made by the manufacturer from a test ingot taken during the pouring of each melt, a copy of which shall be given to the purchaser or his representative. This analysis shall conform to the requirements specified in the table of compositions. Drillings for analysis shall be taken not less than ¼ in. beneath the surface of the test ingot and in as sound metal as possible.

Check Analyses

7. (a) Unless otherwise specified, specimens from the original product shall be submitted for sampling by the chemical laboratory. Where cuttings are acceptable, these must be taken dry, must be thin and small, free from foreign matter and discoloration.

(b) Analyses may be made by the purchaser and shall conform to the requirements specified in the tables.

(c) Drillings for analyses of bars, billets or other regular shapes shall be taken parallel to the axis, at any point midway between the center and surface.

(d) Drillings for analyses may be taken from broken tension or bend test specimens, if physical requirements are specified.

(e) Drillings or cuttings for analyses of irregularly shaped pieces for which no physical requirements are specified, shall be taken from both the thickest and thinnest sections.

(f) Wire, tubing, sheets and rods less than 1¼ in. thick shall be sampled through or across the entire section.

(g) Surface drillings shall be discarded.

Physical Properties and Tests

Physical Properties

8. If physical requirements are specified, the following sections (9 to 13) shall form a part of the modified specifications.

9. The yield point, where specified, shall be determined by the drop of the beam of the testing machine.

10. The elastic limit, where specified, shall be determined by means of an extensometer.

11. The bend test shall be made cold.

12. (a) Tension and bend test specimens shall be taken from the rolled or forged material; except that in the case of irregularly shaped forgings, they may be taken from a full-size prolongation. Specimens shall not be annealed or otherwise treated, except as specified in paragraph (b).

(b) Tension or bend test specimens for material which is to be annealed or otherwise treated before use shall be cut, for rolled material, from properly annealed or similarly treated short lengths of the full section of the piece, and for forged material from the treated forgings.

(Continued on page 49)

New Six-Cylinder Lozier for $1,875

Larger Six Price $475 Lower—Four-Cylinder Model Now Only $1,595—New Six Motor 3½ by 5¼

NEW YORK CITY, Jan. 4—Lozier show announcements include the introduction of a new seven-passenger six to sell at $1,875, the reduction of the larger six from $3,250 to $2,775, and the reduction of the four from $2,100 to $1,595.

The new model is rated at 50 hp. and is equipped with a 3½ by 5¼ in. L-head block motor with the crankcase integral with the upper half of the motor. Starting, lighting and ignition are by a two-unit Gray & Davis system, and a Stewart vacuum feed system is used. The crankshaft is mounted on three bearings; crank, cam and connecting-rod bearings are nickel babbitt. The timing gears are helical and the camshaft is drop-forged. Cooling is by centrifugal pump. The multiple-disk clutch and three-speed gearset are in unit with the motor. Semi-elliptic springs are used in front and platform in the rear, and the rear axle is a floating with spiral bevel drive. The wheelbase is 120 in. and tires are 36 by 4½.

The new Lozier six-cylinder car for $1,875

Convertible and Permanent Touring Tops Highly Developed

Removable Glass Sides, Permanent Top Designs and Quickly Demountable Convertible Types Give All-Season Service and Provide Two Cars for the Price of One

Left—Permanent top design which allows of clear opening all the way around, giving the same results as the summer touring top except that it cannot be lowered

Right — Small roadster with convertible coupé top which can be placed on the roadster body by removing the summer top. This gives an ideal all-year-around design suitable for any kind of weather and makes a good physician's car

WINTER and summer have different sets of conditions which must be met by the body manufacturer, and it has been general practice for the owner of a high-priced chassis to have at least two bodies which can be mounted upon the chassis to provide against these requirements.

To bring the winter and summer body arrangement into the reach of the average car owner has been a feat which it would have been impossible to accomplish without the convertible body idea. Inaugurated at the show a year ago, the convertible touring car-sedan idea has spread rapidly and now many of the manufacturers in the field of cars selling for anywhere between $500 and $2,000 are providing bodies which have a removable top that can be put away for the summer, leaving the car in the same form as the ordinary touring design. Some of the interesting types of these cars which are now on exhibition are shown by Kissel, Hupmobile, Briscoe, Saxon, Marion, Empire and Dodge. There are others also who are manufacturing bodies of this type and all claim that the demand this season for the convertible design is up to their greatest expectations.

When the Winter body is in place the car resembles a high grade sedan; it is comfortable in the coldest of weather and the glass area is so large that the view of the occupants is not cut off to any appreciable extent. With the regulation top and side curtains the car cannot be kept as warm and, owing to the necessity for providing a large amount of cloth or other fabric between the windows in the side curtains, the view is not very good when these side curtains are in place. The convertible design provides a car with practically all glass sides, and one which if desired could be toured in with perfect comfort during the summer months.

An Optional Body Type

With the winter top removed the ordinary touring body is left. The summer top is put in position and the summer windshield put into place. To all intents and purposes this leaves the ordinary stock touring car, which does not differ in any respect from the car which the purchaser would have possessed if he had not purchased the convertible design.

In fitting these tops to the touring body the top irons, which ordinarily hold the summer top in position, act as the main supports. The touring bodies are so shaped that they conform exactly to the line of the removable sedan top, and when the latter is in position it should only be possible to detect the line of juncture between the convertible top and body by very close inspection.

The sedan effect of the convertible body is carried out by having the glass front a unit with the top, the supports for the ordinary summer windshield acting as the forward supports for the convertible sedan body when it is in place, so that in fitting the closed top the windshield and summer top are first removed and then the top is slipped down into the fastenings, which are made rigid enough to clamp the closed top tightly into place.

Roadsters also Fitted

The use of the all-season top is not confined to the touring cars. There are many two-passenger roadsters which are now provided with this extra fitting if so desired. The prices for these convertible bodies run as low as $455, at which price the Saxon is furnishing a two-passenger car fully equipped with a convertible design known as the all-winter top. This top is easily removed and really transforms the roadster into a coupelet. The price of $455 includes both tops, the standard roadster top being a part of the regular equipment whether the all-winter design is purchased or not. For physicians, salesmen, collectors and others who are compelled to be outdoors in all kinds of weather a car of this type should be ideal, and it is a fact that exhibitors at the Palace show have found that the listing of bodies of this type noticeably increase their sales.

Tops for All Seasons in Vogue

There is a growing class of motorists that desires to travel with a top on the car both winter and summer. To suit these the permanent top design, known as the touring-sedan, is proving to be very popular. There are glass sides on this type of car which are lowered directly into the sides of the body when it is desired to have a top which in general appearance conforms quite closely to the up-to-date one-person design. This top does not take away from the side view any more than does the ordinary summer touring top, but owing to the fact that it is permanent and no provision need be made for raising or lowering it, it is rigid and at the same time is lighter, through the elimination of the top bows.

When the glass sides are up on a design of this kind a complete sedan is provided which is just as windproof and weatherproof in every particular as the permanent sedan with the added advantage of the fact that the windows can be lowered in a few seconds, providing the open air touring body much desired during the summer months. The windshield of the cars of this class are such that on the road it would be difficult to distinguish a touring-sedan from the ordinary touring car with the top up.

Permanent Tops Are Popular

Another feature of the touring-sedan which makes it somewhat more luxurious than the ordinary touring car with the top up is that the sedan-top can be lined with upholstery that matches the interior of the body. It is also possible to provide electric lights in the upper rear corners of the body so that when the glass sides are up all the luxury of the full-town body is provided.

One of the points brought up in connection with the convertible designs is that the paint work of the winter top is apt to be bright and new while the lower part of the body has lost its bright finish, due to continuous use. In order to overcome this objection the convertible tops are given a dull black finish, much on the order of black leather. This black color blends very well with bodies which have lost their original paint lustre.

In making the convertible top absolutely waterproof it is necessary to take great care in the connecting joint lines between the touring body and the removable upper section. Rubber insert washers, which act as continuous weatherstrips, are placed around the entire top and also around the windows to prevent leakage. The irons for the summer top and for the windshield are made heavier than ordinarily for the purpose of taking the added weight due to the use of the convertible top.

A suggestion which has been made in connection with the use of the closed top on the convertible body is that it permits of the employment of a Victoria top for summer if so desired. This is a fine appearing top which acts admirably as a sunshade and at the same time permits a maximum view range from the tonneau seat. It is, of course, not a bad-weather top, but since the convertible design is so readily fitted in case of impending bad weather the Victoria top in connection with it furnishes an ideal combination.

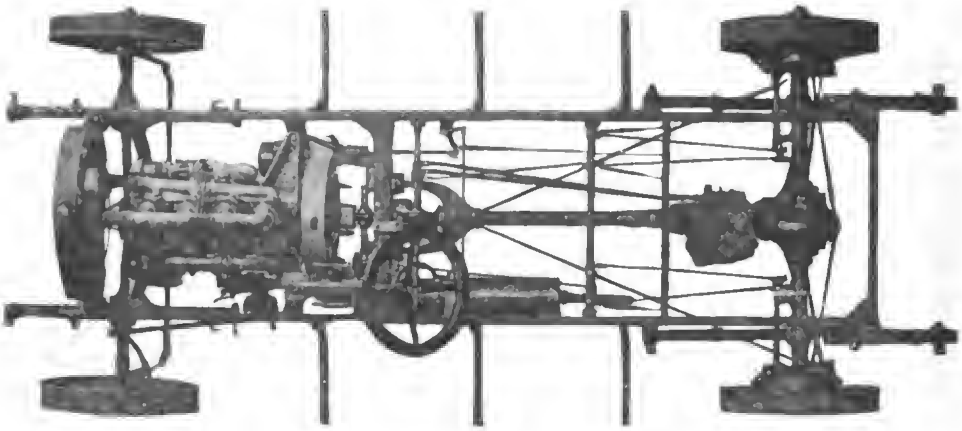
Convertible roadster coupé which gives a luxurious town body for winter or city use and an open roadster for summer work when it is desired to tour without a top. The summer top and windshield are fitted to this body when the coupé is removed

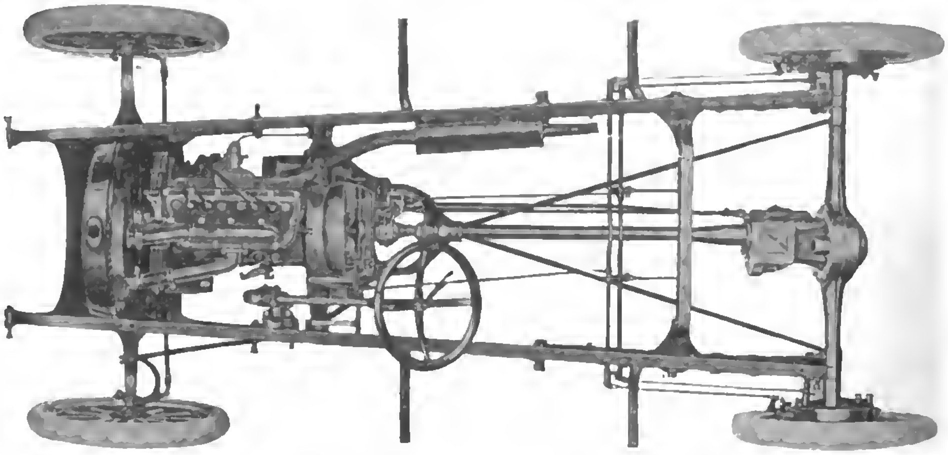
Lower—Quickly removable top which converts the typical open-roadster design into a convenient coupé with broadly glassed sides which do not interrupt the view as is even the case with the summer top with side curtains in position

Chassis Simplified for 1916

Elimination of Links, Rods and Arms Makes a Quieter Design of Greater Accessibility

By J. Edward Schipper





Contrasting the old and new Overlands, the relative simplicity of the 1916 car becomes apparent

ALL the tendency toward simple motor exterior and unit construction would be incomplete unless the same trend could be traced back through the chassis design. In the development of the car simplification has been the keynote, and giant strides have been made in this direction since 1914. In fact, it may be said that up to that year development had been more in the line of increased mechancial efficiency than in simplification of detail. In order to attain better mechanical results more detail was added than taken away, and the result was that the chassis of 1914 probably reached the pinnacle in number of parts. Since that time, every tendency has been toward securing the same results with fewer parts, and this in turn has made the car lighter and given a better vehicle because this lightness is such an important factor in performance.

Unit Powerplant a Factor

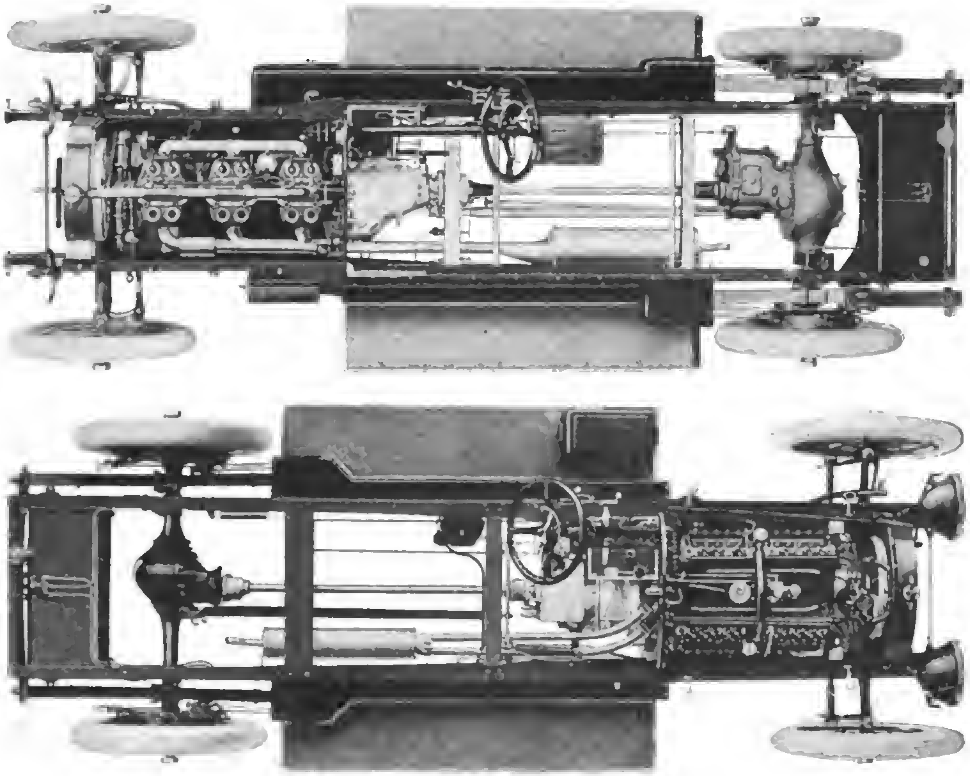
The first big step toward clearing the chassis lines and eliminating surplus parts came with the development of the unit powerplant. This method of construction immediately obviated the necessity for a large number of links and bars which on a plan view of the chassis make a striking difference. It must be remembered that every long link and every joint is a potential source of noise which may either develop into the rattle of looseness or the squeak due to dry rubbing contact. It is also a barrier in the way of accessibility and it is another part which requires attention from either the maker or repairman when he is working about the car. Simplification and accessibility go hand in hand. It is impossible to find an engineering job which is accessible that is not simple.

Illustrated on these pages are some good examples of where block casting and unit powerplant have had a sharp influence on the simplicity of the ultimate design. Referring to these it will be seen that the Packard twelve, for instance, is simpler than the Packard six as far as the entire chassis layout is concerned. The Cadillac eight is simpler than the four-cylinder model in chassis detail, in spite of the fact that it has double the number of cylinders, and the Overland model 75 for 1916 is a far more simple job than the Overland model for 1913. These are only a few examples selected at random, but they serve to show that the tendency toward simplification is not confined to the lower-priced or higher-priced cars, but covers the entire field.

The tendency away from the amidship gearbox in favor of the unit powerplant design in which crankcase, clutch housing and gearbox are all one compact unit, means far more than merely a change in position of the gearbox. In the first place it has meant the elimination of at least one cross member of the frame, this being the pedal and lever shaft which was frequently carried across the chassis just forward of the gearbox. It has eliminated, in many instances, a universal joint which was placed between the clutch and gearset in order to take any alignment variations in the drive and, most valuable of all, it has eliminated the connecting-rods between the gearshift gate and the gearbox.

Center Control Cuts Parts

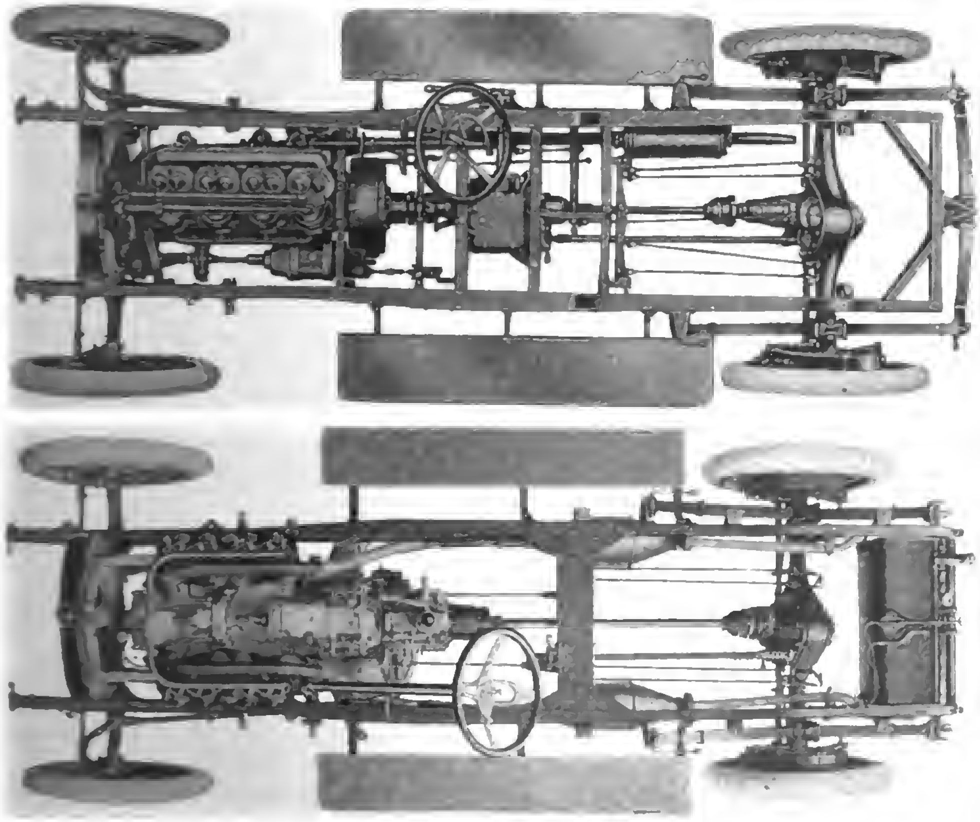
When the unit powerplant was developed it fortunately came at a time when the trend was all in favor of center control. These two features of design blend admirably. The unit gearbox is in such a position that the gear change lever can be mounted directly on the cover plate of the gearbox allowing the bottom part of the rod to extend downward and to act directly on the shifter collars. The result is that there need be no interconnection between the shifter lever and the gearset, since the shifter rod itself can act directly on the gearbox mechanism. This eliminates five or six exterior parts which were exposed to grit and dirt. It also eliminates certain parts which in connection with the gearshift lever, were outside the gearbox and in other positions were inside. These parts had to be lubricated as they had a sliding motion in the gearcase and the result was that a large amount of dirt and grit were carried into the gearbox and became a factor which tended toward shorter life of the gears.



Above—The Packard of 1913, and below, that of the present year. Observe the simplification resulting from adopting the unit powerplant

The up-to-date gearbox with its compact housing is gritproof. Furthermore, by the absence of disadvantageous linkage the throw of the gearshifter lever is considerably shorter, the gearbox itself being of smaller overall length, due to better design and closer spacing of the bearings; giving a relatively stiffer shaft owing to the shorter span between bearings.

Eliminating the rod connections between the shifter lever and the gearbox when it is in the amidship or rear axle position has not been the only means of clearing up the masses of linkage from the chassis structure. Brake connections have afforded an opportunity for the engineer to display his ingenuity as well as in the gearshifter mechanism. Taking an average 1914 chassis there were eight parts necessary to carry the motion of the emergency lever back to the rear brake shaft. These were first, a sleeve on the cross shaft at the center of the chassis; second, a bell crank lever mounted on the sleeve; third, another bell crank lever mounted on another cross shaft; fourth, a sleeve on this cross shaft; fifth, another rod leading back to a bell crank lever on the shaft to the brake assembly; sixth, a bell crank lever on this shaft; seventh, a bearing sleeve on this shaft, and eighth, a bell crank lever to the contracting mechanism. This number has been reduced by about one-half in most of the up-to-date chassis, the result being accomplished by the use of one straight rod from the brake lever or pedal directly back to the rear brake shaft. If it is necessary to increase the leverage between the lever or pedal and the applying point of the brake, this is done by having one intermediate shaft with the desired reduction linkage.



Above—The Cadillac of 1913, and below, the eight-cylinder Cadillac. Notice the much cleaner nature of the latter

Hotchkiss Drive

Hotchkiss drive in which both propulsion and torque are taken through the rear springs has eliminated the use of radius rods, torque tubes, torque arms and the various spring connections on a large number of chassis for 1916. Hotchkiss drive is used on nearly 50 per cent of American cars, and this means that nearly half the American makes are not complicated by miscellaneous bars, rods and springs fitted for the purpose of taking driving and torque stresses.

On the rear axle the cable truss reinforcement which, with its turnbuckle adjustment was a notable feature on cars of 1914 and 1915, is noticeably absent on the 191[illegible] cars.

Accessory Improvements Reflect Car Design

Simplification and Refinement Make Devices More Efficient While Attention to Detail and Mounting Enables the Car Designer and Owner to Blend Them Into Car Lines

TAKEN broadly, the accessory field shows that there has been a marked amount of progress in detail design during the past year. Each individual accessory has a trend toward simplification and efficiency and also toward the important matter of having the accessory blend with the car. The tendency in automobile design is to maintain a clean exterior and, hence, it is found that accessories are being designed to carry out harmoniously this idea of simple appearance. In accessories which do not fit on the car, but are of use in taking care of it, there have been improvements which tend to make the devices in question quicker in action and simpler of manipulation in the hands of the car owner. With these lines of improvement have come reductions in price, so that it can be generally said that automobile accessories are better than they were a year ago and lower in price.

Follow Car Trends

Some of the trends in accessory design have been direct reflections of the tendencies in the design of the complete vehicle. For instance, the higher speed motors have called for more efficient ignition apparatus to meet the demand of more sparks per unit of time and hotter sparks at lower speed to correspond with the ability of the up-to-date car to travel at the lowest possible speed on high gear. These two developments lead specifically to the fact that ignition apparatus on the whole this year is capable of producing a hotter ignition flame at the lowest possible rotative speeds and is also able to furnish ample ignition and positive firing in every cylinder up to speeds of as high as 3500 r.p.m.

The two developments of higher rotative maximum speed and minimum high gear traveling speed have also put the two most difficult demands possible on the carbureter, and the result is that it will be generally found that the carbureter of 1916 is capable of furnishing a better mixture at minimum speed, better acceleration throughout the speed range, and, finally, consistent carburetion at the maximum speeds. These results have been accomplished both through the better design of the gas handling features of the motor and through the efforts of the carbureter manufacturer.

The same story of better efficiency and better co-ordination between car and accessories spreads throughout the entire gamut of accessories. It is found in electric lighting and starting units, steering gears, horns, shock absorbers, tire pumps, bodies and every other accessory development, as well as in the ignition and carburetion field.

Magnetos for Twelves

The automobile show this year discloses the first efforts of the magneto manufacturer to meet the demand of the twelve-cylinder motor. The Splitdorf Dixie type, which has been in use now for a few months, ushered the magneto into the new field. At the show there are two others, the Bosch and the K-W. The new magnetos do not depart radically from previous magneto design in meeting the necessity for twelve-cylinder ignition, but there has been one important change which inaugurates a new epoch in magneto manufacture. This is the use of the offset poles in which the fields are so arranged that instead of generating two sparks for the revolution of the armature shaft, four sparks are produced. The result of this is that the magneto does not have to be driven at abnormal speeds to produce the ignition for twelve-cylinder motors. In a magneto producing but two sparks to a revolution it would be necessary to gear the magneto to three times crankshaft speed. It can be readily perceived that, with an engine rotating at 3000 r.p.m., it would be necessary in the case of a twelve to have the magneto rotating at 9000 r.p.m. This is impractical. With the offset pole and four sparks per revolution, the 1½ to 1 ratio solves the problem. Bosch has introduced this in its new type and the K-W likewise uses it.

Battery Ignition Progress

Battery ignition design has been quite well developed during the year and the show does not bring forth any surprises. Perhaps the one new feature is the Price combined lighting and ignition unit in which the generator casing houses the entire ignition unit, including breaker mechanism, distributer, coil, and condenser. Interesting applications of all the systems will be noted on the cars exhibited. The outstanding feature is that the electric system now is a built-in portion of the power plant.

Few New Carbureters

There are few new carbureters at the show, although the exhibit is entirely representative of the carbureter industry in that nearly all of the large producers, with the possible exception of Holley, are present. There are very creditable exhibits by such firms as Wheeler & Schebler, Stromberg, Rayfield, Zenith, Kingston, Carter, Stewart, Master and others.

The Stromberg is exhibiting its new model in which the auxiliary air valve is eliminated and in which the basic principle is atmospheric control as based on the Ahara patents. In this carbureter there is not a single moving part with the exception of the throttle. The design has a gasoline well for rapid acceleration. In Stromberg Model K acceleration is cared for by a secondary nozzle in which is a metering pin controlled by the auxiliary air valve.

Wheeler & Schebler shows its new Model T with the metering pin controlled by the auxiliary air valve instead of by the throttle. Rayfield has its improved model in which an acceleration feature is combined with the auxiliary air valve whereby the quick opening of the valve injects by pumping action gasoline through the secondary nozzle. Zenith shows its conventional design for different motor types.

Sunderman has a new carbureter, the Mouse Trap, which resembles an oblong box, one-half of which is float chamber and the other half a square cross-section mixing chamber extending from end to end. In this are two nozzles of different heights which are brought into operation by a hinged air valve controlling the air entrance. The lower nozzle begins first.

There are two other unusual carbureter designs. One is the Evans, which has a revolving drum driven from the crankshaft of the engine. This drum is relied upon to break up the fuel rather than relying on a nozzle.

The other unusual type is the Pagel, a syphon type in which there is no float chamber, the gasoline entering a mixing chamber through a single pipe leading direct from the fuel tank on the car. An air nozzle connected with the explosion chambers of the cylinders projects a current of air against the tip of the gasoline pipe, thereby syphoning the gasoline the same as in an atomizer. It is claimed that the air current created by the explosions in the air cylinders is strong enough to syphon gasoline a height of 18 ft.

Among the other carbureters shown are Juhasz, which is an expanding type with three separate nozzles, and having three separate air passages in the throttle, Shakespeare, Webber, Actus, Diamond, F. A. C., etc. In all of these no new principles are employed. They are either metering pin types, or metering pin combined with air valve control designs.

Electric Systems on Sound Basis

In starting and lighting equipment the show contained scarcely a single true novelty. This is striking testimony to the conclusion reached a few months ago, that the electrical equipment had settled down upon a sound manufacturing basis with most of its original faults and failings eliminated. Most impressive also is the decrease in the number of miscellaneous Ford starters. The big firms who entered the field during 1915 seem to have been wonderfully successful, while the lesser lights among the pioneers have dwindled away.

Great interest at the show is to be noticed as centered upon the Stewart air starter for Fords. This has been announced and on the market for several months and consists of a piston working in a circular cylinder, the whole inclosed in a small steel case that bolts to the front end of the frame, a coupling linking the starter shaft with the crankshaft. A tank, kept filled with compressed air automatically, holds enough air for some fifty starts and each start drives the motor through one revolution with such energy that it spins for three or four more. The outfit is inexpensive and easily attached.

Similarly of the electric starters for Fords, the Gray and Davis, the Disco, the North East, the Westinghouse and the Kemco, to mention just a few, are practically the same to-day as they have been for some time past. Some have detail changes tending to increase efficiency, reduce weight or cut manufacturing costs, but to the user they all appeal as simple electrical machines, easily attached and efficient in service.

There are two new models of electric Ford starter, one being the Bosch and the other the Eveready. The former is an elaborate system combining the ignition service and the starting motor is a separate unit acting on the flywheel, a special split gear ring being clamped to the latter. The Eveready is a single unit machine mounting out in front of the radiator and secured to the crankshaft by a flexible coupling. Electrically, it is a simple machine with no controls requiring any attention. The makers claim that the position chosen is the ideal for a Ford starter, as the weight being central the natural three-point balance of a Ford is not interfered with. They even arrange the battery in a thin case that goes against the front seat so that its weight shall be evenly disposed on either side of the car.

For the Eveready starter is claimed the virtue of reducing vibration, it being said that the flywheel effect of the armature spinning on the front end of the crankshaft steadies the running to a noticeable degree.

Absorbers Reflect Spring Progress

Greater confidence on the part of the shock absorber manufacturer in the spring suspension fitted with the cars is manifested this year. The Hartford Suspension Co. has given up its progressive friction type and concentrated on the continuous friction device, as the company has come to realize that the longer springs enable the car to better absorb the minor shocks. The cantilever, with its great flexibility, has been one of the factors in this development. To meet the requirements of the cantilever, there is a new set of brackets for the Sager shock absorber, which have been added to make the absorber suitable for this type.

Horns and Body Design

The development in horns is an instance of where the accessory maker has endeavored to make his product coincide with the tendency to keep the body lines clear. The Long horn, for example, is made in a new model which permits the horn to be mounted under the hood, although still operated by hand. The horn is controlled by a double Bowden wire which operates the ratchet mechanism. Klaxon horns are now made with horizontal instead of vertical drive, allowing the motor to be mounted in the casing behind the diaphragm instead of below it.

More Electric Vulcanizers

The high spot in vulcanizer design is in the use of more electric and fewer steam types. The reason for this is in the quickness with which the electric designs attain their working temperature. Shaler has a new type for garage use and there is a new Premier portable type for the owner. Both of these are characterized by simplicity and by the quickness with which they can be operated.

Single Cylinder Pumps Gain

In power tire pumps there is a marked trend toward the single cylinder design and even in these single cylinder types, the installations are more compact and smaller than ever before. An example of where compactness has been sought and accomplished is shown in the Kellogg single-cylinder job in which the small diameter, long cylinder has been replaced by a larger bored cylinder which is shorter. Rigidity is secured by the use of a double connecting-rod. Another improvement in pump design is suggested in the Stewart type which, in place of plain pistons, has now pistons which are fitted with rings.

Clocks Are Simpler

Clocks are, on the whole, more easily read and less likely to be neglected as far as winding is concerned than ever before. The Hartford company puts out an electric clock which can be run on any voltage from 2 to 110. It is made in both flush and extended models with black on white or white on black faces. Another clock known as the B-4-U is designed to fit in the center of the steering wheel and of course is always accessible.

Refinements in Speedometers

Speedometer designs are more refined in detail and have not had any radical variations during the year. Perhaps the most significant development is the universal employment of a re-set mechanism which can be employed to put the mileage of the trip odometer at any desired point. Stewart-Warner employs a small button on the face of the instrument which, when pressed, turns all the trip disks back to O. The Jones speedometers are now known as the Johns-Manville and have a wheel reset instead of a knob. The Corbin-Brown uses a large knurled wheel and Van Sicklen now has an instrument known as the Spedistimeter which is a combination speedometer and watch.

Dimmers Are Factors

In electric lights and accessories, the use of scientific dimming devices and convenient spot lights are the big points. The Corning and Guide optical methods which keep the light on the road and yet eliminate the glare, are very good examples of what is being done in this respect. The result of tilting the lamp is improved upon without the bad feature of spoiling the appearance of the car. The J. M. frosted globe with slotted front is still used by this concern and in the way of spotlights, it will be noted that these are smaller, more compact and better mounted than ever before and at the same time are selling for less money.

Salon Is an American Show

Fine Examples of Bodywork Illustrate Trend Towards Convertible Type—Cowl Instrument Boards Disappearing

WHILE broadly speaking the automobile salon at the Hotel Astor is a body show, still there are exhibited a number of polished chassis which give an insight into a field of engineering development in which price has not been the dominant factor. The combination of ultra-luxurious bodywork and engineering design unfettered by price consideration makes the Salon exhibit occupy a unique position and furnishes an exhibition which brings out the latest word in refinement of mechanical and coach design.

This year the Astor Salon is not an importers' salon as there are only five foreign chassis on the floor, and these are not of design new to the American public, Peugeot, Rolls-Royce, Lancia and the Delaunay-Belleville.

The American cars on the floor are the Singer, White, Daniels, F. R. P., Simplex-Crane, Brewster-Knight and Owen Magnetic. In addition to these there is another foreign car on the floor, the English Daimler, which exhibits a town body by Henry Labourdette of Paris. The Holbrook company, body maker of New York City, is showing a Cadillac eight chassis fitted with a Berline design, a Packard with a landaulet and a White with a landaulet body. Healy has several bodies on Locomobile chassis and Bender & Robinson are showing two special bodies on Singer chassis. The regular Singer bodies are also manufactured by Bender & Robinson.

Instrument Board Eliminated

Some of the trends in body design which will no doubt be followed in a short time by the lower-priced American stock jobs are very interesting. The absence of the instrument board is perhaps the dominant note in body trend, the line of instruments in most instances being taken from the cowlboard and placed in a neat setting at the toeboard. In addition to the clock and speedometer in the driver's compartment, the practice is growing to place another clock and speedometer in the second cowl in the tonneau, thus allowing the owner an opportunity to know the rate of the car and time of the day as well as the driver.

Convertible Bodies Are Factors

The tendency toward making the body an all-season proposition is very marked at the Salon. Some of the bodies can be transformed from a limousine into a landaulet and then into a touring car. The Healy company is showing one body on a Locomobile which is a good example of the work. It is what is known as a touring-limousine, but so neatly do the glass sides fold into the body and the pillars which support the limousine roof drop into the lines of the touring car that it is difficult to perceive either in the case of the touring or the limousine arrangement how that body could be transformed from one type to the other.

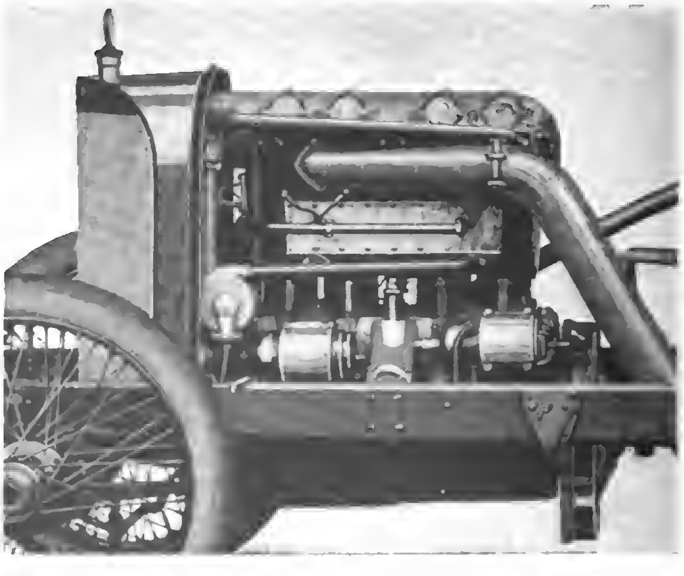
The convertible body and the toeboard instrument set are not universal, however, at the Salon, although they do represent two notable trends. For example, on the Simplex-Crane chassis, the complete cowlboard instrument set is used, and every conceivable type of instrument is arranged across this flat board before the driver. From right to left the outfit includes a voltmeter, clock, air pump, switch block, carbureter adjustment, gasoline gage, oil gage, ammeter, speedometer and odometer. This is the most elaborate cowlboard exhibited, and the line of instruments takes up every available portion of the space which is available across the entire front of the car.

Transmission Brakes Shown

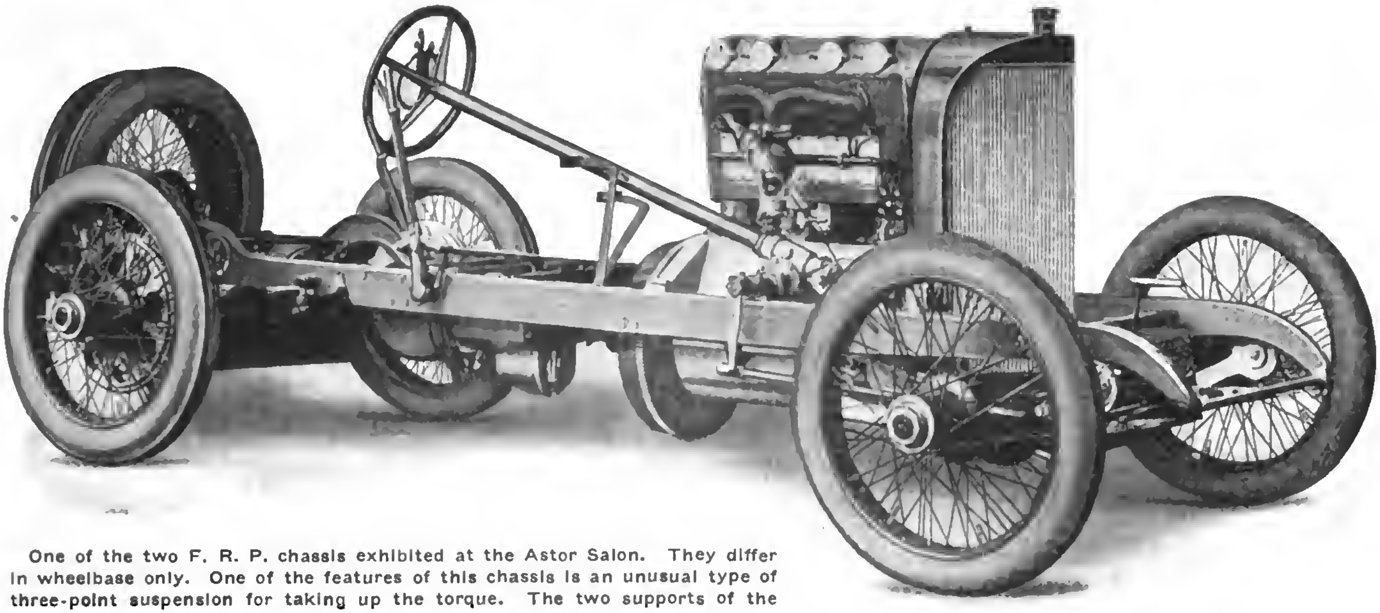
Examples of transmission brakes which are very neatly designed may be seen on some of the chassis exhibited at the Astor. Peugeot has a good example of the transmission type of brake mounted on the forward universal. It is deeply ribbed for cooling and is of great area. Taking this area into consideration with the reduction at the rear axle, there is no doubt that a highly powerful braking action is possible with this construction. The transmission brakes are not confined to the foreign cars, a good example of the installation of the transmission brake on an American chassis being on a Simplex-Crane. Another feature about the Simplex-Crane which is interesting is in the subframe motor support. This subframe starts at the forward end of the main frame and runs back parallel to the main frame member, forming really a frame within a frame. The subframe supports the motor and gives a very rigid support all the way back to the gearset and at the same time acts as an efficient transverse stiffening member to the main frame.

The chain drive chassis has not altogether disappeared from American practice. This is evidenced by the fact that the Simplex chain-drive job is shown in stripped chassis form on the floor. The chains, however, are inclosed in metal cases which permits them to be free of the danger of grit and dirt which was always the big objection to chain drive. The casing about the chain also acts as a silencer and as an oil container.

The F. R. P. chassis is exhibited in two forms, one of short and the other of longer wheelbase. The overhead valve action with the overhead camshaft is exposed, showing a cam contour and drive which is suggestive of big gas passages and high speeds. The cam lines are quite square, giving very quick valve opening and the springs for the valves are short but of heavy section for quick closure. Another interesting point on the F. R. P. chassis is the three-point suspension for the motor. The triangular layout differs from that gen-



Right side of F. R. P. motor, showing overhead valve mechanism



One of the two F. R. P. chassis exhibited at the Astor Salon. They differ in wheelbase only. One of the features of this chassis is an unusual type of three-point suspension for taking up the torque. The two supports of the layout are located just forward of the center of the engine and are in the form of flexible trunnions. The third support is at the rear of the motor

erally found in three-point systems, the two supports being located just forward of the center of the engine and are in the form of flexible trunnions. The third support is at the right rear of the motor which gives a right angle triangle layout of supporting members, with two points on the right side of the frame and one point on the left. The object of this is to absorb the immense torque of the motor which is designed for power and speed without risking the stresses which would fall upon the crankcase member and tend to throw the main bearing out of line.

Subframes Are Strong

It seems to be a distinguishing feature of the cars at the Salon that the subframe structure is extraordinarily sturdy. This is in direct opposition to the tendency to be noted at the Palace show where frame sub-structures and cross-members are if anything, lighter and more flexible than ever before. An example of heavy subframe work is given in the Peugeot stripped chassis. This is one of the 40-hp. jobs and is characterized by this heavy transverse structure which carries the gearbox and also no doubt acts as a torque-absorbing member for the stresses created by the transmission brake. The Singer chassis, which is of American design throughout, provides an interesting study in frame substructure. The F. R. P. is also an example of this and so is the Brewster-Knight. In the latter the subframe bracing is very stiff, the connections being made by heavy gusset plates to the main frame.

A Fine Cabriolet

It is in body work that the Salon has its greatest distinctiveness. A cabriolet designed by J. F. DeCausse of the Healy company is a good example of convertible work. When in the cabriolet position, the body exhibits a town car design which is the last word in luxury. The upholstery is in gray cord and the body itself is gray. In two minutes this body can be transformed into an open roadster, the pillars which support the forward end of the cabriolet top fold downward into the body, the entire top slides backward and folds into such a form that it can be incased in an envelope and the glass sides by the turn of a small crank handle slide into the sides of the body, leaving nothing but a sociable type roadster which is an exact counterpart of designs of the non-convertible type intended only for roadster use. This combination gives an all-year car which is luxurious both in its roadster and in its cabriolet form.

Another Healy body is in the form of a five-passenger sporting model. The interesting point of this is that although the front seats are not divided there is no door to the rear compartment. Accessibility for the passengers is accomplished by having a forward seat which by means of a slight push ahead instantly opens a passage from the forward compartment to the rear seats. The absence of doors in the rear gives the body great strength and lightness, the lines of the roadster and the capacity in spite of this is equal to the average touring car.

Ingenious methods for concealing the extra seats in the seven-passenger touring design are shown in the Singer bodies. These slide into the front of the compartment folding into the back of the front seats and being covered by a shutter. Folding arrangements for seats and body parts are carried out with a neatness which hardly permits of detection of the folding parts. In all of the work at the Salon, the Bender & Robinson special roadster with folding rear deck is a good example of the thoroughness in this work. When the rear compartment is folded open an upholstered seat with upholstered arm rests is provided and when closed the flat deck of the roadster conforms exactly with the ordinary lines of a two-passenger car.

Sedan Bodies Are Popular

Sedan bodies with V-shaped front, the apex being at the front end of the inclosed body, seem to be quite popular. One of these is shown on the Singer chassis, another on the White and also on the Cadillac. These give an added length to the body and add to the appearance of lowness. They are difficult, however, to maintain raintight in front and careful provision has to be made on the windshield for shedding the rain and not allowing it to work through crevices.

Victoria tops also seem to be popular on some of the touring designs. The White company is showing a victoria top on an olive-green touring car which makes a very handsome body. The Lancia victoria top on a top with no running-board gives a combination which shows the ultimate in high-class design.

Sloping windshields are not in as much evidence as they are at the Palace. The Daniels eight has a roadster in which the windshield is raked backward slightly. On the touring car, however, the straight windshield is adhered to. The Daniels landaulet is a regular stock design and is a good example of conservative design in this work. The Daniels eight is not exhibited at Grand Central Palace. It is fitted with a V-type powerplant which is made in either 3-in. bore or 3¼-in. bore with 5-in. stroke. The wheelbase is 127 in. and the tire size 34 by 4½.

The History of the American Automobile Industry—11

The Advent of Onesiphore Pecqueur, Whose Steam Automobile, Patented in 1828, Embodies Practically All Essential Features of Modern Practice Except the Motor

By David Beecroft

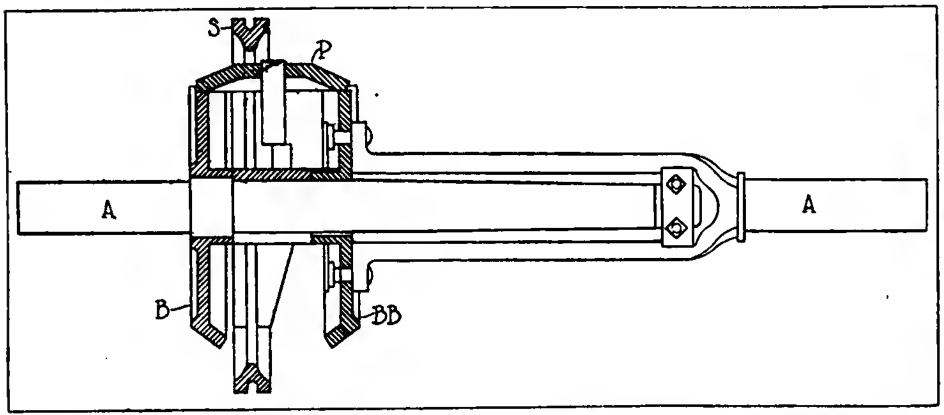
IN the early development of steam no inventor was further ahead of his times than Onesiphore Pecqueur, a very celebrated Frenchman, who in 1828 patented a steam vehicle which embodied practically all the essential features of the modern automobile with the exception of the motor. To Pecqueur should be ascribed the title of Father of the modern automobile. His patent drawings of April 25, 1828, show that he employed the accepted type of automobile steering gear as we have it to-day, Fig. 1, although each front wheel is carried in a bicycle type fork by itself and a front axle connecting the two wheels is not used. Fig. 2 shows how he combined the two front wheels by using steering arms and the cross tie rod employing also a rack-and-pinion type of steering gear.

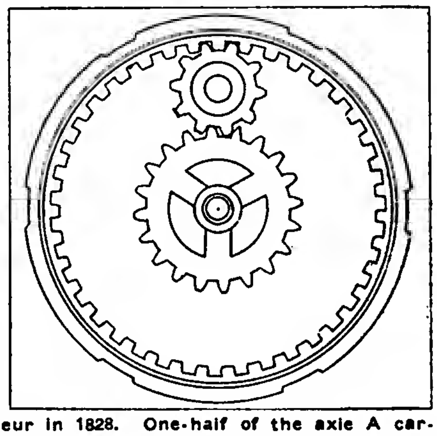
First to Use Differential

Pecqueur, in addition to being the first to patent the present-day steering gear, was also the first to use a differential or balance gear in the rear axle. Fig. 3 is a plan view of the complete Pecqueur steam vehicle and shows the differential mounted in the axle proper, and Fig. 4, a section of this axle, gives further details. Fig. 5 shows the complete details of the first modern type of differential ever employed in the automobile.

But Pecqueur went further and used a planetary gearset giving two forward speeds, the reverse not being necessary because of using a steam engine which could be reversed. Not requiring a reverse or friction clutch, his patents show a jaw or positive clutch which he used in connection with his speed-change planetary gearset.

His patent drawings show very plainly a rear axle in two parts, one forming a sort of sleeve over the other, and each carrying a bevel gear with a spider carrying a bevel pinion and a sprocket for a chain, practically identical with the Duryea, Knox and other constructions in common use at the end of the nineteenth century. He employed the fixed front axle with steering knuckles and short spindles now universally used, a device which was patented by Rudolph Ackerman, an Englishman, in 1818, for use on horse vehicles. His engine was a type of rotary and evidently not a very practical affair, which probably accounts for nothing more being heard of his device. One of the advantages of the Ackerman steering as exploited in those early days was "lessened danger of upsetting." It was argued that a continuous axle and king bolt gave but one point of support for the front end of the vehicle, whereas the Ackerman device constantly maintained a support at each front corner. This argument would be more valuable if uneven roads did not demand a considerable flexibility of structure, which must be supplied by springs, three-point support or in some equivalent manner.





Left—Fig. 5.—Complete section of rear axle with bevel differential invented by Pecqueur in 1828. One-half of the axle A carries the bevel gear B; and on the other half of the axle is carried the other bevel gear BB. One of the pinions P is shown, as is the sprocket S for single chain drive. Instead of dividing the two halves of the axle as we do to-day, Pecqueur made one half in the form of a sleeve or tube within which he carried the inner end of the other half

Right—Fig. 6.—Type of two-speed planetary gearset employed by Pecqueur on his steam vehicle of 1828. To change the speed of the engine with relation to the rear wheel the driver pushed a small handle which regulated the planetary gearset, which operates in the conventional planetary gear manner as in use at present

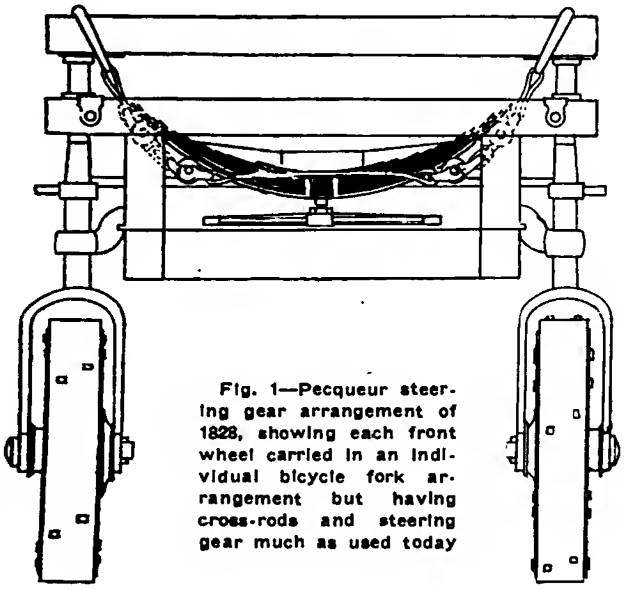


Fig. 1—Pecqueur steering gear arrangement of 1828, showing each front wheel carried in an individual bicycle fork arrangement but having cross-rods and steering gear much as used today

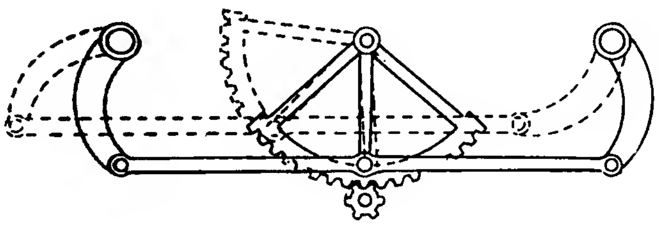


Fig. 2—Diagram of rack-and-pinion type of steering gear used on Pecqueur steam cars in 1828, showing the use of steering arms and cross-tie rod, the same as employed in steering at the present time

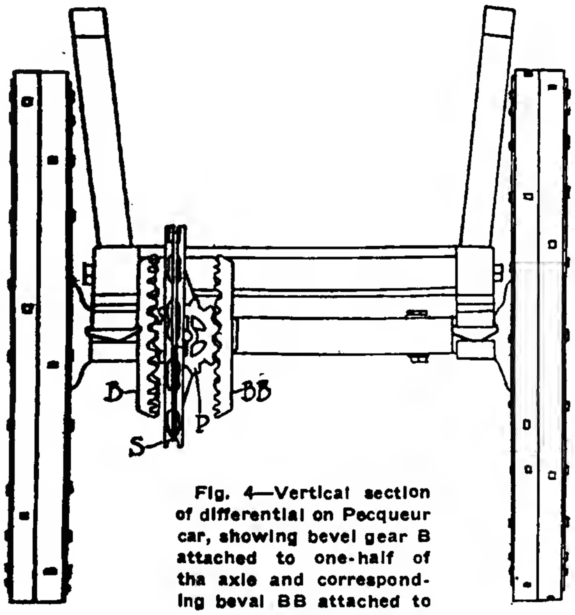


Fig. 4—Vertical section of differential on Pecqueur car, showing bevel gear B attached to one-half of the axle and corresponding bevel BB attached to the other half. Between them is mounted one of the balance pinions P and outside is the sprocket S for chain drive

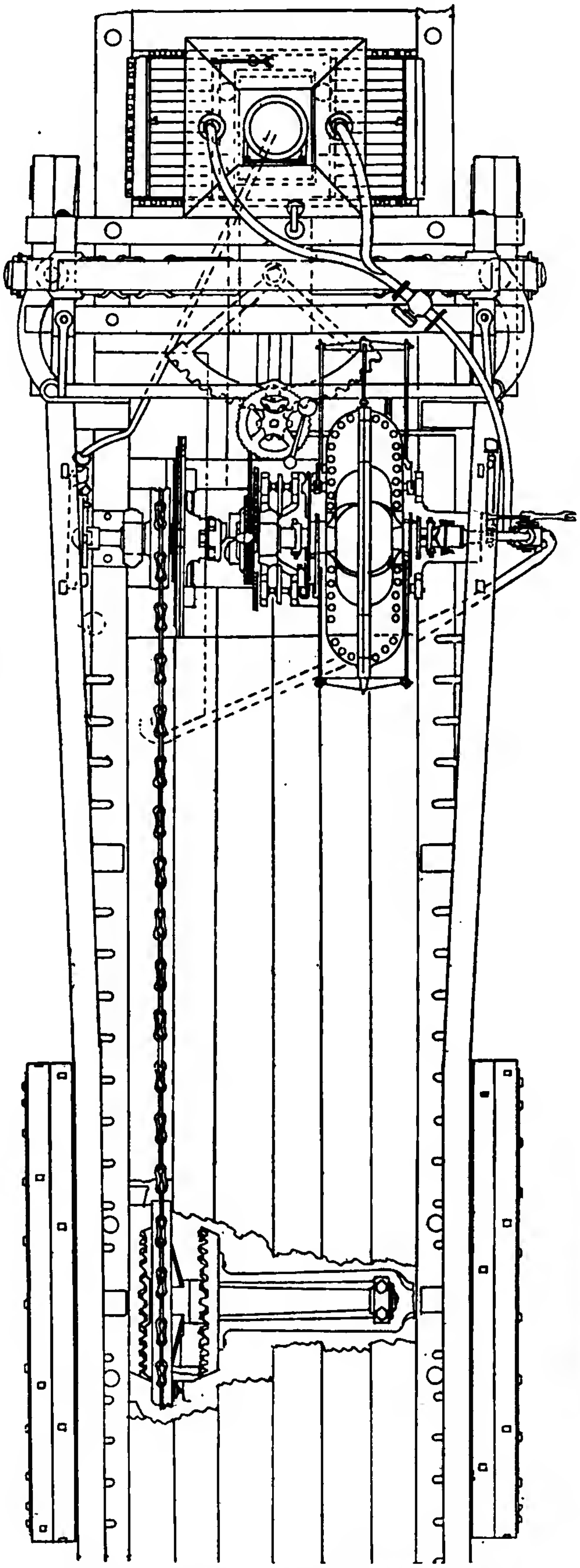


Fig. 3—Plan view of Pecqueur steam car, 1828, which merits being known as the father of the modern automobile in that it employed for the first time the modern steering gear, a two-speed planetary gearset, and a divided rear axle carrying a modern type of differential

The Rostrum

Chipped Gears Cause Differential Knock

EDITOR THE AUTOMOBILE:—I noticed a knock in the differential of my car which is a 1911 model Oakland 33 and after washing out the housing noticed a piece of steel lodged between the teeth of the large bevel gear. Last week a similar piece produced a knock. On observing the large bevel gears through the pipe-plug hole, I cannot detect the wear, but am unable to examine the small pinion without disassembling the housing. End play in the axle is not over 1/32 in. as tested by jacking up the wheels. Heretofore I lubricated the differential with steam cylinder oil, 600 W. and am now using light motor oil. The car runs all right and I would like to know whether I should continue using it or have the differential housing disassembled?

Dubuque, Iowa. W. E. C.

—The differential housing should be disassembled immediately for the purpose of determining what is giving way in the gears.

From the explanation you give it would seem that the gears had become chipped which will result very often from careless handling of the car, that is, by dropping in the clutch when the motor is speeded or by applying the brakes heavily. It can also be produced by mental fatigue due to long service.

Wiring Diagrams for Installing Ammeters

Editor THE AUTOMOBILE:—Will you please publish a wiring diagram for installing ammeters on models B-55 and C-55 Buick cars so as to show the discharge when the starter and lights are in use? Also, the rate of charge from the generator to the battery?

Barre, Vt. H. & M.

—The wiring diagrams for installing ammeters are furnished herewith, the diagram for Buick model B-55 being shown in Fig. 2 and for C-55 in Fig. 1. The rate of charge from the generator to the battery will depend entirely on the speed at which the car is operated, but it should not exceed 18 amp.

Second Speed Gear Slips Engagement

Editor THE AUTOMOBILE:—What would be the cause of the second speed gear slipping out when pulling up a hill. It is a Lozier type 82. I have deepened the notch in the shifter rod and also tightened the plunger spring, but without success.

Montreal, Que. W. O. G.

—It is probable that the second speed plunger has become worn and needs replacing and it may also be that the spring has become weakened and needs to be replaced with a new extra heavy spring.

Installing Ammeter on Hudson 6-40

Editor THE AUTOMOBILE:—Please publish directions for installing an ammeter on a 1914 Hudson model 6-40. What size wire should be used?

Lancaster, N. H. H. M. M.

—There are two terminals on the side of the generator, one immediately above the other. From the upper side of these two terminals a wire leads to the ignition and lighting switch and from the lower one a heavy cable leads to the storage battery. Immediately beneath the terminals is a brass strip forming an electrical connection between the two. All current going into the storage battery and all current coming out of it, with the exception, of course, of the cranking current, passes through this brass strip.

To connect an ammeter in the circuit, therefore, this brass strip may be removed or simply severed, using a hack-saw blade for the purpose, and the ammeter is then hooked up with the positive side connected to the upper terminal and the negative side connected to the lower terminal. No. 10 wire should be used.

Carbureter and Line Need Cleaning

Editor THE AUTOMOBILE:—I have a six-cylinder Albatross motor radial type with Remy magneto and Schebler Model D carbureter. When I prime the motor it gives about six revolutions and then stalls. The carbureter is new and the spark seems to be all right as it runs when I prime it.

Kindly advise me what your opinion is. Before starting I open the needle valve about two turns and open throttle about half.

Cleveland, Ohio. L. M.

—Evidently there is a stoppage somewhere, either in the tank or in the line between the tank and the carbureter or in the carbureter itself.

If the carbureter is taken off and thoroughly cleaned out and the tank and line are cleaned out, you should have no further trouble, as there is unquestionably dirt or foreign substance somewhere between the gasoline tank and the carbureter or in the carbureter in the nozzle, preventing same feeding properly.

Wants 1911 Regal Instruction Book

Editor THE AUTOMOBILE:—I would like to inquire through the columns of the Rostrum whether any of your readers has a copy of the instruction book issued by the Regal Motor Car Co., for its 1911 torpedo roadster, for which he has no further use?

I endeavored to obtain this book from the Regal Motor Car Co., but was informed that it was out of print and that they did not intend to reproduce the same. I would be glad to pay any reasonable price for the book.

New York City. P. F. S.

Steam Turbines Impractical for Cars

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for Dec. 9, S. T. asks the question, "Could a steam turbine be used in the Stanley steam car to furnish the motive power? If not, why?"; and you reply, "No, because it has not so far been possible to make a steam turbine in small sizes." I beg to differ with you on this point.

To my certain knowledge steam turbines are made in very small sizes by several manufacturers and are used for a variety of light power work such as driving exhaust fans, blowers, cream separators, etc. The reason that a turbine is not a practical drive for the Stanley or any other steam-

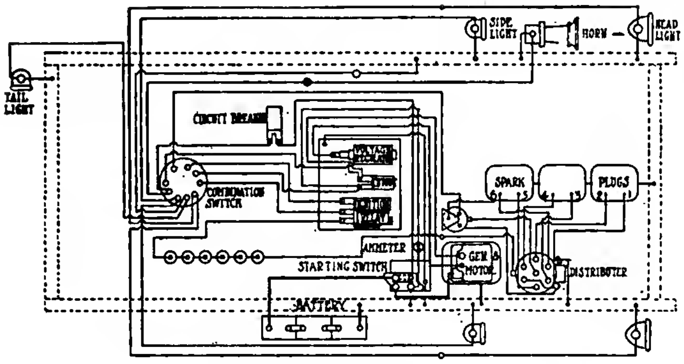


Fig. 1—Wiring an ammeter on a Buick C-55

propelled vehicle is because it has the inherent defect of possessing almost no starting torque. Steamships would be unable to use turbines but for the fact that there exists a large amount of slippage between the propeller blades and the water when starting slowly, and consequently very little load comes on the turbine till a high enough speed is attained to create sufficient friction against the propeller thrust to move the boat through the water. By this time the turbine has acquired momentum and is enabled to continue merrily on its way.

Newark, Del. R. R. W.

Must Keep Battery on Line

Editor THE AUTOMOBILE:—Will you please advise us what effect it has on a Delco generator to run a car with the storage battery removed, providing the wires are taped so that they are unable to ground?

Oneida, N. Y. O. M. C. Co.

—On none of the apparatus produced to date should a car be driven with the storage battery off the line. With the battery off the line the voltage of the generator rises to a very high limit so that it will burn out the headlights and also have an injurious effect on the ignition.

Replies to Hartford's Gnome Criticism

Editor THE AUTOMOBILE:—I noticed in THE AUTOMOBILE for Nov. 11 a criticism of an article on the Gnome rotary cylinder aeroplane engine. In this article Mr. Hartford says that the engine in question is also a reciprocating motor in that the pistons reciprocate in the cylinders. So far he is right, but he has failed to analyze further. The relative movement of the pistons and the cylinders is one of reciprocation, but the actual movement is rotary around a given center.

The cylinders revolve uniformly around the center of the crankshaft. The pistons revolve around the center of the crankpin. Owing to the design of the connecting-rods in the Gnome motor, the pistons do not revolve with a uniform speed exactly, but this difficulty has been overcome.

Mr. Hartford has fallen into the error of not appreciating the difference between relative and actual motion.

One pound of weight at 1 ft. from the center revolving at 1100 r.p.m., produces a centrifugal pressure of 412.6 lb.

San Francisco, Cal. A. F. B.

Information on Fuel Feed Systems

Editor THE AUTOMOBILE:—Will you kindly inform me of the relative merits of the several types of gasoline feed? So far as I know there are three types: gravity, vacuum and force feed, by air pressure. Of whom may I obtain literature on vacuum feed? I have air pressure feed and am always uneasy about leaks developing. Can one feel more secure with other types, or is he warranted in feeling greater security?

Norfolk, Va. M. E. R.

—Gravity feed, though usually efficient in level districts, sometimes fails to give best results when ascending steep grades. Even if entirely efficient, gravity feed requires location of the main gasoline tank either in the cowl or under the front seat, locations both dangerous and inconvenient.

Pressure feed requires an elaborate system of tubing and pressure pump, and needs constant attention on the part of the driver. Leaks are frequent. Its construction permits carrying the gasoline tank in the rear where it belongs, while at the same time forces the gasoline to the carbureter faster than needed, resulting in waste because of unconsumed gas.

Vacuum feed permits carrying the main gasoline tank in the right place, that is, in the rear, and carries gasoline unfailingly to the carbureter, without attention. A saving of gasoline consumption of from 10 to 12 per cent is shown over pressure feed, although no saving in fuel consumption is shown over gravity feed.

Proper Firing Time on 1911 Elmore

Editor THE AUTOMOBILE:—I have a 1911 Elmore 30 touring car on which I broke the timer arm. I would greatly appreciate it if you could send me instructions to time the ignition on this particular motor. It is equipped with an Atwater Kent system. The main trouble which I have had is to find the position of the distributer and piston at the proper firing time.

Cortland, N. Y. R. E. A.

—The spark in No. 1 cylinder should occur when the piston is between compression and power strokes.

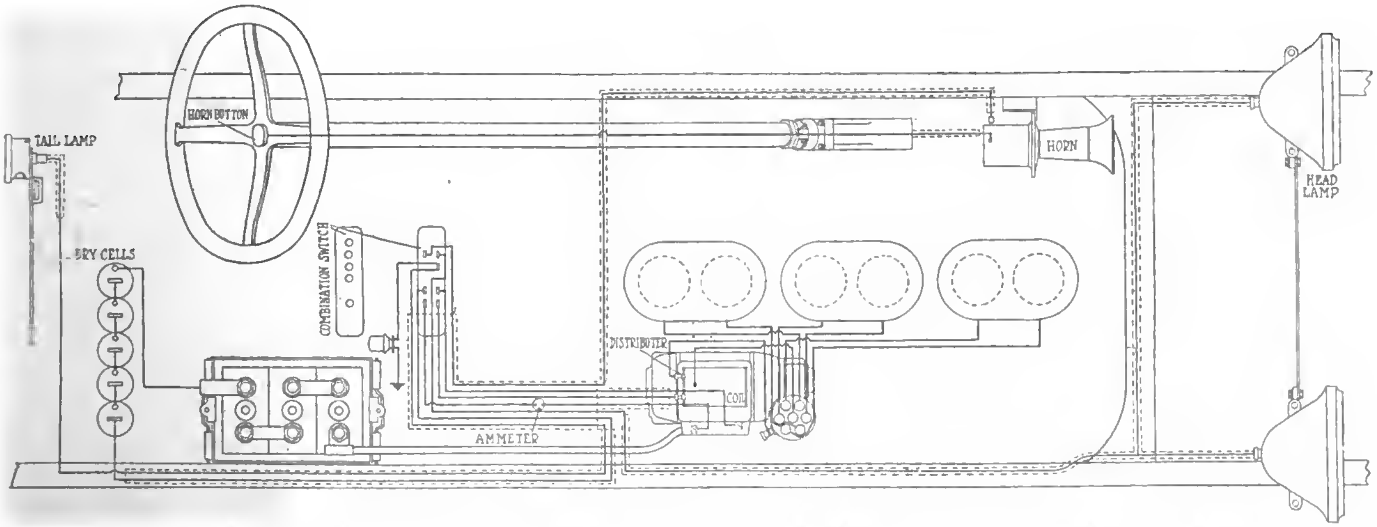


Fig. 2—Wiring diagram for installing ammeter on model B-55 Buick. Insert ammeter in No. 10 red wire between generator and switch

Bakelite—A Synthetic Resin

Formed by a Chemical Reaction Between Carbolic Acid and Formaldehyde—Used as an Insulator for Electric Starting, Lighting and Ignition Systems

ONE of the most noteworthy chemical achievements of recent years has been the work of the well-known chemist, Dr. L. H. Baekeland, in the line of phenolic condensation products which has resulted in giving to the world an entirely new and useful synthetic product, now familiarly known as Bakelite—or sometimes described by its more formidable chemical name of oxy-benzyl-methylen-glycol-anhydrite.

A Commercial Success

To the lay mind it is somewhat puzzling that two strong-smelling liquid substances—carbolic acid and formaldehyde—can be made to unite chemically with each other so as to produce a solid, transparent, amber-like substance, absolutely without taste or odor, and possessing entirely new chemical and physical characteristics. Yet this is exactly what is accomplished in the manufacture of Bakelite. In chemical products of this kind there is usually a wide gap between the laboratory stage and the final commercialization of same—but in the case of Bakelite it is an interesting fact that its commercial introduction met with almost instantaneous success, and the material is now being successfully used in a wide range of varying applications.

Bakelite in its pure form is a transparent, amber-like substance of marked chemical inertness. Physically, it is heat-resisting, mechanically strong, a high dielectric, impervious to most acids, steam and oils, and cannot be dissolved by any known solvents. In this form it is used for pipe stems, parasol handles, fountain pens, jewelry and similar applications.

A Good Insulator

For electrical insulation the pure Bakelite gum or resin is incorporated with various filling ingredients which give it strength, toughness, and other desirable qualities. Its largest, and perhaps most interesting application, is in the line of electrical insulation, where it seems indeed to have filled the proverbial long felt want and is now employed with notable successes in the electrical industry. It seems to have been particularly successful as applied to automobile ignition work. Bakelite does not burn or soften with heat like hard rubber or the shellac compositions; neither does it deteriorate with age or suffer injury from oils or moisture, which makes it peculiarly suitable for distributer blocks and other parts of electric starting, lighting and ignition systems. A large proportion of the leading lighting and ignition systems now use Bakelite insulation because ignition engineers must provide a dependable system, and dependability is largely a matter of high-grade insulation which is proof against heat and moisture.

Aside from strictly electrical applications, Bakelite is being successfully used on automobiles for many purely mechanical applications, such as radiator and gasoline tank caps, steering wheels, door strips, etc. And perhaps in no other use has it justified itself more fully than in the molding of delicate instrument covers, where extreme accuracy of dimensions, fine finish, permanency of color and chemical stability are of primary importance.

The Bakelite molding process is simple and very interesting. Steam-heated hydraulic presses are usually used for this purpose, the molding temperature being approximately 350 deg. Fahr. (120 lb. steam) and the hydraulic pressure from 1500 to 2000 lb. per square inch of mold surface. Hardened steel dies are necessary to insure the best results. The molding material is pre-

(*Continued on page* 50)

Good examples of Bakelite used as insulation and for other useful purposes in automobile design

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The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

New York's Sixteenth Show

THE sixteenth annual New York automobile show is unique in that it can be called the freakless show, a show without a single novelty-row candidate in the sense we have annually studied such during the past sixteen years. Every car in the show is a full-grown vehicle, a thought-out machine and not a sensation creator. In the accessory division the same freakless program prevails, in fact, freakiness is not present; it is not a symptom much less a factor in the atmosphere. For the time at least the creator of some pet hobby that an inventor has ridden to death, is not in manufacturing favor. To-day you walk through the four floors of the show, look over the 326 chassis and cars and glance at the hundreds of accessory exhibits and the dominating influence is one of feasibility, of practicability, of accomplishment.

For a new industry to discard entirely its sensationalism in less than a score of years, in approximately one-half a generation, is an accomplishment that few industries can boast of. It is but a score of years since America witnessed the practical birth of the automobile in the Times-Herald-Chicago race, and yet in that brief span much of the story of evolution has been written.

The present show demonstrates the impossibility of any one feature of construction stampeding the industry. The days of stampedes may return but the industry has emerged from a strenuous two-year test with eights and twelves, as the major stimulants to stampeding, and yet the spirit of developing along varied lines is stronger than it was a year ago. The makers are more busy in improving the general chassis and body rather than warring with one another for supremacy in some particular designs. The story of the industry's growth is a very general one, embracing all branches of the automobile. This healthy condition is certain to make the automobile a better balanced machine and at the same time serving as an adequate antitoxin to stampedes, which have been characteristic of many makers for many years.

Dimmer Regulation

OFFICIAL automobiledom has taken its first definite step in suggesting adequate ordinances to regulate the glaring headlight that is menacing our highways. By its recommendation of what a good light is, the Standards Committee of the Society of Automobile Engineers has set up an anti-dazzle bogey, which has been demonstrated as safe, conservative and yet adequate for the average automobilist. The recommendation is particularly opportune, coming as it does before the legislatures begin their country-wide annual campaign of anti-motor legislation. The recommendation is a sane suggestion for all legislators and one that no manufacturer or sane automobilist could reasonably object to.

By requiring adequate illumination to distinguish objects on the road at a distance of 150 ft., to distinguish objects on either side of the roadway at a point 10 ft. in advance of the car, and by requiring that the beams of light shall not be over 42 in. from the ground at a point 75 ft. or more in advance of the vehicle, the committee has practically covered the essentials of anti-glare legislation. Their recommendation is particularly commendable in that it makes no endeavor to suggest means of correcting existing glare devices, but rather leaves that to the versatile and inventive genius of the industry. There is not a single recommendation as to how the problem might be solved; only a sane recommendation as to the safety requirements that are necessary in connection with night driving. The recommendations have not been based on mere guesswork but are practically in accord with the findings of various investigating committees that have been analyzing headlight glare conditions in various cities during the past year. The general meeting of the society, held the day following that of the standards committee saw fit to modify this resolution, leaving only that part relating to restriction of light below 42 in., at 75 ft., and beyond and eliminating the parts defining adequate driving light. It seems a pity that the finding of the committee was not backed up by the general meeting; a pity that the membership as a whole has shown itself less courageous than the standards committee. Still the fact that the standards committee approved the resolution is of immense importance, for it means the whole society may approve something equally good before long.

Kelly-Springfield Raises Tire Prices

Increases Range from 7½ to 26%—More Cos. to Raise Lists

NEW YORK CITY, Jan. 4—The looked-for increase in the price of pneumatic tires which was expected to be announced by nearly all of the tire manufacturers Jan. 1 has been announced by only one concern, Kelly-Springfield, whose new prices represent an increase ranging from 7½ per cent on the smaller sizes such as 30 by 3 to approximately 26 per cent on such sizes as 37 by 5. Although none of the other companies has given any intimation of a rise, it is generally rumored in tire circles that one will come Jan. 8.

The present rise is due entirely to increase in the price of rubber, which has risen from 57 cents a pound in September and October to $1.05 yesterday. The rise in price, which has been going on steadily since Nov. 1, started with the reported closing of the Suez Canal, and although this great waterway through which comes all of the crude from the Federated Malay States and Ceylon has not been closed, the rubber price nevertheless has continued to rise. To date only one boat carrying rubber from the East has been torpedoed, this being the Langeon Hall with 500 tons of crude, which was torpedoed early in December. This loss is not sufficient to create any increase in price. At present 60 per cent of the crude used in America comes from the East, and while there has been no shortage of supply, the increase is largely due to the increased demand for rubber. This is due to the greatly increased number of cars in use, and is also due to the large increase in exports,. particularly solid tires, to certain of the belligerents.

Some of the Kelly-Springfield prices, new and old lists, follow:

Size	New	Old
30 x 3	$16.35	$15.20
34 x 4	32.95	27.45
34 x 4½	40.55	33.80
36 x 4	35.00	29.15
36 x 4½	42.95	35.80

N. A. C. C. Banquet Breaks Record

NEW YORK CITY, Jan. 5—The annual banquet of the National Automobile Chamber of Commerce, Inc., held last night at the Waldorf was one of the largest gatherings of automobile manufacturers in the history of the chamber, and perhaps the largest social event of show week. Three hundred men attended, the number representing the majority of the industry. In the absence of Charles Clifton, president of the chamber, due to illness, Wilfred C. Leland, Cadillac, presided. Senator Gore of Oklahoma was the only speaker and discussed preparedness from its many angles.

An entertaining novelty of the dinner was the menu which took the form of a stock certificate for 1000 shares of stock in the Blue Sky Motor Car Co., incorporated under the State of Collapse. Another novelty was the decorating of five automobile manufacturers for conspicuous accomplishments, the decorations taking the form of huge burlesque medals hung by red ribbons around the necks of the recipients. Those so decorated included John N. Willys, designated as the prince of production; Harry W. Ford, Saxon, for his financing; George Kissel as the knight of the all-winter body; and John F. and Horace E. Dodge for what they have done, their medal being split in two, each receiving a half.

Franklin Declares 100 Per Cent Stock Dividend on Common

SYRACUSE, N. Y., Jan. 5—The H. H. Franklin Mfg. Co., this city, has declared a 100 per cent stock dividend on its $900,000 outstanding common stock, payable Dec. 31. Cash dividends for the last half of the year total 38 per cent, one of 10 per cent having been declared for Dec. 31. The common stock was increased to $2,000,000. There is $600,000 preferred in the treasury.

The production for 1916 will be 3800 cars. The company at the first of the new year is two months ahead in orders for cars for delivery to the dealers.

White Motor Co. Elects Directors

CLEVELAND, OHIO, Jan. 4—At a meeting of the White Motor Co. held in this city to-day, the following were elected directors of the company: Warren Bicknell, E. W. Moore, Otto Miller and J. R. Nutt of Cleveland; J. H. Harding, of C. D. Barney & Co., Theodore Roosevelt, Jr., of Montgomery, Clothier & Tyler, E. R. Tinker, vice-president of the Chase National Bank of New York, and A. M. Hall, vice-president of the Liberty National Bank, all of New York.

Windsor T. White will shortly be added to the board and made president of the company. Other members to be included are: Walter C. White and M. B. Johnson of Cleveland.

Keim N. Y. Locomobile Manager

NEW YORK CITY, Dec. 31—Seymour de Benneville Keim has been appointed manager of the New York branch of the Locomobile Co. of America to succeed J. F. Plummer who resigned as manager of the New York branch a few weeks ago to pursue other business interests. Mr. Keim for several years has been manager of the Philadelphia branch, where he will be succeeded by Arthur Prince Hawes, at present manager of the Boston branch of the Locomobile company.

$3,000,000 Packard Preferred

New Issue of 7% Cumulative Stock Offered at 104 and Accrued Dividend

NEW YORK CITY, Jan. 3—The Packard Motor Car Co., Detroit, Mich., has sold $3,000,000 of 7 per cent cumulative preferred stock to William A. Read & Co., this city, and the latter concern is offering it to the public at 104 and accrued dividend. This stock is callable at any time on ninety days' notice at 110 and accrued dividend per share, and is subject to redemption at par on Aug. 30, 1939.

The cash received by the Packard company from the sale of this new stock will place the company in a position which will enable it to redeem all its outstanding debenture notes, which fall due next December.

The statement of the Packard company for its fiscal year ending Aug. 31, 1915, and published in THE AUTOMOBILE for Oct. 28, showed that the net current assets of the concern were approximately $10,000,000, and that the total tangible assets after very liberal deduction for depreciation were approximately $21,000,000. In the last fiscal year the company's net income available for preferred stock dividends, after depreciation reserves of more than $1,300,000, was $2,265,926. In the past five years investment in the property of surplus profits and reserves exceeded $13,000,000.

Packard 10 Per Cent Stock and 1¾ Per Cent Cash Dividend

DETROIT, MICH., Dec. 31—As a fitting climax to the ending of its busiest year, the Packard Motor Car Co. to-day announced that common stockholders will receive a 10 per cent stock dividend in addition to a cash dividend of 1¾ per cent. Payment will be made Feb. 1 to holders on record Jan. 15.

This is the first time a cash dividend is declared on the common stock. A 40 per cent stock dividend was declared Oct. 16, 1913.

Including the stock to be distributed Feb. 1, the total outstanding common stock will be approximately $7,771,830 out of the total of $8,000,000 authorized issue.

Reliance Engineering Capital, $1,720,000

LANSING, MICH., Jan. 3—The Reliance Engineering Co. has increased its capital stock from $1,250,000 to $1,720,000. This company recently took over the Saeger Engine Works, the Michigan Crank Shaft Co., and the Emergency Forge Co.

Chevrolet-G. M. C. Deal Strikes Snag

Eight of G. M. C. Directors Opposed to Merger Plan—Voting Trust Proposed

NEW YORK CITY, Jan. 4—A conference of directors of the General Motors Co., held in this city recently developed the fact that a majority of the directors of the company are opposed to the plan for a merger with the Chevrolet Motor Co., advanced by W. C. Durant, who proposed turning a controlling interest in the larger company over to the Chevrolet by means of an exchange of stock. The capital of the latter company, as a result of the plan, was increased from $20,000,000 to $80,000,000.

A letter has been sent to the General Motors stockholders by eight of the fourteen directors of the company stating that they are not a party to any arrangement looking to the vesting of control of the General Motors Co. in any other company, and that they favor the formation of a three-year voting trust beginning November, 1916, at which date the term of the present board of directors expires. These directors ask the stockholders to signify whether they wish to unite in forming such a voting trust, and state that if a sufficient number of the stockholders so desire, action to that end will be taken. The voting trust proposed, which they say is favored by a majority of the board, is to be made up of five members of the present board as trustees, to be selected by the present directors. The statement sent to the stockholders was signed by S. F. Pryor, A. H. Wiggin, Thomas Neal, C. H. Sabin, J. J. Storrow, C. S. Mott, Albert Strauss, and E. W. Clark.

Peerless Stock Syndicate Dissolved

NEW YORK CITY, Jan. 5—The Peerless Truck & Motor Corp. stock syndicate, which expired by limitation Jan. 3, has been dissolved and will not be renewed. This means that there are now no restrictions on the sale of the stock by subscribers.

In a statement sent to shareholders President Frederick Gilbart states that the aggregate sales by the company in the eleven months ended Nov. 30, 1915, were $11,458,513 and that net profits, after deduction of charges for maintenance and depreciation, before deducting interest obligations, cancelled or provided for in the formation of the corporation, were $1,903,058. This is at the rate of $9 a share per year, 18 per cent of par value, on the entire outstanding capital stock of $10,000,000, after providing for interest on the corporation's 6 per cent convertible gold notes now outstanding.

The consolidated balance sheet of the subsidiary companies of the Peerless Truck & Motor Corp., as of Nov. 30, follows:

ASSETS	
Patents, franchises and goodwill.. ($5,000,000 represented by common stock of General Vehicle Co., Inc., as per contra.)	$5,100,000
Land, buildings, plant and equip..	4,816,586
Investments	511,035
Inventories	1,428,265
Accounts and notes receivable....	655,695
Cash in banks and on hand........	2,147,008
Prepaid expenses and insurance..	65,418
Development, engineering ex., etc..	184,636
Total	$14,908,646

LIABILITIES	
Peerless Motor Car Co. 7% cum. pf.	$2,100,700
Peerless Motor Car Co. com. stock.	2,085.500
General Vehicle Co., Inc., 7% cum.pf	1,200,000
General Vehicle Co., Inc., com. st'k. (This amount represents patents, fr'nch's, goodwill as per contra.)	5.000.000
First mtge. serial gold 6% bonds of the Peerless Motor Car Co........	900,000
Less—Since retired or to be retired by the Peerless Motor Car Co...	300,000
Mortgage on real estate in N. Y. C.	300,000
Special deposits	175,490
Accounts payable	734,288
Peerless Truck & Motor Corp. advance	50,000
Sundry creditors, including accrued payroll	114,304
Reserves against inven., doubtful accounts, etc....................	250,360
Surplus capital created by cancellation of notes payable of General Vehicle Co., Inc., as of Oct. 31, '15.	900,000
Surplus	1,398,003
Total	$14.908,646

Standard Steel Car Takes Model Engine—To Double Output

PITTSBURGH, PA., Jan. 3—The Standard Steel Car Co., this city, has taken over the Pittsburgh Model Engine Co., with plants in Pittsburgh and Peru, Ind. The Model Engine Co.'s assets in property, buildings and machinery, when taken over, exceeded $1,000,000.

The production of Standard cars is to be doubled and the manufacture of Pittsburgh Model engines for the trade will be continued.

Six Hupmobile Men Promoted

DETROIT, MICH., Jan. 4—The Hupp Motor Car Corp., this city, has made a number of promotions in the factory organization, effective Jan. 1.

Lee Anderson, formerly sales and advertising manager, becomes commercial manager in charge of sales, service and advertising. J. E. Fields, formerly director of the Hupmobile national coupon service plan and special sales representative, becomes sales manager, with H. E. Westerdale as his assistant.

Frederick Dickinson, formerly assistant advertising manager, becomes advertising manager. R. D. Heartz, formerly assistant to Mr. Fields, becomes sales promotion manager. J. S. Patterson, who has handled the Hupmobile publicity, becomes assistant advertising manager. J. L. Kenyon becomes general service manager in charge of technical service, parts stock and orders and claims.

Calls for Gasoline Price Probe

Congressman Introduces Resolution Demanding Punishment of Price Boosters

WASHINGTON, D. C., Jan. 4—That the rapid increase in gasoline is almost certain to bring about a Federal inquiry was indicated to-day when the attention of Congress was directed to it. Congressman Steenerson of Minnesota, introducing a resolution calling upon the Department of Justice to advise whether it has begun prosecutions against those responsible for the increased prices. Price of gasoline in Washington was to-day advanced 1 cent a gallon from 20½ to 21½ cents.

The preamble of the Steenerson resolution asserts that the present price of gasoline is "unreasonable and extortionate" and that it is sufficiently high to injure the industries of the United States.

The resolution directs the Attorney-General to advise what steps he is taking in connection with reports that dealers in the commodity are violating the Sherman anti-trust law. If the department has not begun prosecution, the resolution provides, the Attorney-General shall explain why such prosecutions have not been started and if they are contemplated. The Steenerson resolution was referred to the judiciary committee.

"We will answer the resolution when it comes to us," said Assistant Attorney-General Todd this afternoon when advised of Congressman Steenerson's action in the House.

Monihan Forms New Company

NEW YORK CITY, Jan. 5—John G. Monihan, has resigned from active participation in the affairs of the Mutual Motors Co., of Jackson, Mich., and has formed a company of his own, known as the Co-operative Exhibitors of Motor Cars, with headquarters in Detroit, and offices in Cleveland and Buffalo. Mr. Monihan states that the purpose of his new concern is to distribute automobiles, but does not as yet announce the name of the car he is to handle, although it is understood that this will be an entirely new make.

Mr. Monihan retains his position as a stockholder of the Mutual company and as a member of the board of directors.

Snell Interstate Production Manager

MUNCIE, IND., Jan. 4—F. E. Snell, who was connected for many years with the Service Motor Truck Co., Wabash, Ind., and the Garford Motor Truck Co., has taken over the duties of production manager of the Inter-State Motor Co.

Gasoline Higher Despite Increase in Crude Output—Retardation Charged

Dept. of Justice and Federal Trade Commission Both Prepare to Investigate Reasons Given for Increasing Price of Fuel—220,000,000 Bbl. of Crude Held in Reserve

WASHINGTON, D. C., Jan. 1—With both the Department of Justice and the Federal Trade Commission preparing to investigate gasoline prices and with the probability that Congress will also take a hand in the matter, the subject is sure to receive a lot of attention during the next few weeks. Official government figures just made public disclosed that in the face of rising prices of gasoline, production of crude petroleum during the last year was greater than in 1914, although production was "purposely retarded as far as practicable," that reserve stocks of crude petroleum now being held in the country are the largest ever recorded, and that exports of gasoline, to which the rise in prices frequently has been attributed, were in the last ten months of 1915 less than the exports during the corresponding period of the two years previous.

A statement issued by the Geological Survey estimated the 1915 production of market petroleum at 267,400,000 barrels, 2000 barrels more than in 1914. "This," says the statement, "does not agree with the currently reported reason for the exceptionally high prices now prevailing for motor fuel. As a result of the overload put on the transporting and refining phases of the petroleum industry by the excess output of 1914, the year 1915 may be characterized as a period of readjustment, in which production activity was purposely retarded as far as practicable. The small increase, therefore, is more significant than the simple figures indicate."

Factors that might be expected to affect the price of gasoline, according to the survey officials, are production, consumption and prices of crude petroleum. Consumption figures, they said, were not available, though consumption was increasing. A low petroleum price level was reached in April and until August the price remained at $1.35 a barrel for the market standard. Then the price began to soar, and on Dec. 17 petroleum was selling at $2.15. Indications now are, says the statement, that the price soon will reach $2.50, its previous high record.

Reserve of 220,000,000 Barrels

One production fact brought out by the survey is that crude petroleum stocks held in reserve, the largest ever known, increased 50,000,000 barrels in 1915, and at present more than 220,000,000 barrels are being held. Field storage by producers accounts for 24,000,000 barrels of this.

Export figures for the first ten months of 1915 show that gasoline exports dropped far below the same period in 1914, and slightly below 1913. During the ten months ended with October last 98,471,466 barrels left the United States against 140,275,273 barrels for the same period of 1914 and 100,353,871 barrels for 1913.

The relation between the cost of crude petroleum and gasoline is hard to determine, according to officials who have given the subject study, because of the varying grades of petroleum and the variety of oils produced in refinement. An increased demand for gasoline, they say, means an increased production of kerosene, lubricating oils and other petroleum products. All petroleum products have risen in price.

Rittman Process Influence

Officials familiar with the situation say the recent discovery of Dr. Walter F. Rittman, a government chemist, of a process for obtaining from crude oils 200 per cent more gasoline than by old methods, probably will have a bearing on both production and price before another year had passed. Several companies already have started production under the new method. Their output, and the output of others to be started, it was said, would be felt soon on the market.

In connection with the gasoline question some interesting facts have been developed by Judson C. Welliver, of this city, who is an authority. Some points brought out in an interview with Mr. Welliver are of interest at this time. "The government's big investigation of the whole petroleum products situation in this country has thus far tended to increase the mystery about tendencies in the oil business," said Welliver. "Less than three years ago authorities on oil matters were diligently predicting that conditions, which were then thoroughly bad, were going to be worse. The refiners in the midcontinent field were pictured as practically all losing money with every indication that they were going to lose more or else be forced out of business.

"Despite this gloomy forecast the price of gasoline is now high and mounting higher. There has been prophecy lately that it would soon reach 25 cents the gallon, and might get to 35 at no distant period. The investigators want to know why; and they are not finding out very fast.

War Affected Supply Little

"One part of the explanation, which occurs promptly to the inquirer, is that the war has created a huge, unexpected demand. I asked one of the government authorities, and he declared that he did not consider this true. While detailed figures on export of petroleum products as affected by the war had not been studied, it was doubted if, in fact, any more gasoline had been sold since the war began than before. The explanation was that for a considerable time after war started the oil steamships, which were largely sailed under the British flag, were off the seas; there were too many German cruisers turning up in unexpected places. By the time these commerce destroyers were cleared away, a big volume of sales had been lost. Since then the Allies have been taking large quantities of gasoline, but they have not been able to take as much as they wanted, because there were not ships to handle it. Some of the midcontinent refiners have recently been quoted as saying that they could send several times as much gasoline abroad if they could get ships to carry it. Moreover, the big Austro-German market has been cut off entirely from commerce in the fuel in recent time.

Seeking Other Causes

"So the investigators are seeking other causes for the increase in gasoline's price. Among the possible causes is the fact that production in the great Cushing, Okla., field is beginning to diminish. This was the greatest oil field ever opened in the world. It turns out a very high grade of crude oil for gasoline purposes; so good, in fact, that refiners in other sections of the midcontinent field found themselves under necessity of extending pipe lines to Cushing or using great numbers of tank cars in order to supply themselves with this high-class crude. The business got adjusted to the notion of making Cushing oil the basis, and now that the production there is falling off it is suspected that there is difficulty readjusting."

Avery to Make Tractor at $295

PEORIA, ILL., Jan. 2—The Avery Farm Implement Co. has decided to add tractors to its line, and equipment has been installed to produce a new model which is to be placed upon the market this year for $295, the lowest price ever quoted for a farm tractor. Models were shown during the past fall at the leading fairs and implement shows of the United States and orders have been received for 800. It is planned to manufacture several thousand during the coming year. The new tractor displaces four horses, and in addition, can be belted to any farm machinery, developing 10 hp. when used as an engine. It will pull two plows of 12-in. width at a depth of 6 in. in ordinary stubble ground; a 6-ft. disk harrow over plowed ground; a four section spike tooth harrow over plowed ground; a grain drill; a road drag; two loaded farm wagons; or anything else upon the farm that requires four horses to move. It will also operate a silo filler or feed grinder or any other farm implements of the present day.

May Examine Mass. Motorists

BOSTON, MASS., Jan. 1—The Safety First propaganda is to be carried before the Legislature this year according to plans now being formed, and it is possible that all future motorists in Massachusetts may have to pass an examination. Secretary of State Langtry has filed a report with the Highway Commission urging the appointment of from 1000 to 1500 persons, motorists as well as non-motorists, to act as monitors throughout the State. They would be given a badge by the commission, and authorized to warn drivers seen operating recklessly, and also report them to the commission. If a driver were reported two or three times by different monitors that would be evidence enough to cause a suspension of his license. The monitors would not have police power to make arrests.

The other movement has been started by the Highway Safety League. Its secretary, Lawrence G. Brooks, has filed with the incoming Legislature a bill calling for the examination of all motorists as follows:

> Section 1. Before granting a license to operate a motor vehicle the Highway Commission shall make an investigation into the mental, moral and physical qualifications of the applicant, such investigation to include a practical test of the applicant's ability to operate a motor vehicle and of his familiarity with the motor vehicle laws, and no license shall be issued until the commission or its authorized agent is satisfied that the applicant is a proper person to receive it. The foregoing provision shall only apply to applications for licenses made after the passage of this act.
>
> Section 2. All acts or parts of acts inconsistent herewith are hereby repealed.
>
> Section 3. This act shall take effect upon its passage.

$20 Fine for Jaywalking

On top of this Boston has put into effect its ordinance compelling all pedestrians to cross the streets at cross-walks where police officers direct traffic, and there is a penalty of $20 for crossing when the officer has signaled to vehicles to proceed.

Porter With Smith Form-a-Truck

CHICAGO, ILL., Jan. 3—Samuel D. Porter has been appointed general sales manager for the Smith Form-a-Truck Co., this city.

Overland Larger Four $55 Lower

Quantity Production and Abundant Material Permits Reduction from $750 to $695

TOLEDO, OHIO, Jan. 4—The Willys-Overland company has reduced the price of its larger four-cylinder Overland car $55, or from $750 to $695. It is stated that this reduction is made possible by the foresight of President Willys of the Overland organization in purchasing materials before war sent prices soaring. As an example of the economy effected as compared with present prices of these materials, the company has been able to save $3,500,000 on aluminum alone, while the savings on steel and other raw materials is in proportion. Quantity production is another factor in the reduced price of this model 83-B, large factory additions recently completed having enabled the company to more than treble its output of a year ago.

More than 50,000 cars of this model have been sold in all parts of the world since June, breaking all Overland sales records, more cars having been delivered in the past few months than in any previous year of the company's history.

Federal Truck Announces 2-Tonner at $2,100

DETROIT, MICH., Dec. 31—The Federal Motor Truck Co. has brought out a new 2-ton model. This was made necessary owing to the increasing demand from Federal distributors for a truck having a greater carrying capacity than 1½ tons and yet less than the 3½-ton truck which the company is making. Many business houses have been inquiring for such a medium model.

The price of the new truck is $2,100. It will be optional with the purchaser to have his truck with either a wheelbase of 144 in. or of 168 in. The motor is a Continental 4⅛ by 5¼. The ignition is single, the Eisemann being used. The gearset is of the selective sliding gear type. The axle is of the floating type. Springs are semi-elliptic. The front solid tires are 36 by 4 in., the rear tires 36 by 6 single or 36 by 4 dual.

Lewis, of Mitchell-Lewis, Dies

RACINE, WIS., Dec. 30—William Turnor Lewis, second vice-president of the Mitchell-Lewis Motor Co., Racine, Wis., one of the founders and principal stockholders in the concern, died suddenly on Dec. 30 at his home, from apoplexy. Mr. Lewis was born in Utica, N. Y., on March 10, 1840. His first occupation was that of a telegrapher. Mr. Lewis served through the Civil War as a military operator. In 1864 he married Mary Mitchell, daughter of Henry Mitchell, the first wagon manufacturer in the Northwest and founder of the business which in later years became the $10,000,000 Mitchell-Lewis Motor Co. When the present concern was organized, Mr. Lewis preferred to take a post of lesser importance and made his son, Capt. Wm. Mitchell Lewis, president. However, Mr. Lewis took an active interest in the affairs of the company until the day of his death. He served two terms as a State Senator and once was a popular choice for the nomination for United States Senator from Wisconsin. He is survived by a son, Captain Lewis, two daughters, and the widow.

Kentucky Wagon to Assemble Cars for Dixie Co.

LOUISVILLE, KY., Jan. 1—At a special meeting held Friday, a contract whereby the Kentucky Wagon Manufacturing Co. will assemble automobiles for the Dixie Motor Car Co., a concern in process of organization, for a period of 5 years, was approved by the stockholders.

The proposed concern will pay the wagon company a stipulated sum to assemble the cars and manufacture certain parts. R. V. Board, president of the wagon company, will be president of the wagon company's new enterprise. He announced to the wagon works' shareholders at Friday's meeting that they would be privileged to subscribe to stock in the automobile company on a pro rata basis.

2000 Moline Tractors for 1916

MOLINE, ILL., Jan. 2—The Moline, Ill., Plow Co. will, during the coming year, manufacture 2000 farm plow tractors. The two-plow tractor with plows of 12 and 14 in. in width, will be specialized, as this style has the advantage of being able to make a very short turn at the end of each furrow. The price has been fixed at $750.

Ford Tractor Plant for Canada

FORD CITY, ONT., Jan. 4—The Ford Motor Co. of Canada has purchased a site for the erection of a tractor manufacturing plant. Mr. McGregor is manager.

Trumbull Receiver Appointed

BRIDGEPORT, CONN., Dec. 31—Attorney E. K. Nicholson of this city, has been appointed temporary receiver of the Trumbull Motor Car Co., this city, with a bond of $25,000. At a stockholders' meeting recently it was voted to discontinue the business of the concern and the officers asked for the appointment of a temporary receiver.

S.A.E. General Meeting Modifies Headlight Resolution

All New Standards Passed—Small Attendance at Business Session—Constitution of Nominations Committee Discussed

NEW YORK CITY, Jan. 5—The business session of the S. A. E. opened this morning at 10.30, an hour later than scheduled. The business was mainly of a formal character, including the election of officers for the session 1916-1917, the acceptance of the treasurer's report, and passing of the general meeting upon the new standard resolutions passed the day previous by the standards committee and the council.

All these standards resolutions are reported on pages 19 to 23 and every one was accepted by the general assembly with the exception of the headlight resolution, which was modified a good deal.

Headlight Resolution Modified

On the presentation of the report of the electrical equipment division, the chairman, A. L. Riker, who had been absent from the standards committee meeting on Tuesday on account of sickness, stated that he personally did not agree with the resolution propounded by his division. His idea was that it was too sweeping and outside the province of the society. He said he did not think the society should go into legal questions but should confine its attention to engineering matters. President VanDervoort, speaking from the chair, said that he thought the subject ought to be discussed very fully indeed as it was of such great importance, and indicated that his own feeling was not entirely in accord with the resolution as passed by the standards committee and quoted on page 21 of this issue.

Hot Discussion Follows

The discussion following Chairman Riker's announcement was one of the most vigorous ever heard. It was very long, occupying most of the morning, and the final result was that the resolution was cut down so as to read:

> "The Division suggests as recommended practice the following, as a standard provision for the regulation of headlight illumination.
>
> "The headlights shall be so arranged that no portion of the reflected beam of light, when measured 75 ft. or more ahead of the lamps, shall rise above 42 in. above the level surface on which the vehicle stands."

It will be observed that this amended resolution confines itself to what the lamps shall *not* do and omits all reference as to what they *shall* do.

In the discussion the many speakers changed their exact opinions a good deal as the discussion progressed, but the apparent main reasons for the action taken were two in number. First, it was pointed out by several speakers, that electric cars and trucks, especially the latter, very seldom had lamps that would illuminate the road 150 ft. ahead of the vehicle, and that the recommendation as it stood would compel the purchase of new lamps by a great many users of automobiles, should it be adopted for legislative purposes.

Secondly, there was a fairly strong feeling evident that the subject was a dangerous one, that the S. A. E. might find the result of standing back of such a resolution extremely troublesome. In other words that it would involve taking part in activities outside the proper sphere of the society.

Innumerable Angles

Nearly every speaker had a different viewpoint. K. W. Zimmerschied, chairman of the standards committee pleaded for the resolution as it stood originally, saying that the present legal restrictions in different parts of the country are such that no one headlight can comply with them all. That it was essential someone should set up a definite guiding rule for legislators. He preferred the original resolution, but would sooner have it as amended by Mr. Riker than have it referred back to the division. In this view Mr. Zimmerschied was supported by a few, notably B. B. Bachman who, as a man vitally interested in the running of trucks went on record to the effect that illumination of a thorough character was essential to the safe operation of any sort of vehicle.

It was stated that the electric passenger cars were among the worst offenders on the glare question despite the fact that their light was not good from the driver's viewpoint. The president added a comment that it would seem to be difficult to compel a man to have so much light, in many cities all the law enjoined was that there should be a white light on either side to render the approach of the vehicle visible to another road user.

This led to a side discussion as to whether or not a *sufficiency* of light for safe driving ought or ought not to be a subject of legislative activity.

Finally on being put to the vote Mr. Riker's amendment was accepted, and will go through the mails to the full membership.

Nomination System Discussed

Under the head of "new business" W. H. Conant proposed that the method of selecting members for the committee upon which devolves the nomination of officers should be changed. At present the committee has seven members and the idea is that they shall be truly representative of the industry. Mr. Conant held the view that the present committee gave too strong a representation to certain sections and he suggested a new rule to the effect that each section of the society should select one member giving the minimum membership of the committee as five.

In discussion, which was vigorous, it was ascertained that only about half the total membership of the society is contained within the sections. So J. N. Heald proposed that the committee should consist of two nominees, not members of sections and a nominee from each section in addition.

The president said that the matter would have to be submitted to the whole membership by mail, sixty days before the summer meeting before anything could be done, so it was left to Mr. Heald and Mr. Conant to prepare written suggestions which could be dealt with in this way.

New Members of Council

As usual every nominee was accepted, for the new officers and councilmen, Russell Huff becoming president, with vice-presidents Eugene S. Foljambe and Robert H. Combs. Members of council to serve one year are David Beecroft, Directing Editor THE AUTOMOBILE, Edwin R. Hall, Goodyear Tire & Rubber Co., and John G. Utz, Perfection Spring Co. To serve one year on the council, George W. Dunham, consulting engineer. For treasurer, Herbert Chase was chosen.

New U. H. Klaxon Horn at $12

NEW YORK CITY, Jan. 4—A new motor-driven horn styled U. H. Klaxon, has been brought out for $12 by the Lovell-

McConnell Mfg. Co., Newark, N. J. It resembles the Klaxonet in shape but is longer and in that the motor shaft is horizontal and carried in a housing directly back of the horn bell. This motor drives a cam with many teeth cut on it, which vibrates the diaphragm and thus produces the sound.

It operates on 6 volts and is finished in black, which is the standard finish for the coming year. The other models will be continued. These include the Klaxonet, $15; U. H. Klaxet, $6; and the Klaxon, $20.

Promotions for Three Goodyear Men

AKRON, OHIO, Dec. 31—At the annual meeting of the Goodyear Tire & Rubber Co., Akron, Ohio, the promotion of secretary G. M. Stadelman, who has been sales manager throughout the Goodyear up-building, to a vice-president. He continues as sales manager.

P. W. Litchfield, who has been with Goodyear as factory manager almost since the beginning, was also elected a vice-president. A. F. Osterloh was elected secretary. He is also assistant sales manager.

233,325 N. Y. Cars Registered

ALBANY, N. Y., Jan. 4—Receipts aggregating $1,905,153 are reported by the Automobile Bureau for the eleven months ending Dec. 31, 1915. The whole of 1914 totaled only $1,618,060.

For the eleven months a total of 233,325 automobiles had been registered by owners or dealers—231,126 by the former and 2199 by the latter. During the same months in 1914 a total of 169,966 cars were registered, or 61,160 less than this year; dealers numbered 1743 and owners 168,223.

There were 101,074 cars registered in the New York City district up to Jan. 1, 1916; 72,815 cars were registered in the Buffalo district, and 57,237 in the Albany district.

Springfield Metal Body Detroit Plant Ready by March 1

NEW YORK CITY, Jan. 1—The Detroit plant of the Springfield Metal Body Co. will be ready for occupancy between Feb. 15 and March 1. This plant is somewhat smaller in area than the other one, in Springfield, Mass. There is a possibility that the main office may be in Detroit, but as yet nothing has been settled in regard thereto.

Middleton Steel Products Representative

DETROIT, MICH., Dec. 31—Ray T. Middleton will be Michigan representative and manager of the local branch of the Steel Products Co., Cleveland, beginning Jan. 1. Headquarters have been opened in the Ford building.

Freight Car Shortage Again Acute

N. A. C. C. Announces 15,582 Carloads Shipped in Dec., an Increase of 144 Per Cent

NEW YORK CITY, Jan. 5—That the freight car situation has again become acute is brought to light by the report of the traffic committee of the National Automobile Chamber of Commerce submitted at the annual meeting to-day. The shipments of automobiles for the month of December amounted to 15,582 carloads. This is an increase of 144 per cent over the same month of last year when 6378 were shipped. The number of freight cars for automobiles now in service is 59,274 and these will shortly be increased by 10,000 as the New York Central will soon put on 9000 more freight cars and the Pennsylvania road 1000.

The traffic department of the Chamber of Commerce intends to have representatives visit all centers to confer with the local traffic organizations for the purpose of securing co-operation. The traffic department is also in correspondence with every railroad for the purpose of securing more cars and impressing on the freight departments the necessity for quick return of the unloaded cars to the proper terminals.

Besides the routine business taken up at the meeting to-day, the Chamber has approved the recommendations of the Society of Automobile Engineers on standardization of methods of numbering motors, the uniform license plate and the proposed anti-glare headlight ordinance. These matters are at present before the S. A. E. for adoption and the approval of the N. A. C. C. will undoubtedly carry considerable weight.

Percy Owen Retires from Active Service With Saxon

DETROIT, MICH., Dec. 31—Although remaining as a director of the Saxon Motor Car Co., of which he was one of the organizers, Percy Owen has retired from all active service according to an announcement made by officials of the Saxon company. Mr. Owen had been giving special attention to all matters pertaining to the sales of the company.

Motor & Accessory Manufacturers Meet

NEW YORK CITY, Jan. 5—A meeting of the Motor & Accessory Manufacturers' Assn., was held in this city to-day at the Waldorf-Astoria where action was taken in regard to the election of four new directors to succeed the four retiring as follows: F. Hallett Lovell, Jr., C. E. Thompson, Alfred P. Sloan, Jr., and C. E. Whitney. About 100 members were present at the meeting. The four directors are elected for three years.

President Lovell's report showed that there are 241 members in the association. C. W. Stiger, chairman of the finance committee and J. S. Marvin, of the traffic department, made reports.

To-morrow the association will meet at its offices to elect officers. The present officers are: President, F. Hallett Lovell, Jr.; vice-president, C. A. Stiger; second vice-president, C. E. Thompson; third vice-president, T. J. Wetzel; treasurer, L. M. Wainwright, and secretary and assistant treasurer, A. P. Sloan, Jr.

General Motors Common Pays 20 Per Cent

NEW YORK CITY, Jan. 5—At to-day's meeting of the board of directors of the General Motors Co. the main issue on which action was taken was the placing of the common stock on a regular dividend basis of 20 per cent yearly. L. G. Kaufman, president of the Chatham & Phoenix National Bank, this city, was elected chairman of the board to succeed Emory W. Clark of Detroit, who was re-elected to that capacity at the annual meeting on Nov. 16. In confirming the decision as to dividends Mr. Kaufman refused to make any statement as to the affairs of either the General Motors or Chevrolet interests.

Ross & Young Machine Capital Now $750,000

DETROIT, MICH., Jan. 4—The Ross & Young Machine Co., established in 1910 with a capital stock of $35,000 has increased its capital to $750,000. This company also operates and controls the Ross Automobile Co., which incorporated in July, and is capitalized at $300,000. The latter company is bringing out a new model eight this year and is now making arrangements for a large production. The new Ross is to be shown in Chicago in connection with the annual automobile show.

Fitzsimmons Steel Products Breaks Ground

MILWAUKEE, WIS., Jan. 2—The Fitzsimmons Steel Products Co., which is the Wisconsin interest of the Fitzsimmons Steel & Iron Co., Chicago, Ill., has broken ground for a new steel finishing mill and power house in the Menomonee Valley at Milwaukee, Wis. The plant will be used exclusively for the production of cold drawn steel products. The factory will be 105 by 200 ft. on a site 200 by 275 ft. fronting both on the canal and the railroad tracks. Carl and Ernst Prinz of Milwaukee are among the principal stockholders

$4,000,000 Co. May Take Grant

Detroit and Chicago Interests Forming Corporation—Syndicate to Market Stock

DETROIT, MICH., Jan. 3—Andrews & Co., of this city and Chicago, and Livingstone & Co. are interested in a new corporation now being formed with a capital stock of $4,000,000 to take over the business of the Grant Motor Co., Findlay, Ohio.

These brokers will take $1,000,000 in preferred stock and $2,000,000 in common stock. The balance of $1,000,000 of common stock is to be held to exchange it for the preferred stock.

A syndicate is now being formed by the purchasers for the purpose of underwriting $1,000,000 preferred and $600,000 common stock and place it on the market. The preferred stock, which will pay 7 per cent dividends, is to be convertible into common at the option of the stockholder, prior to Jan. 1, 1919. After that time it will be redeemable at 120 plus the accrued dividends.

The present capital stock of the Grant Motor Co., which was organized in 1913, is $200,000. This is double the original capitalization.

Rockwell-Drake to Make Ball Bearings—May Remove to Plainville

HARTFORD, CONN., Jan. 1—It is admitted by Hugh Rockwell and L. A. Drake of the recently organized Rockwell-Drake Corp., which, among other things, is to make ball bearings, will remove to some location other than that at 78 Grove Street in Hartford. Because of this fact, coupled with the knowledge that A. F. Rockwell, late of the New Departure Manufacturing Co., and father of the younger Rockwell, acquired a site in Plainville, it is assumed the firm will locate there. The members of the firm are non-committal on the subject and the senior Rockwell says he is not interested. Messrs. Rockwell and Drake were formerly with the New Departure Manufacturing Co.

Martin Rocking Fifth Wheel Co. Organized in Springfield

SPRINGFIELD, MASS., Dec. 31—The Martin Rocking Fifth Wheel Co. has taken over the business and the patent rights of C. H. Martin, this city. The officers of the new corporation are C. H. Martin, president, Adolf A. Geisel, treasurer and H. G. Farr, secretary. Mr. Geisel, who will have the general management of the business, has been connected with the automobile industry for the past fifteen years.

The tractor-semi-trailer business had grown to the point where it was necessary to take in additional capital in order to supply the fifth wheel connections as fast as they were ordered. In addition to making fifth wheels in different sizes—from one that makes a Ford roadster into a 1-ton tractor to one that makes a 5-ton truck into a 10-ton tractor—the new company plans to make semi-trailers for the Ford size.

Pfau Mfg. Co. Enters Field

CINCINNATI, OHIO, Jan. 1—The Pfau Mfg. Co., this city, which has been engaged in the manufacture of brass goods in this city for the last twenty-five years, will expand this department to enter the automobile field. The company will be prepared to furnish to the trade large quantities of brass specialties. The company is in a position to duplicate any articles of brass tube and rod, or stamped products of sheet steel, iron, copper or brass. It is not the intention to manufacture large sheet metal parts like hoods, fenders, etc., but to make small and medium-sized specialties for manufacturers of automobiles, and also for those engaged in the manufacture of automobile accessories such as radiators, gasoline tanks, etc.

Detroit Steel Products Co.'s Production Increased Sevenfold

DETROIT, MICH., Jan. 1—The automobile spring plant of the Detroit Steel Products Co. is now in a position to handle about seven times as much production as a year ago. Production increases throughout 1915 were marked, averaging 43 per cent in February, 30 per cent for May and 25 per cent for June, and 24 per cent in August. November production was held up slightly because of inability to obtain sufficient steel, but it is expected that December's production will have increased sevenfold over January's record.

Simplex Plant to Be Enlarged

NEW BRUNSWICK, N. J., Jan. 2—The plants of the Simplex Automobile Co., this city, are being materially enlarged for the manufacture of aeroplane motors on designs and under the patents of the French motor which representatives of the company have secured in France through the assistance of the French government. The motors, which are being made for the Wright Aeroplane Co., will be made under license, free of charge.

Contracts for the construction of additional buildings at the Simplex plant to cost $300,000 have already been let and more than $200,000 worth of new machinery has been ordered. It is planned to increase the output of the Simplex plant to 100 motors a day.

A. B. C. Starter Co. Formed

C. P. Sieder, Alexander Churchward and B. S. Colburn, Incorporators

NEW YORK CITY, Jan. 4—The A. B. C. Starter Co. has been incorporated in Michigan for $150,000 by Charles P. Sieder, Alexander Churchward and B. S. Colburn. Mr. Sieder is president and general manager; Mr. Churchward, vice-president and chief engineer, and Mr. Colburn, secretary and treasurer. The company will manufacture a lighting and starting system adaptable to Ford cars. The system is of Mr. Churchward's design and has independent units for starting and lighting. The entire outfit, according to Mr. Churchward, will weigh less than 100 lb. and will be on exhibition at the Ward Leonard booth at the Grand Central Palace show before the end of the week.

The starting motor is series wound and provided with a Bendix gear. It will have 150 lb. stalling torque and is fitted with a Bendix drive geared 14 to 1 to the flywheel. The generator is driven from the same belt as drives the fan, this being a patented feature. The generator is a slow-speed machine and its ratio to the crankshaft is 1¼ to 1. The generator cuts in at 8 m.p.h. and carries a full lamp load at 10 m.p.h. It is designed to operate in conjunction with a 6-volt, 60-amp. battery, and is fitted with the Ward Leonard magnetic regulating system.

American Rotary Valve Discontinues Electric Motors

ANDERSON, IND., Jan. 1—The American Rotary Valve Co., this city, announces that, due to the development of business on the Arvac universal joint, which it manufactures, and to which the company will now devote its entire effort, the manufacture of electric motors, press drives and its present line of vacuum cleaners will be discontinued. It will fill orders at present in hand, and continue to provide repair service on all these lines.

New Factory for S. K. F.

HARTFORD, CONN., Jan. 1—A permit to build a factory of brick, one and two stories to cost $150,000 has been issued to the S. K. F. Ball Bearing Co. The building is to be 180 by 200 ft.

Piston Ring Co. Expands

MUSKEGON, MICH., Dec. 29—Twelve lots have recently been purchased by the Piston Ring Co. and the company will put up a new large building, 125 by 180 ft., which will more than double the present factory capacity. Between 100 and 150 more men will be added to the working force. The new building will cost about $20,000 and about as much will be spent for additional equipment and machinery. At the present time day and night shifts are working and the company has more orders than at any other time since it started in business.

It is said that president Charles E. Johnson of the Piston Ring Co. will back a new company now being formed and which will make automobile parts. This concern's business will not interfere with that of the piston ring company.

American Tire Fabric Co. Formed, Capital $1,500,000

BOSTON, MASS., Dec. 31—The American Tire Fabric Co. of Boston and New York has organized under Massachusetts laws with an authorized capital of $1,500,000, consisting of 35,000 first preferred, 65,000 second preferred and 50,000 common, all of $100 par value. The purpose of the company is to manufacture, buy and sell cotton, yarn and other textile fabrics.

Auto Parts Co. Reorganizes and Absorbs Badger Specialties

MILWAUKEE, WIS., Jan. 3—The Auto Parts Mfg. Co., 528-532 Broadway, Milwaukee, has effected a reorganization and absorbed the Badger Specialties Mfg. Co., also engaged in the manufacture of accessories, sundries, parts, etc. Andreas M. Soennichsen recently retired from the company to organize the A. M. S. Mfg. Co. The active management of the Auto Parts company is now in the hands of W. N. Schwab, general manager; C. W. Beckler, sales and advertising manager, and F. B. Sykes, factory manager. B. L. Hibbard is president of the company and the other directors are: P. D. Durant, T. J. Pringle, J. D. Millar, H. Nauman, Charles Thompson, E. O. Ellsworth and William Lindsay.

$1,000,000 Goodyear Plant for Canada

NEW TORONTO, ONT., Jan. 3—Arrangements are being made by the Goodyear Tire & Rubber Co., Akron, Ohio, to establish a Canadian plant at New Toronto. A by-law will be shortly submitted to the ratepayers to grant a fixed assessment of $1,000 an acre on the 27 acres to be used for the plant. The Goodyear people have agreed to spend $1,000,000 on the plant.

Rock Hill Co. Makes Ford Bodies

ROCK HILL, S. C., Dec. 31—The Rock Hill Buggy Co., this city, is building standard commercial bodies for the Ford chassis in quantities.

12,000,000 Champion Plugs in 1916

Annual Convention Held at Factory Attended by Complete Sales Organization

TOLEDO, OHIO, Dec. 30.—The annual sales convention of the Champion Spark Plug Co. was brought to a close here yesterday. The complete sales organization, which since 1913 has grown from three to twenty-six members, being in attendance during the three days of the convention. Full details of the company's policies during the present year were discussed and from the enthusiasm at the various meetings, it seems likely that the output of 12,000,000 spark plugs for 1916 will be more than sold. Among those present were: D. M. Barrett, editor of Salesmanship; Henry Paine, general attorney; Harry Harper, sales manager; Willys-Overland Co.; Wilbur Owen, Champion Spark Plug Co. patent attorney; M. DeWitt, president, J-D Co.; President R. A. Stranahan, Advertising Manager H. L. Corey, Treasurer F. D. Stranahan, Sales Manager F. D. Caswell, Purchasing Agent J. F. Barr, H. W. Biddle, C. B. Clark, J. T. Moultroup, George French, Jr., Charles Corwin, H. A. Kaiser, E. M. Stern, W. F. Minnich, H. C. Thanasse, W. J. Shay, C. L. Ughetti, K. Latta, H. MacLaren, Harold E. Butcher, E. H. Blackwell, H. A. Krause, E. C. McKinney, R. C. Parrish, J. B. Cox, H. A. Houston, O. C. Rohe, Charles DeWar.

Goodyear Gives Insurance Policies to Employees

AKRON, OHIO, Dec. 31—The Goodyear Tire & Rubber Co. will give its employees an insurance policy for $1,000, free of all cost, provided the employee is or becomes a member of the Goodyear Relief Assn., which provides sick and disability insurance. Under its new plan it establishes retirement awards, and also a group insurance plan. The retirement awards make provision for stated monthly payments for life to men who have reached the age of seventy and women who have reached sixty-five, and there is also a condition under which old employees may retire, with awards, under the age limits mentioned.

Robbins & Myers Gives Insurance Policy to Each Employee

SPRINGFIELD, OHIO, Dec. 31—The Robbins & Myers Co., this city, manufacturer of electric motors, generators, etc., handed an announcement to each of its employees on Thursday, Dec. 23, to the effect that a life insurance policy had been taken out by the company for every employee. The policy is paid for by the company and all premiums are paid as long as the employee is connected with the concern. The amount of the policy increases with the length of time of the employee's service, as follows:

One year or less	$500
One year and under two	600
Two years and under three	700
Three years and under four	800
Four years and under five	900
Five years and over	1,000

Jeffery Gift of $40,000 to Employees

KENOSHA, WIS., Jan. 2—The largest distribution of profits to employees ever made by a Kenosha concern was the gift of $40,000 to the 3000 operatives in the plants of the Thomas B. Jeffery Co., Kenosha, Wis., in connection with the weekly pay-roll on Dec. 27. The regular pay-roll amounted to $60,000, making a total distribution of in excess of $100,000. A full week's pay was given to each of the 2700 employees working for the company on June 1, 1915, and one-half week's pay to the 300 employees who have been with the concern since that time.

Harper's Latest Trailer

SOUTH BEND, IND., Dec. 31—The Harper Buggy Co., Columbia City, Ind., is manufacturing a trailer of 1500 lb. capacity, arranged to be attached to a motor vehicle by means of a universal joint connection.

Hudson Gives Christmas Presents

DETROIT, MICH., Dec. 30—The Christmas gift of the Hudson Motor Car Co. to those of its factory workers on the payroll six months or longer was a week's wages, while all office employees with the company one year or longer also received an extra week's pay. It is said that over 700 employees came within these regulations and that about $20,000 was involved.

Dort Employees Receive Present

FLINT, MICH., Dec. 24—The Christmas present of the Dort Motor Car Co., and the Durant-Dort Carriage Co., to their employees, was in the shape of $300 which has been deposited with the Flint Vehicle Factories Mutual Benefit Assn. The money is to be credited upon the insurance accounts of all the employees of both concerns.

Cash Gift for Bowser Employees

FORT WAYNE, IND., Jan. 1—All employees of the Bowser Tank & Pump Works, this city, received a cash Christmas gift from the company when between $6,000 and $7,000 were given directly or sent to the 1700 persons connected with the institution. The gifts were from $2 to $5 each.

New Finance Plan for S. R. B.

Assessment of $730,713 to Reduce Debt and Capital $1,908,077

PHILADELPHIA, PA., Jan. 2—Stockholders and creditors of the Standard Roller Bearing Co., this city, have been presented with a plan for the refinancing of the company. The company proposes to make an assessment of $730,713 on stockholders, and .to reduce the debt and capital from $5,799,835 to $3,891,758, with further provisions that the holders of notes and other payable accounts are to be offered the alternative of 60 per cent of their claims in cash as payment of debts in full, or 80 per cent of their claims in the shape of redeemable income certificates covering a period of twenty years. The assessment will be made on the basis of $15 per share of first preferred, in return for which the holders will receive 7 per cent new preferred and 50 per cent of the present holdings in new common stock. Second preferred will be assessed $7.50 per share, in return for which new preferred will be paid, in addition to 25 per cent of holdings in common stock. The assessment will also include common stockholders who will receive 20 per cent of their holdings in common stock.

Premier Motor Corp. Incorporated

DOVER, DEL., Dec. 30—The Premier Motor Corp. has been incorporated in this State with a capital of $2,000,000. The incorporators are: H. E. Latter, N. P. Coffin, C. M. Egner, all of Wilmington.

N. A. C. C. Book on Supervision of Automobile Equipment

NEW YORK CITY, Jan. 1—The traffic department of the N. A. C. C. and the Motor and Accessory Manufacturers has compiled a booklet to facilitate the return of automobiles sent by rail and to serve as a ready reference. This book has been distributed so that better supervision of automobile equipment will be made by the railroads over which approximately 140,000 carloads of automobiles were shipped in 1914. It is expected that shipments in 1915 will exceed 200,000 carloads.

Westcott Not in Indiana Merger

RICHMOND, IND., Jan. 2—The recent publication of a rumor that the Westcott Motor Car Co. is to enter a combination of Indiana automobile and parts companies has brought a vigorous denial from H. G. Root, general manager of the Westcott company. Mr. Root declares that the Westcott company will not enter the proposed merger and has not even been contemplating such action.

Morgan & Wright Add $600,000

DETROIT, MICH., Dec. 31—Morgan & Wright, this city, have increased their capital stock from $5,000,000 to $5,600,000. Approximately $500,000 of the new capital will be issued at once while the remainder will be held in reserve. It is said that plans are under way for increasing the expansion of facilities of the company which has been going on for some time.

Goodrich Directors Meet Jan. 26

AKRON, OHIO, Jan. 3—The directors of the B. F. Goodrich Co. will meet for action on the common dividend, Jan. 26.

Hupp Gains 25 Per Cent in Quarter

DETROIT, MICH., Dec. 30—During the last quarter of 1915, the production and sales of the Hupp Motor Car Co. were 26 per cent better than during October, November and December, 1914. Orders on the books now for immediate delivery are 100 per cent greater than at this time a year ago, according to Commercial Manager Lee Anderson.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat	Mon.	Week's Ch'ge
Aluminum	.53	.53	.53	.53	.53	.53	...
Antimony	.39	.39	.39	.39	.39	.39	...
Beams and Channels, 100 lb.	2.07	2.07	2.07	2.07	2.07	2.07	...
Bessemer Steel, ton	32.00	32.00	32.00	32.00	32.00	33.00	+1.00
Copper, Elec., lb.	.21½	.22	.22½	.22½	.22½	.23	+ .01½
Copper, Lake, lb	.21½	.22	.22½	.22½	.22½	.23	+ .01½
Cottonseed Oil, bbl	8.49	8.50	8.54	8.54	8.60	8.70	+ .21
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.48	.48	.48	.48	.48	.48	...
Gasoline, Auto, bbl	.21	.21	.21	.21	.21	.21	...
Lard Oil, prime	.92	.92	.92	.92	.92	.92	...
Lead, 100 lb	5.40	5.40	5.40	5.40	5.50	5.50	+ .10
Linseed Oil	.64	.65	.65	.65	.66	.66	+ .02
Open-Hearth Steel, ton	33.00	33.00	33.00	33.00	33.00	34.00	+1.00
Petroleum, bbl., Kansas, crude	1.20	1.20	1.20	1.20	1.20	1.20	...
Petroleum, bbl., Pennsylvania, crude	2.15	2.15	2.25	2.25	2.25	2.25	+ .10
Rapeseed Oil, refined	.96	.96	.96	.96	.96	.96	...
Rubber, Fine Up-River, Para	.82	.85	.87	.87	.87	.93	+ .11
Silk, raw, Italian	...	...	5.25	...	...	5.25	...
Silk, raw, Japan	...	...	4.67½	...	...	4.70	+ .02½
Sulphuric Acid, 60 Baume	1.50	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb	39.25	39.75	40.00	40.00	40.50	41.00	+ .75
Tire Scrap	.05½	.05½	.05½	.05½	.05½	.05½	...

Higher Prices for Materials

Para Rubber Reaches 96 Cents—Open-Hearth at $34 a Ton—Pa. Crude Rises to $2.25

NEW YORK CITY, Jan. 4—Steel, rubber, copper and lead prices last week reached new high marks. These four materials have seen a steady rise during the last few months. There is an unprecedented demand for these materials and it is expected that a further rise in prices will occur. Bessemer and open-hearth steel have reached $33 and $34 per ton, respectively. Sharp advances occurred in the crude rubber market both here and in London. Up-River fine was quoted at all the way from 93 cents to $1 a pound and first latex pale at $1.02 to $1.05. The rise of prices in rubber is at the present time of importance to the trade in general because of the pending general rise in tire prices. Copper last week rose from 21½ to 23 cents. The demand for copper continues large and sales at the high prices are limited. Lead was firm at $5.50 per 100 pounds.

An advance of 10 cents a barrel to $2.25 occurred last week in the price of Pennsylvania crude oil. Oil authorities expressed some hope that this latest rise would bring out stocks now in the hands of producers, which are badly needed by refineries because of the tremendous demand for oil for domestic and foreign use. As to what will develop with regard to the production of crude oil, nothing at the present time can be ascertained, but provided the ratio of decrease in supply to demand continues, the finding of a substitute for gasoline, it is said, will in the future be the only solution of the high price problem. Apropos of the present prices of gasoline, the question of using kerosene as a substitute for that fuel has been the cause of many experiments along that line. Europeans since the war have had their eyes opened to the adaptability of the American automobile engine to a low gravity gasoline. Some of the French makes of cars require 68 to 76 deg. gravity, whereas the American-made motors use 60 to 62 deg. gravity.

Ajax Elects Directors

NEW YORK CITY, Dec. 31—The following directors of the Ajax Rubber Co. have been elected: Horace De Lisser, W. G. Grieb, H. W. Stimson, J. C. Matlack, L. P. Destribats, R. A. Patterson, H. K. Pritchitt.

Autocar Dividend of 5 Per Cent

ARDMORE, PA., Dec. 31—The directors of the Autocar company, this city, have voted that a 5 per cent cash dividend be declared, payable to-day, to stockholders of record at the date of the meeting, the first cash dividend declared for a number of years. They also voted that $400,000 of their accumulated surplus be made permanent capital by issuing capital stock therefor. The capital of the company was increased on Oct. 14 from $1,000,000 to $2,000,000.

Lozier Motor Capital to Be $3,000,000?

DETROIT, MICH., Dec. 31—The Lozier Motor Co. has succeeded the Associated Lozier Purchasers, which was the name under which the purchasers of the assets of the old Lozier company had incorporated last year. It was stated at the offices of the Lozier company that the reorganized company will be incorporated some time in January and that the capital stock will be between $3,000,000 and $5,000,000.

Canadian Ford Dividend to Be Paid Jan. 8

FORD, ONT., Dec. 31—Stockholders of the Ford Motor Co. of Canada, Ltd., have been notified that the 600 per cent stock dividend recently declared will be paid to stockholders of record Jan. 8. From Jan. 8 to 12 the books of the company will be closed, and during that time old stock certificates must be surrendered.

Regular Dividends Declared

Packard Motor Car Co.; cash dividend of 1¾ per cent and stock dividend of 10 per cent on common, payable Feb. 1.

Kelly-Springfield Tire Co.; quarterly of 3 per cent on common, payable Feb. 1 to stock of Jan. 15.

Tire Stocks Are Higher

Firestone Common Rises 20 Points—Miller Rubber Common Shows 25-Point Gain

NEW YORK CITY, Jan. 4.—Activities in last week's securities were for the most part based on pre-dividend announcements. A number of the companies will hold directors' meetings this month to decide on dividends. A Goodrich meeting is scheduled for Jan. 26. It is expected in financial circles that a resumption of dividends on the common stock will be at a rate around 4 per cent. The Maxwell dividend on the first preferred disposes of the accumulation on the first preferred stock. The first preferred stock holders have the option to use their warrants in paying for new first preferred stock at par at any time on and after Jan. 3 and up to June 30, 1916. Ajax Rubber stockholders, it is stated, will not have to wait for dividends. During the present month the directors will declare the initial quarterly dividend of $1.25 a share on the new stock and dividends will be maintained regularly thereafter at the rate of $5 a share with frequent extra disbursements. This stock first appeared on the market several weeks ago at 65. It sold yesterday at 71¾.

The market yesterday showed strength under the test of evil news from the Mediterranean where much submarine warfare has been carried on lately. Much strength was shown in tire issues, especially in Miller Rubber, Firestone and Goodyear. Miller Rubber common went up 25 points, closing at 260; Firestone rose 20 points to 710, and Goodyear common went up 7 points to 342.

Maxwell first preferred closed Saturday at 92 and went up another point yesterday, making a gain of 11 points. Packard common went up 5 points and Peerless closed at 27 with a 7-point gain.

A number of the automobile stocks were lower last week. Reo Motor Car went down 35 points on the ex-dividend of 100 per cent. Willys-Overland common dropped 7 points to 232 and Studebaker common dropped 2½ points.

Quotations on the Detroit Exchange were lower, with the exception of General Motors common, which rose 32½ points to 460. Maxwell first preferred dropped 8½ points to 91, presumably on account of the payment of the dividend on that stock. Packard common closed at 185 with a 3-point loss. Studebaker common rose 2 points to 166½.

Recent Changes in Capitalization

FOSTORIA, OHIO, Dec. 31—The Allen Motor Co. has decreased its capital from $500,000 to $400,000.

AKRON, OHIO, Dec. 31—The Mohawk Rubber Co. has increased its capital from $250,000 to $500,000.

DETROIT, MICH., Dec. 31—Goodspeed-Detroit Mfg. Co., capital increased from $20,000 to $50,000.

NORTH DETROIT, MICH., Dec. 31—Russel Motor Axle Co., capital increased from $150,000 to $250,000.

DETROIT, MICH., Jan. 3—Morgan & Wright, capital stock increased from $5,000,000 to $5,600,000.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	71½	72	+1
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	..	..	87½	89	+4½
Chalmers Motor Co. com	..	88	130	150	..
Chalmers Motor Co. pfd	..	92½	101	103	..
Chevrolet Motor Co	..	..	130	132	+3
Electric Storage Battery Co	..	..	64	65	—1
Firestone Tire & Rubber Co. com	350	356	710	..	+20
Firestone Tire & Rubber Co. pfd	110	112	113½	..	+1½
General Motors Co. com	80	82½	490	500	—5
General Motors Co. pfd	85	91	114	115½	—3
B. F. Goodrich Co. com	24	25	74	75½	— ¼
B. F. Goodrich Co. pfd	92	94½	112	113½	..
Goodyear Tire & Rubber Co. com	188	191	342	345	+7
Goodyear Tire & Rubber Co. pfd	101	102½	114	115½	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	25	30	—1
International Motor Co. pfd	..	..	45	50	—2
Kelly-Springfield Tire Co. com	69	71	295	300	—2
			† 74	75	..
Kelly-Springfield Tire Co. 1st pfd	75	79	94	96	—1
Kelly-Springfield Tire Co. 2d pfd	94	96	†74	75	..
Maxwell Motor Co. com	14⅝	15	74½	76	+1
Maxwell Motor Co. 1st pfd	42½	43½	92	94	+10
Maxwell Motor Co. 2d pfd	16¼	17	56	57	..
Miller Rubber Co. com	..	..	260	270	+25
Miller Rubber Co. pfd	..	..	113	115	+1
New Departure Mfg. Co. com	..	..	..	..	..
New Departure Mfg. Co. pfd	..	..	..	..	..
Packard Motor Car Co. com	..	100	185	192½	+5
**Packard Motor Car Co. pfd	90	..	101½	103½	— ½
Paige-Detroit Motor Car	..	..	..	700	..
Peerless Motor & Truck Corp	..	..	27	28	+7
Portage Rubber Co. com	25	30	70	72	..
Portage Rubber Co. pfd	80	85	102	105	+2
Regal Motor Co. pfd	..	..	..	22½	..
‡Reo Motor Truck Co	10½	11½	23	24	+ ½
‡‡Reo Motor Car Co	21¾	..	32	33	—35
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	51	52½	87	90	+1

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Stewart-Warner Speed. Corp. pfd	99	101	108	..	..
Studebaker Corp. com	34¾	35¾	165	166	—2½
Studebaker Corp. pfd	90	91½	113	114	+ ½
Swinehart Tire & Rubber Co	69	70	89	90½	+2
Texas Company	..	..	230	232	—1
U. S. Rubber Co. com	52	56	57	58	—2
U. S. Rubber Co. 1st pfd	100	102	109	110	..
Vacuum Oil Co	..	..	230	235	—3
White Motor Co. (new)	..	..	51½	52	—1½
Willys-Overland Co. com	83	85	232	234	—7
Willys-Overland Co. pfd	92	94	111½	113	— ½
ACTIVE STOCKS					
Chalmers Motor Co. com	..	88	..	156	..
Chalmers Motor Co. pfd	..	92½	99	102½	..
Continental Motor Co. com	155	175	..	258	..
Continental Motor Co. pfd	..	..	91	94	..
Ford Motor Co. of Canada	445	480	..	410	..
General Motors Co. com	75	80	460	490	+32½
General Motors Co. pfd	88	92	114	116	—1
Maxwell Motor Co. com	13¾	14¾	74½	77½	+1¼
Maxwell Motor Co. 1st pfd	40½	43½	91	95	—8½
Maxwell Motor Co. 2d pfd	16	18	55	58	+1½
Packard Motor Car Co. com	..	100	185	192	—3
Packard Motor Car Co. pfd	90	..	104¼	105	+ ½
Paige-Detroit Motor Car Co	..	..	..	700	—10
‡Reo Motor Car Co	21½	..	32½	33½	..
‡‡Reo Motor Truck Co	10½	11½	23¼	23⅞	+1¼
Studebaker Corp. com	..	..	166½	169½	+2
Studebaker Corp. pfd	..	..	112	115	..
INACTIVE STOCKS					
§Atlas Drop Forge Co	..	25	28½	31	..
Kelsey Wheel Co	185	..	285	..	..
§W. K. Prudden Co	..	20	26¼	..	+2
Regal Motor Co. pfd	..	25	..	22½	..

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*Old. †New. **And accrued dividends. ‡Par value $10; ex-dividend. ‡‡Par value $10; ex-dividend, 100 per cent. §Par value $10.

Boston Show Space Insufficient

May Have To Secure Another Hall—Chicago Show a Japanese Garden

Boston, Mass., Dec. 31—The officials of the Boston Automobile Dealers Association are faced with the alternative of either hiring an additional hall for the motor show or turning away applicants for space. At Boston a big share of space is taken by the truck dealers, and so that means the space that was available in the past when there were two distinct shows is allotted. Some of the passenger car men would like to have the trucks put in another hall, for they realize that to exhibit outside will hardly pay. The matter will be put up to the applicants and they can make the decision. If enough of them decide to go in the other hall will be engaged.

Chicago Show a Japanese Garden

New York City, Dec. 31—Samuel A. Miles, general manager of Chicago Automobile Show to be held in the Coliseum and Armory, Jan. 22-29, announces that the decoration scheme in the Coliseum will be in the form of a Japanese garden. This scheme will be carried out by covering the entire ceiling with Japanese kiosks, together with Japanese lamps, etc., throughout the building.

New Machinery for Duplex

Charlotte, Mich., Dec. 31—More machinery is being added to the equipment of the Duplex Power Car Co. Further enlargements of the plant are also contemplated. Business on hand will keep the plant running to full capacity well into the new year.

Indianapolis Entry Blanks Out

Indianapolis, Ind., Dec. 31—Entry blanks have been sent out for the 300-mile race to be held May 30 on the Indianapolis speedway. The purse for the race has been reduced from $50,000 to $30,000, the first prize $12,000. There will be ten prizes, the same as in former years.

New Cast-Steel Wheel

Syracuse, N. Y., Dec. 31—The Smith Wheel, Inc., of this city is shortly to produce a new form of cast-steel wheel especially for motor trucks. It is of the hollow one-piece type, with twelve spokes, like a wooden wheel, thus avoiding the odd appearance common to some steel wheels. Each spoke is a graceful smooth exterior oval, blending naturally with the felloe and hub. It is fitted with reinforcements in its cored-out interior and has no holes except the regular hub flange holes, which are standard, thus permitting the wheel to be interchangeable with standard wood wheels.

The wheel is made both for single and dual tires and is adapted to either pressed-on or demountable solid tires.

In tests it is claimed that the wheel was able to take a load of 30 tons in a horizontal direction before the wheel dished ¼ in., when with the pressure withdrawn, it sprang back into its normal shape. Individual spoke sections were also stressed up to 30 tons, it is stated, the wheel load being taken by six spokes three upper and three lower in practice.

Reo Refuses War Order for 1000 Motor Trucks

Lansing, Mich., Dec. 30—The Reo Motor Truck Co. was approached recently with regard to furnishing 1000 trucks to one of the European belligerent nations. R. C. Rueschaw, sales manager of the company, states that the order was not accepted because the Reo company is not looking for business from those countries at this time. The reason is that the domestic business of the Reo Motor Truck Co., has been increasing so rapidly that it has not been possible to take care of it as would have been desirable. To have accepted the foreign order would have been the cause of still greater disturbance in taking care of the American business.

A. C. A. Tests Four-in-One Heater

New York City, Jan. 3—The testing laboratory of the Automobile Club of America has made a series of tests to determine the effect of the Four-in-One heater, manufactured by the Continental Auto Heater Co., 18 E. Forty-first Street, New York, upon fuel consumption, power output and back pressure. It was found that while the power output and fuel consumption were unaffected, back pressure was reduced to a marked degree. With the heater valve open the back pressure was less than one-half of what it was without the heater attached, and with the heater valve closed the back pressure was less than without the heater in the line. The device is a radiator heated by exhaust gas.

Dann Inserts Cost Less

Chicago, Ill., Jan. 1—Dann cushion spring inserts have been reduced in price, sets formerly selling for $8 now being priced at $5.70 each.

Bosch Holds Annual Convention

New York City, Dec. 30—The Bosch Magneto Co. held its annual distributors' convention on Dec. 30, an all-day session being held in the offices of the company. After a morning session begun at 9.30, luncheon was served to the delegates at 1.00. Business was resumed after luncheon and the session continued until 7 o'clock. A banquet was served at Reisenweber's immediately afterward and the party disbanded to meet on Friday for a trip of inspection through the Springfield works.

Bosch Adds Eighteen Concerns

New York City, Jan. 1—The Bosch Magneto Co., this city, has signed contracts with eighteen concerns in the automobile and commercial vehicle fields to use Bosch magnetos for the coming season, making a total of 176 closed during the past season. The eighteen new contracts are as follows:

Nordyke & Marmon Co.	Indianapolis, Ind.
The Russell & Co.	Massillon, Ohio
Croce Automobile Co.	Asbury Park, N. J.
Bessemer Motor Truck Co.	Grove City, Pa.
Harwood-Barley Mfg. Co.	Marion, Ind.
Diamond T Motor Car Co.	Chicago, Ill.
Krebs Commercial Car Co.	Clyde, Ohio
D. F. Poyer Co.	Menominee, Mich.
Service Motor Truck Co.	Wabash, Ind.
J. D. Fate Co.	Plymouth, Ohio
The New-Way Motor Co.	Lansing, Mich.
Signal Motor Truck Company	Detroit, Mich.
Zeitler & Lamson	Chicago, Ill.
Walden W. Shaw Livery Co.	Chicago, Ill.
Winton Co.	Cleveland, Ohio
Transport Tractor Co.	Long Island City, N. Y.
Old Reliable Motor Truck Co.	Chicago, Ill.
Chester County Motor Co.	Coatesville, Pa.

Overland Factory Office for Seattle

Seattle, Wash., Jan. 1—The Willys-Overland Co. will establish a factory office in this city, controlling the territory of Washington, Oregon, Idaho, Montana and British Columbia. J. V. Hough will have charge of the office.

Cox Raises C-C Shock Absorber Price

New York City, Jan. 3—Increased cost of production due to improvements in design, material and workmanship are responsible for an increase in the price of the C-C heavy type shock absorber manufactured by the Cox Brass Mfg. Co., Albany, N. Y. The price is now $12 per set of four, as against the former price of $10 per set. The Ford type remains at $8 per set or $4.50 per pair.

Dinner Tendered to Kennerdell

New York City, Jan. 4—A complimentary dinner was tendered Richard Kennerdell last night at the Biltmore by President Wilson of the American Automobile Assn. and thirty of his associates on the contest board. Mr. Kennerdell was presented with a watch in recognition of his services as chairman of the committee.

Gets Crane-Simplex on Coast

New York City, Jan. 2—The Arnold-Stelling Co., Inc., has secured the Pacific Coast agency for the Crane model Simplex cars and will open representation in San Francisco at Hotel St. Francis, Feb. 1. A salesroom will be opened in March. In addition to the exclusive rights for the Pacific Coast, Arnold-Stelling have all territory west of the Mississippi which is open at present. Jan H. Stelling, president, has been sales manager of the DeDion in New York for eight years, and Geo. K. Arnold, secretary, has been connected with the business in New York.

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Anderson Electric Managers Meet

DETROIT, MICH., Dec. 31—The first annual convention of branch managers and road men of the Anderson Electric Car Co. was held here this week. Those in attendance reported this to have been the biggest year in history for electric passenger cars while prospects for next year are very encouraging. The Anderson company is planning a greatly increased production for 1916.

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Allen Banquet Celebrates Addition

FOSTORIA, OHIO, Jan. 3—By way of celebrating the completion of its new chassis assembly plant, the Allen Motor Co., last week entertained its employes and about 500 guests at a banquet. The new building increases the floorspace of the Allen company by 32,000 sq. ft. Following a program of entertainment, the gathering was addressed by E. W. Allen, who stated that the present capacity of the factory was eighteen cars per day and that this will be increased to fifty cars by March 1. Others who spoke at the gathering were S. M. Hopkins, W. O. Allen, Judge George Schroth and J. P. Hunting.

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Eisemann Magnetos Exclusively on 1916 Pierce-Arrow Trucks

BUFFALO, N. Y., Dec. 31—For the coming year, the 3-ton Pierce-Arrow trucks will use exclusively Eisemann magneto type EM4 dual and Eisemann coil type DCR. The Pierce-Arrow 2-ton trucks will use exclusively Eisemann magneto waterproof type G4. Deliveries will begin in February.

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White Adopts Eisemann Magneto

NEW YORK CITY, Jan. 1—The Eisemann Magneto Co. will begin deliveries in January on a contract made some months ago, of the Eisemann type G 4 magneto to the White Motor Co., Cleveland, Ohio, which has adopted this magneto as standard equipment for all its trucks.

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Doehler Die Casting to Add

TOLEDO, OHIO, Dec. 31—The Doehler Die Casting Co. is planning to build factory structures estimated to cost $69,514. Three buildings are planned in the 1900 block, on Smead Avenue. All are to be of steel, concrete and brick. One building, estimated to cost $42,746.77 will consist of two stories and a basement, and will be 50 ft. wide by 260 ft. long. A new foundry will cost $8,922 and will be one story and a basement, 50 by 180 ft. The third building, a warehouse, 50 by 160 ft., will cost $17,844.82, and will be one story, with basement.

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Toledo Machine Sold to N. Y. Interests

TOLEDO, OHIO, Dec. 31—The Toledo Machine & Tool Co. has been bought by Hoit, McWilliam & Co. of New York for clients. The company is capitalized at $6,000,000, the stock having been increased through the distribution of a 400 per cent stock dividend. The company has specialized in the manufacture of machinery for making sheet metal products.

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Mich. Hearse & Motor Co. Reorganized

GRAND RAPIDS, MICH., Dec. 31—The Michigan Hearse & Motor Co. has been reorganized. Walter Ioor has been elected president, succeeding Alvah W. Brown. Mark Norris is vice-president; A. C. Chapman is secretary and sales manager and E. W. Aumeal, general manager. The factory has been enlarged through a three-story addition, 40 by 100 ft.

Proposed Eighth Report of Iron and Steel Division

(*Continued from page* 23)

(c) Tension and bend test specimens for plates and shapes shall be of the full thickness of material as rolled; and may be machined to the form and dimensions shown in Fig. 1 (see proof for sheet 15a of Vol. I of Handbook) or with both edges parallel.

(d) Tension and bend test specimens for rolled bars and forgings of uniform cross-section 1½ in. or less in thickness or diameter, may be of the full-size section of material as rolled or forged, or may be machined for a length of at least 9 in., in which case the gage length shall be 8 in. Tension test specimens should preferably be of the S. A. E. standard form as illustrated in Fig. 2 (See proof for sheet 15xa of Vol. I of Handbook).

(e) The axis of tension and bend test specimens for rolled bars and forgings of uniform cross-section over 1½ in. thickness or diameter, and for forgings of irregular sections, when practicable, shall be located at any point midway between the center and surface when solid, and at any point midway between the inner and outer surfaces of the wall when bored, and shall be parallel to the axis of the piece in the direction in which the metal is most drawn out. Tension test specimens shall be of the form and dimensions shown in Fig. 2. Bend test specimens shall be ½ in. square in section with corners rounded to a radius not over 1/16 in., and need not exceed 6 in. in length.

Number of Tests

13 (a) Unless otherwise specified by the purchaser, one tension and one bend test shall be made from each melt; except that if material rolled from one melt differs ⅜ in. or more in thickness, one tension and one bend test shall be made from both the thickest and the thinnest material.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded; in which case the manufacturer and the purchaser or his representative shall agree upon the selection of another specimen in its stead.

(c) If the percentage of elongation of any tension test specimen is less than that specified and any part of the fracture is more than ¾ in. from the center of the gage length of a 2 in. specimen or is outside the middle third of the gage length of an 8 in. specimen, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

Finish

14. The material shall be free from injurious defects and shall have a workmanlike finish.

Inspection and Rejection

Inspection

15. (a) The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the material ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. Tests and inspection at the place of manufacture shall be made prior to shipment.

(b) The purchaser may make the tests to govern the acceptance or rejection of the material in his own laboratory or elsewhere. Such tests, however, shall be made at the expense of the purchaser.

(c) All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection

(a) Unless otherwise specified, any rejection based on tests made in accordance with Section 15 (b) shall be reported within ten working days from the receipt of samples.

(b) Material which shows injurious defects while being finished by the purchaser will be rejected, and the manufacturer shall be notified.

Rehearing

17. Samples rejected in accordance with Section 15 (b) shall be preserved for one month from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

Regarding Specifications, and Notes and Instructions

The notes and instructions following the Specifications given above are not to be considered in any way a part of these Specifications. They are added solely for the information of the user of the steels and the guidance of the purchaser in the selection of proper materials for his different purposes. They should not be incorporated in the Specifications when ordering steel except under such conditions as are imposed in the Specifications themselves.

(End of Seventh Report Revision)

Standard Test Specimens

Shock Test

It is recommended that the 10 by 10 mm. test piece 40 mm. long with notch 2 mm. deep and 1 mm. wide be adopted as the standard specimen for shock test. The bottom of the notch is to be of 0.5 mm. radius, smooth and free from scratches. (See proof of sheet 15xb of Vol. I of Handbook).

Flat Tension Specimen

It is recommended that we adopt the standard flat strip test specimen of the American Society for Testing Materials. The gage width of specimens ¼ in. or less in thickness should be equal to five times the thickness, except that in no case shall the width be less than ¾ in. The gage length should equal twenty-four times the thickness of the specimen, except that in no case shall it be less than 2 in. (See proof of sheet 15xa of Vol. I. of Handbook).

It is recommended that our present flat tension test specimen be called recommended practice for use in cases where the standard specimen cannot be made. (See proof of sheet 15a of Vol. I of Handbook).

Alternating Stress Specimen

The removal of the present alternating stress test specimen (see sheet 15b of Vol. 1 of Handbook) from the list of standards is recommended as it is very little used in its present form.

Gray Iron Specimens

It is recommended that the A. S. T. M. gray iron specimens be adopted as standard of the S. A. E. (See sheet 15c of Vol. I of Handbook).

Finish on Standard Specimen

It is recommended that instructions be appended to the present standard 2 in. tension test specimen, calling for finished lapping or grinding of the gage length. (See proof of sheet 15 of Vol. I of Handbook).

Brinell Test

It is recommended that instructions for the Brinell test, based upon the recommended practice of the A. S. T. M. (See proof of sheet 15xd of Vol. I of Handbook) be published as the standard method of this Society.

"Temper" of Sheets and Tubing

A sub-committee constituted of Messrs. Johnson and Zimmerschied were appointed to investigate the advisability of establishing standard practice or nomenclature relating to the various "tempers" or physical conditions of sheet steel and seamless drawn tubing.

Standard Color

A sub-committee consisting of Messrs. Rys, Johnson and Trabold was appointed to investigate the feasibility of establishing a scale of standard colors for painting each of the various grades of S. A. E. carbon steels, it being recognized that the alloy steel grades are too numerous to lend themselves to a suffciently simple scheme of designation by colors.

Bakelite—A Synthetic Resin

(*Continued from page 36*)

pared in the form of a dry, granular powder or sometimes in thin, hard sheets which soften readily on being slightly heated so that they can be cut or otherwise manipulated for loading the dies.

The first application of heat and pressure applied to this material has the effect of momentarily softening it so that it fluxes freely, taking accurately the form of the mold. The continued application of heat and pressure brings about a chemical reaction which causes it rapidly to harden or "set," into a solid homogeneous mass, after which it cannot be softened again by further heating. The time of this "cure" will vary from 5 to 8 min., depending upon the size of the piece. The work comes finished from the die, excepting for a slight "fin" where the halves of the die come together, which has to be dressed off. Bakelite parts can be molded with great accuracy and will take a high molding finish. Metal inserts can also be readily molded in the material, which in many cases reduces the item of assembly costs.

The great flexibility in the properties which finished Bakelite may have is largely responsible for its extended use. Bakelite can be made to combine many different groups of essential or desirable properties. It is also made as a liquid or varnish in which form it is largely used for impregnating armature and other coils. In a somewhat modified form it is also used as a lacquer and protective enamel which can be applied by dipping, brushing or spraying. It differs essentially from other insulating compounds used for impregnating armature coils. When subjected to heat, Bakelite hardens, whereas most other compounds soften. After hardening, Bakelite has no melting point, but at temperatures in excess of 575 deg. F. it gradually carbonizes and disintegrates. Bakelite impregnating material bonds wires into a solid mass, preventing abrasive friction. It facilitates the dissipation of heat from the interior of the coils so much more rapidly than ordinary insulating compound that there is little danger from burnouts.

Bakelite micarta and dilecta are trade names for a material built up of laminations of paper coated and impregnated with Bakelite. These materials have qualifications which render them superior to fiber.

While there is as yet no accepted standard test piece or test method for measuring dielectric strength, the product as applied to automobile use will have a resistance of 250 to 300 volts per mil. Other properties are specific gravity, 1.33, temperature resistance 250 to 300 deg. F., and tensile strength of 4000 to 4500 lb. per sq. in.

Factory Miscellany

Hyatt Top to Establish Plant—The Hyatt Auto Top Co., Trenton, N. J., will establish a plant on Wood Street, Trenton.

Columbia Truck Will Build—The Columbia Motor Truck & Trailer Co., Pontiac, Mich., will build a plant 60 by 200 ft. at Pontiac.

Brockway Truck to Build—The Brockway Motor Truck Co., Corning, N. Y., is taking bids for its factory, which will be 40 by 186 ft., two stories.

Perfection Oiler to Build—The Perfection Automobile Oiler Co., Seattle, Wash., will build a plant to manufacture its devices. This concern was recently incorporated with $100,000 capital stock.

Beaver Motor Adds—The Beaver Motor Car Co., Gresham, Ore., will construct an addition to its factory, 32 by 70 ft., to be used as a foundry. It will be equipped with the latest type of machinery.

Pierce-Arrow to Build Laboratory—The Pierce-Arrow Motor Car Co., Buffalo, N. Y., has let contract for the erection of a laboratory and experimental building, 50 by 90 ft., two stories, at its plant at Elmwood Avenue and New York Central Railroad Line.

Akron Double Tread Adds—The Akron Double Tread & Tire Co., Jefferson Avenue, Akron, Ohio, contemplates constructing a two-story reinforced concrete, brick and steel factory addition to cost $30,000. No details decided.

Schacht Truck Moves Plant—The G. A. Schacht Motor Truck Co., Cincinnati, is moving its plant from Spring Grove Avenue to the manufacturing building at Gest and Evans streets. It will increase its manufacturing facilities.

Mutual Wheel to Add—The Mutual Wheel Co., Third Avenue and Sixth Street, Moline, Ill., has taken out a permit to build a four-story building to cost $10,000. It will be of brick, and will be used for the manufacture of automobile wheels. The company has been making wagon and buggy wheels.

Milwaukee Engine Co. Adds—The Milwaukee Auto Engine & Supply Co., 708 Winnebago Street, Milwaukee, Wis., has awarded contracts for the erection of its new factory at Twenty-eighth Street and Meinecka Avenue. The building will be of brick and steel construction, fireproof, one and two stories high, 60 by 120 ft. in size and contains an electric elevator.

Frome Co. Adds—The R. L. Frome Mfg. Co., box manufacturer, Howard's Grove, Wis., plans to manufacture motor trucks on a small scale. A 36 by 38-ft. addition is being made to the plant, to accommodate experimental work. The company plans to be ready to start production in March.

St. Albans Buildings Leased—The old buildings of the St. Albans Foundry & Implement Co., St. Albans, Vt., have been leased to the Foundry, Motor Car & Manufacturing Co., representing several St. Albans interests, and will be used for the carrying on of a general automobile business as well as manufacturing and general machine work.

To Make Tops—The Consolidated Auto Top Co., Detroit, Mich., has been organized and incorporated, its capital stock being $10,000, to make automobile tops. The incorporators of the new concern are C. P. Sieder, formerly president of the Sieder Mfg. Co.; L. N. Gay, formerly manager of the American Top Co., and H. R. Bidwell, formerly foreman of the American Top Co.

The Automobile Calendar

Dec. 31-Jan. 8	New York City, Sixteenth Annual National Automobile Show; Grand Central Palace; N.A.C.C.
1916	
Jan. 5-6	New York City, S. A. E. Winter Session, Standards Committee Meeting.
Jan. 7, 8, 10, 11	New York City Convention National Assn. of Automobile Accessory Jobbers.
Jan. 7-13	Milwaukee, Wis., Show, Auditorium.
Jan. 8-15	Cleveland, Ohio, Show, Wigmore Coliseum, Cleveland Automobile Show Co.
Jan. 8-15	Philadelphia, Pa., Show, Philadelphia Auto Trade Assn.
Jan. 13-18	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Club and Columbus Auto Trades Assn.
Jan. 14-22	Dayton, O., Show, Delco Bldg., Dayton Automobile Dealers' Assn., and Dayton Accessory Dealers' Assn.
Jan. 10-15	Fort Wayne, Ind., Show, Auto Trade Assn.
Jan. 10-15	New Bedford, Mass., Show, State Armory.
Jan. 15-22	Detroit, Mich., Show, Detroit Automobile Dealers' Assn.
Jan. 17-22	Rochester, N.Y., Show, Exposition Park, C. A. Simmons, Mgr.
Jan. 17-22	Wilmington, Del., Show, Wilmington Automobile Show Assn.
Jan. 18-21	Fargo, N. D., Show, North Dakota and Minnesota Automobile Dealers' Assn.
Jan. 18-22	Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 18-22	Lancaster, Pa., Show, Conestoga Park Pavilion.
Jan. 22-29	Montreal, Que., Show, Almy's Bldg., Automobile Trade Assn., Ltd.
Jan. 22-29	Chicago, Ill., Show, National Automobile Chamber of Commerce; Coliseum and First Regiment Armory.
Jan. 24-30	Portland, Ore., Show, Armory, Portland Automobile Dealers' Trade Assn.
Jan. 24-29	Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.
Jan. 29-Feb. 5	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Show Co.
Jan. 29-Feb. 5	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.
Feb. 1-3	Frederick, Md., Show, Armory.
Feb. 2-5	Poughkeepsie, N. Y., Show, State Armory.
Feb. 7-12	Kansas City, Mo., Show, J. I. Case T. M. Bldg., Kansas City Motor Dealers' Assn.
Feb. 8-11	Grand Forks, N. D., Show, Auditorium.
Feb. 9-12	Peoria, Ill., Show, Coliseum, Peoria Automobile and Accessory Assn.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Des Moines, Ia., Show, Des Moines Auto. Dealers' Assn.
Feb. 14-19	Winnipeg, Man., Show, Ford Plant, Winnipeg Motor Trades Assn.
Feb. 19	Newark, N. J., Show.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 28-Mar. 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 29-Mar. 4	Ft. Dodge, Ia., Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
Mar. 8-11	Mason City, Ia., Show, Armory.
Mar. 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
Mar. 28-Apr. 3	Manchester, N. H., Show, Under Auspices Couture Bros, Academy.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 20	Chicago, Ill., Amateur Drivers' Race, Chicago Motor Speedway.
May 30	Indianapolis Track Race.
June 17	Chicago Track Race.
June 28	Des Moines, Ia., Track Race.
July 4	Minneapolis Track Race.
July 4	Sioux City Track Race.
July 15	Omaha, Neb., Track Race.
Aug. 5	Tacoma Track Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Track Meet.
Sept. 15	Indianapolis Track Race.
Sept. 16	Providence Track Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Track Race.
Oct. 14	Chicago Track Race.

The Week in the Industry

Tracy Promoted—R. B. Tracy, formerly central manager of the Michelin Tire Co., Milltown, N. J., is now factory representative.

Mead Heads Vermont Firm—B. E. Mead has been appointed manager of the Vermont Auto Sales Co., Brattleboro, Vt., Chalmers agent. He was previously with Manley Bros., Vermont agents for the Hudson.

Middleton Succeeds DeWitt—R. T. Middleton has succeeded Frank DeWitt as Michigan representative and manager of the Steel Products Co. branch office in Cleveland, Ohio. Mr. Middleton has been the company's Central Western States' representative.

Neill G. M. Truck Mgr.—H. A. Neill has been appointed manager of the Kansas City, Mo., branch of the General Motors Truck Co., to succeed Estel Scott, who recently resigned as the result of ill health. Mr. Neill was district representative of the company in Atlanta.

Suess Assumes Duties—J. B. Suess, who succeeded Don Johnson as manager of the San Francisco branch of the Stewart Warner Corp., has assumed his duties. Mr. Suess formerly managed the company's branch in Kansas City.

Vedder Makes Change—E. G. Vedder has been made salesmanager for the Gray Motor Co., Minneapolis, Minn., Studebaker dealer. R. A. Briggs has been sent over to the St. Paul branch, which has been established in a new building at Franklin and Ninth Streets, to take Mr. Vedder's place as manager there.

Reed Succeeds Murray—M. E. Murray, who was recently appointed assistant general manager of the Republic Rubber Co. of Youngstown, Ohio, has been succeeded as president of the Republic Rubber Co. of California, the Pacific Coast branch of the Youngstown factory, by Irwin Reed. The latter was formerly manager of the Los Angeles branch.

New McGraw Tire Mgrs.—The McGraw Tire & Rubber Co., East Palestine, Ohio, has established truck tire branches in Buffalo, Detroit and Kansas City. G. J. Marshall will manage the Buffalo department; the Detroit branch is in charge of G. W. Tiffany, with headquarters in the Dime Savings Bank Bldg., and the service station at 26 Franklin Street; and the Kansas City department is under management of C. H. Connelly, who also has charge of the pneumatic sales in that territory.

Motor Men in New Roles

McClellan Tire Agent—J. R. McClellan has been named manufacturer and sales agent in Philadelphia for the McClellan tire, with headquarters at 817 North Broad Street.

Brebner Maxwell's New Castle Superintendent—Frankl Brebner has been appointed general superintendent of the Maxwell Motor Co. plant in New Castle, Ind. He succeeds W. B. Jameson.

Mayl Firestone Memphis Mgr.—J. E. Mayl, formerly sales manager of the St. Louis branch of the Firestone Tire Co., has been appointed branch manager for the same company at Memphis, Tenn.

Bartling Makes Change—E. F. Bartling, formerly general manager of the Auto Tire Sales Co., St. Louis, has become connected with the Nat L. McGuire Oil & Supply Co., 2924 Locust Street, St. Louis.

U. S. Tire Changes—Tom Wilkinson has been appointed manager of the San Francisco branch of the United States Tire Co., New York City, succeeding W. B. Rigdon, who goes to the Boston branch.

Damon Heads Boston Hollier—H. A. Damon, formerly sales manager of the New England agency for Michigan cars, with headquarters at Boston, Mass., has been placed in charge of the sales of the Hollier Motor Car Co.

Davis Heads Portland McGraw Tire—C. E. Davis of Portland, Ore., has been appointed manager of the Portland, Ore., branch of the McGraw Tire & Rubber Co., which has established quarters at 344-348 Burnside Street.

Brandt Makes Cleveland Connection—J. A. Brandt, formerly with the Quaker Tire & Rubber Co., has been appointed manager of the Euclid Avenue branch of the Collister & Sayle Co., automobile accessories and supplies, at Cleveland, Ohio.

Topken in Tacoma—F. W. Topken, A.S.M.E., for 11 years chief designing engineer of the Chicago Pneumatic Tool Co., is now in complete charge of the mechanical and garage departments of the Hunter-Smith Sales Co., Tacoma, Wash.

Schaeffer Enters Motor Field—L. P. Schaeffer of Seattle, Wash., and for many years a well-known figure in banking circles, has joined the automobile merchandisers in that city and has become vice-president and manager of the William T. Patten Motor Car Co., distributer of Hupmobiles in Seattle and King County, Washington.

Raymond Heads Columbus Concern—The Brasher Motor Car Co., Gay and Fourth Streets, Columbus, Ohio, has made H. G. Raymond manager of the concern. H. L. Taylor will continue in the same capacity as assistant to the manager.

Riley Resigns—N. S. Riley, manager of the Studebaker automobile branch at Kansas City, Mo., has tendered his resignation. Mr. Riley was formerly connected with the vehicle department.

Ford Joins Stackpole Carbon—D. E. Ford has been made sales manager for the new Twin City branch of the Stackpole Carbon Co., with temporary quarters at 133 Hennepin Avenue. The Twin Cities have been put on a free delivery basis and a battery factory is to be built in Minneapolis.

Roberts Goes to St. Louis—H. J. Roberts, formerly with the Hudson and Chalmers companies in Detroit has been appointed sales manager of the George C. Brinkman Motor Car Co. of St. Louis, Maxwell distributers in eastern Missouri and southern Illinois.

Dr. Treat Joins G. M.—Dr. D. L. Treat, who was president of the National Bank of Commerce of Adrian, Mich., resigned to become head of the new welfare department of the General Motors Co. In this new institution Dr. Treat will not only supervise the hospital and medical work, but under his direction will be the educational work, the promotion of moral and sanitary work, the health department and many other works and departments, all having some relation to general welfare.

Firestone Appoints District Managers—The Firestone Tire & Rubber Co., Akron, Ohio, announces the appointment of three district managers, who will have headquarters at the home office and at the same time will work closely with the sales organization in the field.

D. C. Swander, formerly branch manager at New York City, will have charge of the Eastern district. He will be succeeded in New York by C. D. Studebaker, who becomes branch manager. E. W. BeSaw, formerly Des Moines branch manager, will look after the Western branches. G. A. Spohr, former salesman, succeeds Mr. BeSaw as Des Moines manager. N. B. Burwell of the home office sales department will take care of the South.

Trade News from the Southwest—The El Paso Rubber Co., El Paso, Tex., has moved into new quarters at 205 West San Antonio Street. A full line of Quaker, Goodrich, Diamond and United States tires is carried.

Mansfield & Condron are now handling the Simplex trailer at Tucson, Ariz.

R. W. Koerner, factory representative of the Ajax-Grieb Rubber Co., will shortly arrange for the opening of a branch in Phoenix, Ariz. Ajax tires have been handled there for the last year by Peters & Pemberton.

W. R. Edison recently purchased the Mission garage, El Paso, Tex., and has decided to do a straight garage business hereafter. In line with this policy he has relinquished the agencies for Chevrolet and Cole cars and Ajax tires. The Chevrolet is to be handled in El Paso territory by the Myers Motor Co., with Guy Watts as sales manager.

A. E. Culbertson, formerly of Phoenix, is now sales manager for the D. L. Meloy Motor Co. at Globe and Miami, Ariz. He is devoting most of his time to the sale of Studebakers. E. L. Meloy, Jr., is handling Chevrolets for the firm.

The Goodyear Rubber Co. has opened a branch at Phoenix, Ariz. Temporary quarters have been secured at 133 North Central Avenue. The new building was ready for occupancy Jan. 1. H. T. Roseland, formerly of Syracuse, N. Y., is manager.

Dodge Bros. Add Shop—Dodge Bros., Detroit, Mich., are erecting a press and die shop, four stories.

Kansas City Items—The Hudson-Brace Motor Co., 1717 McGee Street, Kansas City, Mo., has doubled its space by constructing a new one-story building extending back to Oak Street. The company is the distributor of the Hudson car in the Kansas City territory.

Bruening Bros. Auto Co., 1712 Grand Avenue, will move into the quarters now occupied by the Studebaker Corp. at 162 Grand Avenue. The Studebaker company will move into a new five-story building at Twenty-first Street and Grand Avenue. Bruening Bros are distributors for the Apperson and KisselKar.

Seattle Trade Happenings—The Federal Rubber Mfg. Co., Milwaukee, Wis., has opened a direct factory branch in Seattle, Wash., to supply the trade in this city and the Northwest territory. A spacious location at 1921 Fifth Avenue has been obtained. F. B. Bloom, who is well known in the tire business on the Pacific Coast, is in charge of the branch.

Construction of a two-story building at the corner of East Pine Street and Bellevue Avenue, to be occupied by motor car, repair shops and body painters, has been begun, and the structure will be ready for occupancy by Feb. 1. It will be the new home of G. L. Trotter, agent for Reo and Stewart trucks and Stearns-Knight cars; R. S. Taylor, machine shops, and Pike & Lind, automobile body painters. The building is completely electrified, even to the heating system.

New Simms Stations—The following concerns have been appointed service stations for Simms magnetos and Simms-Huff electric starting and lighting systems. They are prepared to give factory service and prices, as well as guarantee work: Panhandle Motor Co., 604 Polk Street, Amarillo, Tex.; E. H. Odom Bros. Co., 43 Ivy Street, Atlanta, Ga.; Dallas Magneto & Starter Co., 529 S. Ervay Street, Dallas, Tex.; Edwards-Sutton Specialty Co., Armory Bldg., Sixth and Canal Streets, Dayton, Ohio; Denver Auto Goods Co., 1600 Broadway, Denver, Colo.; Kelley Hardware Co., 118 W. Superior Street, Duluth, Minn.; Indiana Electrical Service Co., 419 N. Capitol Avenue, Indianapolis, Ind.; Reinhard Bros. Co., Minneapolis, Minn.; Essex Storage Battery & Supply Co., 272 Halsey Street, Newark, N. J., and Ignition Specialties Co., 798 Seventh Avenue, New York, N. Y.

New Willard Stations—The Willard Storage Battery Co., Cleveland, Ohio, has brought the number from 500 to nearly 600 within a few months. There are now 579 Willard stations, as a result of the adding of the following: I. Lesses, Kingston, Ont.; W. J. Patton, Portsmouth, Ohio; Wolverton Electric Co., Lawton, Okla.; Chillicothe Battery & Supply Co., Chillicothe, Mo.; Miller & Reed, Clay Center, Kans.; Dodge City Vulcanizing & Storage Battery Station, Dodge City, Kans.; Ray Ryan Electric Co., Pittsburgh, Kans.; Albert Lea Storage Battery Co., Albert Lea, Minn.; F. J. Barnes, Blue Earth, Minn.; Nelson Auto Company, Benson, Minn.; National Garage, Crookston, Minn.; W. H. & Webster Jones Co., Brattleboro, Vt.; David City Battery Service Station, David City, Neb.; The Hanford Garage, Hanford, Cal.; Lounsbury & Shaffer, Merced, Cal.; Bogles Electrical Works, San Rafael, Cal., and the Electric Garage, Tulare, Cal.

Seattle Overland to Enlarge—Nine hundred thousand dollars in improvements is to be spent within the next few months by the J. W. Leavitt Co., Seattle, Wash., Pacific Coast distributor of the Willys-Overland Co., in enlarging and bettering the facilities of the firm's branches.

Ground has been purchased in San Francisco at the corner of Van Ness Avenue and Bush Street, upon which will be erected a building costing $400,000, which, it is declared, will be the finest automobile building in the world. The Los Angeles branch is to be improved to the extent of $250,000; Pasadena, $50,000; Oakland, $60,000; Sacramento, $100,000. These new structures, along with the recently completed buildings in Seattle and Portland, will give the Leavitt corporation a total of 436,500 ft. of floor space devoted to the sale, storage and mechanical service shops of Overland cars.

Late Illinois Items—A new garage and sales agency will shortly be opened in Havana, Ill. R. O. Curless of Peoria, is to be the proprietor. He has leased the vacant building of the J. B. Smith Manufacturing Co. on South Water Street, at the corner of Jefferson Street. C. P. Schmidt has been engaged to look after the mechanical and service department. The new firm is to be known as the Havana Auto Co. The Reo car will be handled at the outset and others may be taken on later.

The Auto Tire Boot Co., Chicago, has been incorporated with a capital stock of $2,500, to manufacture and deal in automobile supplies, parts and accessories. The promoters are Samuel Dulsky, Louis Dulsky, and Hanna Schooler.

The Mendota, Ill., Auto Co. has been incorporated with capital stock of $50,000 to deal in automobiles, motors and gasoline engines. The incorporators are John Goebel, August Goebel and V. C. Schaller.

A new service and assembling plant for the Pinkerton Motor Co., distributor of Ford cars, was opened in Pekin, Ill., on Jan. 1. L. J. Malone will be the manager. Ten machinists will be employed in assembling the cars after shipment from the factory.

The firm of McClure & Slingoff, for several years engaged in handling automobiles and supplies in Arrowsmith, Ill., has moved to 217 East Front Street, Bloomington, Ill., and will handle the Velie and Interstate cars.

Recent Baltimore Trade News—The Monumental Motor Car Co., agent for the Kissel, with temporary quarters at Howard and Franklin Streets, Baltimore, Md., has opened a service station at 504 St. Paul Street.

The Storage Battery Service Co., Inc., has opened for business at 1014 Morton Street, Baltimore, Md.

The Auto Supply Co., T. G. Young, president, 217 West Saratoga Street, Baltimore, Md., has taken the agency for Maryland for Wonder Mist, manufactured by the Wonder Mist Co., Boston, Mass.

Tabernacle Garage in York—A tabernacle converted into a garage is the latest plan of the J. W. Richley Automobile Co., 237 East Philadelphia Street, York. The company this week purchased the spacious tabernacle on the old reservoir lot, South Queen Street. The building will be used by the automobile concern for storage purposes and to display automobiles. Mr. Richley has the agency for the Ford, Buick and Hudson cars.

New Agencies Recently Established

Canada

Quebec	Overland	Eug. Julien & Co., Ltd

Colorado

Denver	Mitchell	Maines-Hough Motor Co.
Denver	Kissel	J. M. Patrick
Denver	Kissel Kar	J. M. Patrick
Denver	Enger	Colorado Carter Co.
Denver	Enger	Colorado Cartercar Co.
Denver	Kissel	J. M. Patrick
Littleton	Maxwell	Arapahoe Garage
Littleton	Saxon	Arapahoe Garage

Connecticut

New Haven	Vim	Kirk's Garage
Unionville	Oldsmobile	Tunxie Garage Co.

Delaware

Wilmington	National	Mecca Garage
Wilmington	Brockway	Cahill & Co.

Iowa

Avoca	Oldsmobile	Avoca Auto Supply Co.
Des Moines	Maxwell	Brown Motor Car Co.
Elk Horn	Apperson	Esbeck & Pederson
Fort Dodge	Franklin	Edward Awe
Jefferson	Apperson	G. W. Flack
Keokuk	Vim	W. B. Daniel
Marshalltown	Apperson	Geo. L. Pitcher
Pella	Apperson	CanDuren & Kruseman

Idaho

Filer	Apperson	Beem & Hammerquist
Ilo	Mitchell	Star Hardware Co.
Juliatta	Saxon	Carl Porter
Lewiston	Saxon	Harold Dishon
Lewiston	Mitchell	Erb Hardware Co.
Moeller	Mitchell	Harley Braman
Moscow	Saxon	H. H. Simpson
Pocatello	KisselKar	Mooney & Douglass
Potlatch	Mitchell	Potlatch Mercantile Co.
Wallace	Saxon	Bedard & Lunacker

Illinois

Alton	Saxon	Alton Garage
Alton	Paige	Alton Garage
Alton	Premier	Alton Garage
Belleville	Saxon	A. J. Stoeckel
Belleville	Paige	A. J. Stoeckel
Belleville	Premier	A. J. Stoeckel
Benson	Oakland	Vogel Bros.
Bloomington	Franklin	J. and G. Simpson
Bridgeport	Saxon	Home Garage
Bridgeport	Paige	Home Garage
Bridgeport	Premier	Home Garage
Carlinville	Saxon	H. C. Daley
Carlinville	Paige	H. C. Daley
Carlinville	Premier	H. C. Daley
Carrollton	Saxon	Curnett & Shepard
Carrollton	Paige	Curnett & Shaperd
Carrollton	Premier	Curnett & Shepard
Centralia	Saxon	W. F. Litsinberger
Centralia	Paige	W. F. Litsinberger
Centralia	Premier	W. F. Litsinberger
Chester	Saxon	Chester Saxon Co.
Chester	Paige	Chester Saxon Co.
Chester	Premier	Chester Saxon Co.
Chenoa	Dodge	Schneckenberger & Bauman
Christopher	Saxon	W. H. Owen
Christopher	Paige	W. H. Owen
Christopher	Premier	W. H. Owen
Columbia	Saxon	E. A. Weinel Hdw. Co.
Columbia	Paige	E. A. Weinel Hdw. Co.
Columbia	Premier	E. A. Weinel Hdw. Co.
Danville	Apperson	Barger Sales Co.
Dixon	Dodge	Angier Wilson
Eldorado	Saxon	C. C. Skelton
Eldorado	Paige	C. C. Skelton
Eldorado	Premier	C. C. Skelton
Fairfield	Paige	H. O. Brockett
Fairfield	Saxon	H. O. Brockett
Freeport	Grant	A. H. Hartman
Fairfield	Premier	H. O. Brockett
Highland	Saxon	F. J. Leutweiler
Highland	Paige	F. J. Leutweiler
Highland	Premier	F. J. Leutweiler
Jacksonville	Paige	L. F. O'Donnell
Litchfield	Saxon	G. T. Lackey
Litchfield	Paige	G. T. Lackey
Litchfield	Premier	G. T. Lackey
Marion	Saxon	Marion Saxon Co.
Marion	Paige	Marion Saxon Co.
Marion	Premier	Marion Saxon Co.
Marshall	Saxon	E. F. Clapp
Marshall	Paige	E. F. Clapp
Marshall	Premier	E. F. Clapp
Minonk	Dodge	Oscar White Motor Co.
Minonk	Overland	Minonk Garage Co.
Mt. Vernon	Saxon	W. A. Underwood
Mt. Vernon	Paige	W. A. Underwood
Mt. Vernon	Premier	W. A. Underwood
Olney	Saxon	Otto Supply Co.
Olney	Paige	Otto Supply Co.
Omaha	Saxon	Omaha Motor Co.
Omaha	Paige	Omaha Motor Co.
Omaha	Premier	Omaha Motor Co.
Ottawa	Vim	N. A. Fruland
Pana	Paige	B. R. Butts
Pana	Saxon	B. R Butts
Pana	Premier	B. R. Butts
Robinson	Saxon	Law Hardware Co.
Robinson	Paige	Law Hardware Co.
Robinson	Premier	Law Hardware Co.
Rockport	Saxon	F. S. Gay
Rockport	Paige	F. S. Gay
Rockport	Premier	F. S. Gay
Shelbyville	Saxon	J. W. Wolf
Shelbyville	Paige	J. W. Wolf
Shelbyville	Premier	J. W. Wolf
Streator	Vim	Solon Bros.
West Salem	Saxon	Wm. Harrison & Son
West Salem	Paige	Wm. Harrison & Son
West Salem	Premier	Wm. Harrison & Son
Woodstock	Jackson	J. E. Sberburne

Indiana

Crawfordsville	Oldsmobile	Shaw & Banta
Ft. Wayne	Oldsmobile	Geo. W Souers & Sons
Indianapolis	Marion	Colonial Automobile Co.
Indianapolis	KisselKar	Indianapolis KisselKar Sales Co.
Indianapolis	Imperial	Colonial Automobile Co.

Kansas

Herkimer	Oldsmobile	K. & K. Motor Co.
Topeka	Oldsmobile	H. H. Clark
Topeka	Vim	Rehkopf Bros.
Wichita	Vim	Goodin Motor & Truck Co

Kentucky

Danville	Maxwell	D H. Prewitt
Elizabethtown	Hupmobile	A. H. Miller Implement Co.
Eminence	King	Geo W McDade
Falmouth	Maxwell	J. C. Held
Glasgow	Saxon	Dickinson Bros.
Lexington	Oldsmobile	Lexington Cadillac Co.
Louisville	Oakland	Kentucky Automobile Co.
Mt. Vernon	Maxwell	T. C. O'Mara
Salvisa	Maxwell	G. L. Alford

Maine

Augusta	King	P. B. Gibson

Massachusetts

Boston	Apperson	Apperson Motor Co. Boston
Springfield	Vixen	Winchester Motor Co.
Springfield	Maxwell	Bennett Motor Car Co.
Springfield	Moline-Knight	Winchester Motor Co.

Michigan

Belzoni	Apperson	H. H. Alexander
Charlotte	Paterson	Chas. White
Grand Rapids	Republic	E. C. Patton
Grand Rapids	Marion	William Miller
Grand Ledge	Maxwell	Grand Ledge Mach. Co.
Grand Ledge	Studebaker	Grand Ledge Mach. Co.
Greenville	Studebaker	O. C. Kemp & Son
Greenville	Overland	O. C. Kemp & Son
Greenville	Oakland	O. C. Kemp & Son
Jackson	Dort	L. C. Watkins
Lawrence	Ford	Welcher & Kelly
Morenci	Allen	Lou Hill
New Brunswick	Vim	Enterprise Garage
Lake Odessa	Studebaker	Charles Kart
Lake Odessa	Ford	Charles Kart
Ypsilanti	Reo	Joseph H. Thompson

Mississippi

Canton	King	T. C. Holliday
Jackson	Vim	Capital Auto Co.

Minnesota

Browersville	Chevrolet	Peter Droug
Buffalo	Maxwell	L. J. Hoffman
Excelsior	Oldsmobile	A. E. Phillips
Farmington	Oldsmobile	John Wright
Fergus Falls	Apperson	Fergus Auto Co.
Glenn	Vim	B. A. Goff
Luverne	Oakland	Home Automobile Co.
Minneiska	Chevrolet	Tibbesar & Weiser
St. Cloud	Vim	Grundman Auto Co.

Maryland

Cockeysville	Ford	Walter P. Rechord
Denton	Ford	Denton Auto Co.
Easton	Ford	Clark Auto Co.
Ellicott City	Ford	Robert J. Taylor
Federalsburg	Ford	Covey & Williams
Freeland	Ford	J. M. Hoshall
Galena	Ford	Davis Bros.
Glenwood	Ford	W. H. Stimson
Goldsborough	Ford	Robert Jarrell, Jr.
Havre de Grace	Ford	W. M. Saunders
Jessups	Ford	James D. Gill
Norristown	Ford	The Norristown Garage
Preston	Ford	J. J. Garris
Reisterstown	Ford	Gill & Rauser
Rocks	Ford	Ramsay & Co.
Sudlersville	Ford	Hart & Stunt

Missouri

Bloomfield	Paige	R. E. Parker
Bloomfield	Premier	R. E. Parker
Bloomfield	Saxon	R. E. Parker
Carthage	Apperson	E. S. Williams & Son
Flat River	Saxon	Flat River Motor Co.
Flat River	Paige	Flat River Motor Co.
Flat River	Premier	Flat River Motor Co.
Herman	Premier	R. L. Huzol
Herman	Saxon	R. L. Husol
Herman	Paige	R. L. Husol
Illmo	Saxon	T. J. Eifert
Illmo	Paige	T. J. Eifert
Illmo	Premier	T. J. Eifert
Ironton	Saxon	J. C. Forshee
Ironton	Paige	J. C. Forshee
Ironton	Premier	J. C. Forshee
Jefferson City	Saxon	T. J. Burkhardt
Jefferson City	Paige	T. J. Burkhardt
Jefferson City	Premier	T. J. Burkhardt
Kennett	Saxon	Louis Auten Wholesale Co.
Kennett	Paige	Louis Auten Wholesale Co.
Kennett	Premier	Louis Auten Wholesale Co.
Lixville	Saxon	B. E. Rhyne
Lixville	Paige	B. E. Rhyne
Lixville	Premier	B. E Rhyne
Morehouse	Paige	D. L. Lacy
Morehouse	Premier	D. L. Lacy
Morehouse	Saxon	D. L. Lacy
Moberly	Saxon	T. J. Williams
Moberly	Premier	T. J. Williams
Moberly	Paige	T. J. Williams
Old Monroe	Premier	G. L. Pollard
Old Monroe	Saxon	G. L. Pollard
Olney	Paige	F. C. Stroker & Son
Olney	Saxon	F. C. Stroker & Son
Olney	Premier	F. C. Stroker & Son
Old Monroe	Paige	G. L. Pollard
Washington	Paige	C. A. Krumsick
Washington	Premier	C. A. Krumsick
Washington	Saxon	C. A. Krumsick

New Jersey

Camden	King	Camden Auto Co.
Cape May Courthouse	Vim	Dix Auto Co.
Mt. Holly	King	Central Garage
Medford	King	J. A. Lamb
Passaic	KisselKar	G. T. Ray
Trenton	Vim	J. I. Peoples

New York

Binghamton	Vim	Binghamton Motor Car Co.
New York	Metz	Robt. Lurie & Co.
Newburgh	Oldsmobile	L. H. Cowley
Oneida	Lexington-Howard	George I. Lloyd
Perry	King	Watkins & McKurth
Yonkers	Vim	F. F. Dean

Nebraska

Auburn	Apperson	Workman & Rozean
Fremont	KisselKar	McCoy Motor Car Co.
Grand Island	Apperson	Independent Garage Co.
Norfolk	Apperson	Edward C. Engle
Oakland	KisselKar	Mr. Ford
Scribner	KisselKar	Ball & Zeman

Ohio

Akron	Saxon	The Loveland Co.
Alliance	Mitchell	The Alliance Motor Car Co.
Alliance	Ford	The Alliance Motor Car Co.
Alliance	Overland	The Alliance Motor Car Co.
Alliance	Federal truck	The Alliance Motor Car Co.
Bucyrus	Apperson	Samuel Hirtz
Canton	Interstate	Parr & Sahm Co.
Cincinnati	Detroit Electric	Charles Behlen Sons Co.
Cincinnati	J. W. Lehman	Hellman Motor Car Co.
Cleveland	Westcott	Folberth Auto Specialty Co.
Cleveland	Westcott	Folberth Auto Specialty Co.
Columbus	Fostoria	Fostoria Light Car Co.
Columbus	King	Curtin-Williams Auto Co.
Columbus	Dort	Curtin-Williams Auto Co.
Columbus	Cole	Curtin-Williams Auto Co.
Columbus	King	Curtin-Williams Auto Co.
Dayton	Apperson	W. T. Strickler
Dayton	Westcott	C. W. Hoffritz Sales Co.
Dayton	Westcott	C. W. Hoffritz Sales Co.
Dayton	Vim	Durable Dayton Truck Co.
Delaware	Overland	E. L. Main
Findlay	Vim	Castle's Garage
Ironton	Oldsmobile	W. Carl Hart
Marion	Hudson	The Auo Inn Garage
Marion	Apperson	A. D. Hill
Marion	Maxwell	W. M. Rhoades
Martins Ferry	Overland	The Wahl Motor Co.
Middleport	Oldsmobile	H. B. Anderson
Millersburg	Oldsmobile	Carlos Calhoun
Newark	Maxwell	Baird & Gallagher
Salem	Westcott	W. H. Kniseley & Son
Tiffin	Westcott	Raymond W. Miller
Toledo	Patterson	The Banting Machine Co.
Toledo	Oldsmobile	Bunnell Auto Sales Co.
W. Liberty	Apperson	C. C. Prall
Youngstown	Vim	Vim Truck Sales Co.

Oklahoma

Atlas	Maxwell	Atlas Motor Car Co.
Ardmore	Maxwell	L. C. Slaughter
Bridgeport	Maxwell	Sellers Merc. Co.
Chickasha	Maxwell	Wier & Wagner
Devol	Maxwell	J. L. Crump
Frederick	Maxwell	Wright Garage Co.
Hobart	Maxwell	J. Terry

Pennsylvania

Allentown	Vim	Krause Auto Co.
Ashland	King	J. V. Monaghan
Bally	King	Wm. H. Tagert
Coatesville	Vim	J. J. Higgins
Erie	Oldsmobile	F A Stoeltzing
Hazleton	Vim	Hazleton Motor Truck Service Co.
Lancaster	Franklin	Flory Bros.
New Castle	Apperson	John Kiefer & Wm. Smit
Pittsburgh	KisselKar	Center Ave. Garage
Pittsburgh	Westcott	Westcott Motor Car Sale Co.
Scranton	Vim	Samuel Weinberg
Sellersville	Vim	E. S Jacoby & Son
Union City	King	E. C. Clark & Son
Wilkes-Barre	Apperson	Mac's Garage
York	King	Franklin Finkel
York	Studebaker	York Auto Exchange
York	Maxwell	Penn Anto Co.
York	Dodge	Penn Auto Co.

The AUTOMOBILE

Vol. XXXIV, No. 2

NEW YORK, JANUARY 13, 1916

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December 28, 1915
Patent No. 1165861

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Eights and Twelves Defeated by a Six

THE facts about the Super-Six seem almost like fiction.

Think of increasing motor efficiency 80 per cent at one jump without adding size or cylinders.

Think of a small, light Six—cylinders 3½ x 5—developing 76 horsepower.

Think of that Six, in official tests, breaking all stock-car records.

Think of a simple, light-weight Six out-matching Eights and Twelves.

And think of a $1375 car proving itself, beyond possible question, the best performing car of the day.

MEN WILL HAVE THAT 80%

This motor's capacity is 288 cubic inches. The best former motors in that size delivered about 42 horsepower. The Super-Six delivers 76 horsepower.

Any motor which shows about half that efficiency will have no attraction now.

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So it means vast economy. It means such smoothness as you never have known before. It means matchless flexibility. It means, as shown by official tests, record quick response.

Every quality men prize in a motor has been bettered vastly in this Super-Six.

EXCLUSIVELY HUDSON

Now, for the first time, a premier attraction is found in one car only.

The Super-Six is a Hudson invention controlled by Hudson patents. So no other car will have it. And any like performance is impossible without it.

Eights and Twelves of the finest types have been utterly defeated. Every reason for a double motor, with its extra weight, has vanished. Not a Six of the old type has any chance in comparison.

So this invention gives the palm to Hudson, over all cars in the field. One ride in the Super-Six will convince you of that.

$42,000,000 OUTPUT

We have doubled our factory because of this invention. And we shall build this season $42,000,000 worth of these Super-Sixes.

They come equipped with most luxurious bodies. All that we save by this doubled production has gone into extra elegance.

So the Super-Six will stand supreme both in motor and in looks. Any Hudson dealer stands ready to prove that to your fullest satisfaction.

7-Passenger Phaeton, $1375 at Detroit.

Five Other Body Styles.

Super-Six Catalog Is Ready.

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COMPANY, DETROIT

World's Records Broken

All Records up to 100 Miles

Made at Sheepshead Bay under supervision of American Automobile Association, with a 7-passenger stock-car Super-Six. Breaking all stock-car records for any size, or any price, or any number of cylinders.

100 miles in 80 min., 21.4 sec., averaging *74.67 miles per hour*, with driver and passenger.

Previous best stock-car record was made with a multi-cylinder car carrying driver only.

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Two laps made at 76.75 miles per hour.

Standing start to 50 miles per hour in 16.2 sec. A new record in quick acceleration.

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(Means uncertainty of success)

Experience

(Means certainty of success)

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Vol. XXXIV New York—Thursday, January 13, 1916—Chicago No. 2

The AUTOMOBILE

Truck Industry Triumphant

Foreign and Domestic Demands Eclipse All Records—Better Trucks, Better Finance and Better Prospects Rule for 1916

By A. Ludlow Clayden

ABSORBED as we have been in the spectacle of prosperity presented by the passenger-car industry, we may, perhaps, have overlooked that of the sister industry caring for the demands of users of commercial vehicles. Yet never before has there been such a year of advancement in the truck field, never before have prospects for the future looked so bright throughout the world.

There is a tendency to look upon American truck-building prosperity as a thing fostered by war and sure to wane as peace once more resumes its sway over the civilized world. But, though fostered by war, without doubt there is no more reason for anticipating a slump with peace than there is reason to assume that the roses will wither directly the manure around the roots of the tree is absorbed. Growing slowly from year to year the commercial motor vehicle needed a stimulus to jump it from its adolescence to its manhood, and war has supplied that need. Once man's estate is reached and realized, however, one can never be a child again, and so with the motor truck industry—it can never again lose the place it now occupies, but will go on to work out its great destiny.

War has supplied three things: It has supplied money, money to buy trucks and so keep running the premier factories throughout the world on war supplies. It has supplied money that is being applied to the betterment of those premier companies—money which will see them in a better state at the end of their war orders than they were before the war orders began.

It has supplied advertising, the greatest advertising any industry ever had. To open an illustrated paper in America, France, England, Italy or Germany, without seeing a picture of motor trucks at work is almost an impossibility and has so been for nearly two years past.

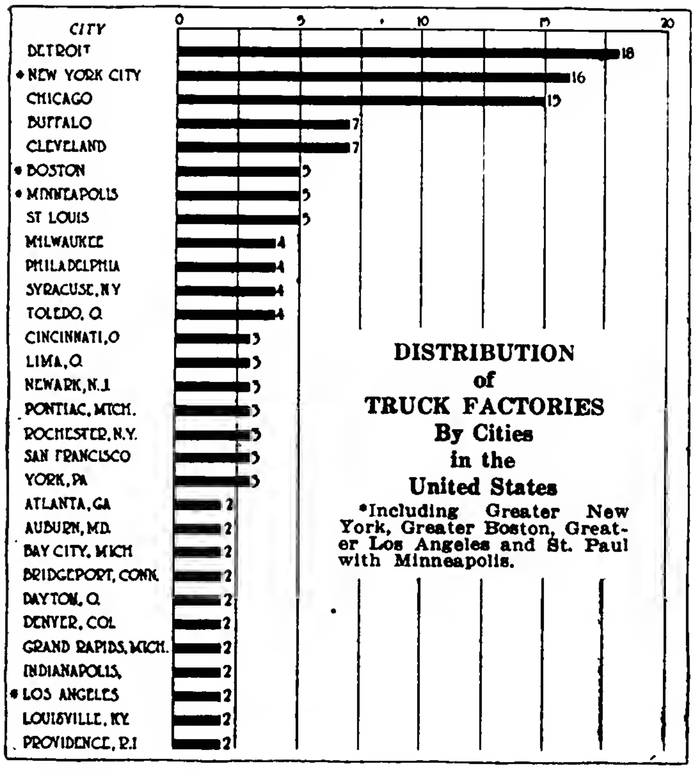
Every civilized man now knows that the armies of the belligerents depend for everything, almost, upon their mechanical transport. That men, food and goods of warlike nature need the motor truck more than the horse; that animal transport is of infinitely less importance than automobile.

It has supplied a market, for war has stripped Europe of its horses and depleted the supply of animals throughout the globe. Every merchant who has to handle goods must for ten years and more to come pay a higher price for animals than ever in history. For years it will be actually hard to obtain horses for ordinary trade purposes throughout Europe. Hence the economies of motor transport, for goods will be obtainable at a capital outlay exceeding that necessary for horse equipment by a smaller amount than ever before.

Thus it may be said with conviction that if war has brought prosperity to the commercial motor vehicle industry, this prosperity will be one of the all too few *good* things that war will leave behind it when the events of the present have become but a nightmare memory.

We have seen throughout the world a year in which the domestic demand for trucks has eclipsed all previous records—a year in which the export demands have eclipsed all previous records also, *apart from war orders*. Between January, 1914, and January, 1917, the motor truck comes into its own.

In 1915 competition in the truck field has been less



DISTRIBUTION
of
TRUCK FACTORIES
By Cities
in the
United States

*Including Greater New York, Greater Boston, Greater Los Angeles and St. Paul with Minneapolis.

keen for two reasons. One is that the firms securing war orders have had so many less trucks to dispose of domestically. In round figures, 24,000 trucks have been exported, and that 24,000 represents just about 30 per cent of the total output. You cannot remove a third of an industry's product without easing competition in the disposal of the remaining two-thirds.

The other reason is that for the 74,000 trucks which were sold in America last year there were more than that number of buyers. The demand has exceeded the supply, and selling is easy under such a condition.

From these generalities there arise many interesting questions for speculation and analysis. For instance, it may be asked what effect has the absorption of certain makes of trucks for war purposes had upon the domestic trade of these manufacturers? Several of the leading makers of trucks in America have secured orders covering a very large share of their output. Is their trade eventually to gain or lose by this war business?

This is a question that each man must answer as he sees it, but it is easy to observe that those firms who are enjoying the war orders are mostly also enjoying a home demand for their trucks greater than ever before. It seems that each war supplying firm has had a row of buyers sitting on its doorstep waiting patiently for such odd trucks as they could snatch. Some of the concerns most deeply involved have, by increasing their capacity, been able to enlarge their domestic sales as well as taking on a few thousand foreign orders.

We have to-day in the truck field full manufacturers who make every part of their trucks, partial manufacturers who buy some parts and make others, and assemblers who make none of their parts. The latter lead, as in the passenger-car field.

Looking around we can see the unmistakable nuclei of great truck-assembling factories with an easily traceable future leading up to outputs of 10,000 or more chassis per year. We see factories making nothing but truck axles, nothing but truck motors, all building, all adding new equipment. This development is natural, was bound to take place, but had it not been for the war it would have been much longer in reaching its present stage, perhaps.

We have said that the removal or partial removal from the competitive home market of some of our big producers has helped the smaller men, and it is reasonable to ask what may then happen when the former have completed their war contracts. One can but speculate, but there is good reason to assume that the other firms have made such good use of the opportunity offered them that their position will be unassailable. The present American demand is capable of absorbing many more trucks than are now available. The world is able to take five times the number, so there should be no room for doubt as to the prosperity of the next few years not merely continuing but growing even greater.

Export Field is Wide

What markets there are in the world as yet hardly touched. All Europe is waiting for the inexpensive American commercial vehicle as well as for her own more costly product. There is room, after the war, for all the outputs of all the European factories and half those of the American plants as well. There is the British Empire, starved for supplies of motor vehicles of all kinds. There is Russia in Asia, where a tremendous wave of civilizing development is looked for after the war. By war a good half of the

Few Local Manufacturers

Below appears a tabulation of manufacturers classified according to markets catered to:

Class of market	Percentage
International	37 1/3
Sectional, a group of states	37 1/3
National, the whole country	16
State	6 2/3
Local, confined to a city or county	2 2/3

Most Makers Build Bodies

Below, in percentages, is given the different policies in regard to factory-built bodies:

Body policy	Percentage
Standard bodies supplied	76
Stripped chassis only	13 1/4
Seldom supply bodies	8 3/8
All chassis sold with bodies	2 3/8

Many Concerns Extend Credit

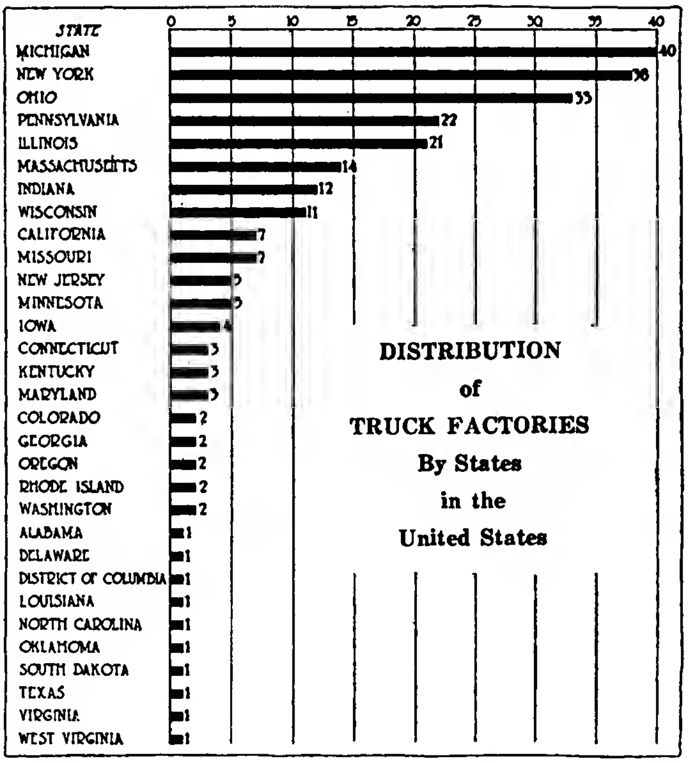
Credit policies of different manufacturers are given as to per cent in the table below:

Credit policy	Percentage
Have a credit scheme	46
Refuse to grant credit	40 1/2
Leave it to banks and credit brokers	5 3/8
Rarely grant credit	4
Leave matter to dealers	2 3/4
Extend credit locally only	1 3/8

world's road-transport vehicles, animal and mechanical, have been used up—destroyed forever. That the animal part will ever be replaced fully is more than doubtful, so the mechanical will be needed more than ever. No longer will it require educational work lasting over months to sell a truck, for there are hundreds of thousands of buyers waiting check book in hand for the chance to take delivery.

So much for the general situation as regards sales of the present and of the future. Internally, apart from the overseas market, there are changes to be observed which have an effect upon the whole situation.

For instance, the use of the trailer is growing immensely, and it is enlarging the scope of a truck. It is allowing a man with much to haul, in suitable country, to haul it more cheaply; it is making the motor truck still more economical in certain classes of application. The truck makers have been slow to approve the trailer, to-day none of them are actively opposed to it, most of them are ready to approve it within reason, and the balance approve it with certain restrictions as to loading and general usage. The present position is that the trailer will be used whatever the truck maker may think about it, so that the trailer may be regarded as having been forced upon the truck industry, the latter not being unwilling but merely a little coy regarding its new partner.



That the great commercial development should have gone hand in hand with engineering progress is natural; it is almost a law that one sort of progress should be accompanied by another, and thus we see the truck of 1916 a distinctly better machine as well as a distinctly cheaper one, on the average.

Methods of commercial handling of the business have changed a little also. There is a distinct increase in credit selling where the makers are absolutely satisfied that the buyer will find the use of the truck a real advantage. To take greater care in selecting credit customers and to be more ready to give credit to those who deserve it is the spirit of the hour. That the truck industry is being regarded rather more hopefully and confidently by the banking interests is also a fact, and doubtless this is partly owing to the creditable showing of the industry during the year.

There have been a number of reorganizations tending toward economy, there have been many new firms come into the business, but we have seen extremely few collapses, few instances of frenzied methods of business. It is as though every man in the truck trade was planning to make it his life's work; it is an industry lately almost untouched by that variety of speculator which the solid financial interests of the country distrust.

We have lately had occasion to remark that never did the immediate future of the passenger-car trade appear so fortunate. That we may truthfully say the same of its sister industry is much more than a happy coincidence. The purpose, the value—in a word the *efficiency* of the automobile was put to the supreme test in the fall of 1914.

The first six months of war proved that neither the truck trade nor the car trade could be injured by civilization's greatest catastrophe; proved that the automobile industry, in the widest sense of the word, is now one of the world's greatest necessities.

Most Trucks Are Assembled

Below are tabulated percentages of makers of motor trucks according to three methods:

Method of manufacture	Percentage
Assembled from standard parts	65 2/3
Partially assembled	23 1/3
Manufactured by maker	11

Trailers Are Generally Approved

The following symposium represents current opinion as to trailers among truck companies:

Trailer policy	Percentage
Approved	35 1/2
Not indorsed	18 3/4
Provision made for attachment	15 1/4
Indorsed under restrictions	13 1/3
Noncommittal	10 2/3
Optional with purchaser	5 1/4
Indorsed for country work only	1 1/4

Starter Question Unsettled

In the table below sentiment among builders is tabulated as to electric systems:

Electric starter policy	Percentage
Supplied on buyer's option	31 3/4
Not indorsed	22 2/3
Approved	21
Refuse to provide	7 1/3
Installed as stock equipment	6 1/3
Electric lighting only supplied	4 1/2
Noncommittal	3 2/3
Will be stock equipment later	1 3/4
Used on light capacities only	1

Truck Design Shows Many Changes

Worm Drive Gains Greatly—Average Capacity Enlarged—General Simplicity Improved

By J. Edward Schipper

TWO thoughts, either of which may be dominant according to the viewpoint taken, are suggested by a study of the past year in the motor truck industry. First, from the economical standpoint, trucks are better adapted to the particular task for which they are used than ever before. Secondly, from an engineering standpoint the mechanics and design of the vehicle have progressed far beyond the usual normal advance for a year. Behind these two conditions there are broad underlying reasons which at first sight would seem only indirectly connected with industrial and mechanical progress, but which on close examination prove to be the immediate cause of development.

Worm Drive Gains 100 per Cent

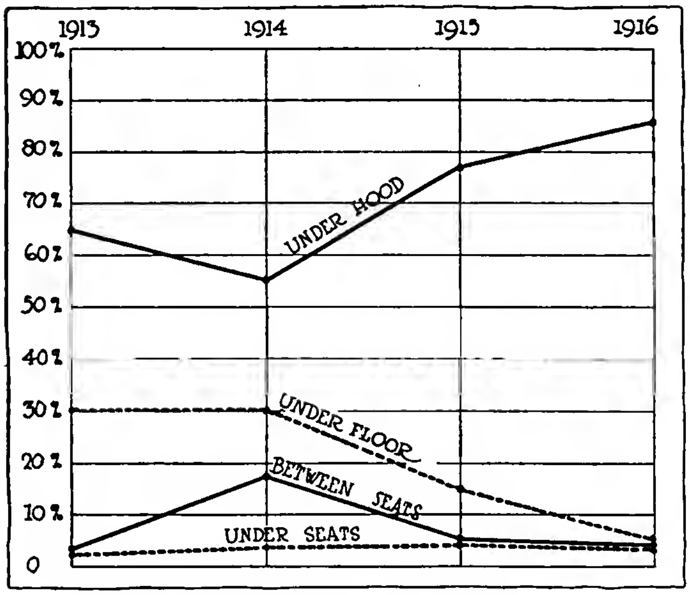
For instance, it seems far-fetched to suggest that Austria's ultimatum to Servia has anything to do with the fact that worm drive has increased over 100 per cent during one year on American motor trucks. And yet, the great war, which that ultimatum, like a torch, kindled throughout Europe, has had more to do with the phenomenal development of the motor truck industry in the United States than can possibly be conceived, except by careful analysis. The percentage of the $65,000,000 received from foreign countries for American trucks that found its way into the engineering departments of the manufacturers has done wonders in the improvement in design. The vast demand had enabled manufacturers to clean their stocks and start afresh on what was realized to be the best practice but which required great sums of money to put in operation. Better graduated capacities, better power plants, better power transmission systems and more efficient control layouts can be directly laid at the door of the greatest year ever known for export business.

One of the first things which manufacturers have done since the opportunity has been offered to supply what previous experience has shown to be essential for success is carefully to scrutinize the capacity problem. There have been some remarkable tendencies in this direction during the past year. The high spot is the development of the 2-ton truck. The overloaded 1-ton and 1½-ton vehicle is passing away, and in its place consumers who formerly through false economy believed that they could carry an occasional high overload are coming to realize that this is a mistake. The average capacity of gasoline motor trucks for 1915 was 4500 lb. For 1916 the average carrying capacity is 4840 lb. This is an increase of 340 lb. per vehicle, or approximately 7½ per cent.

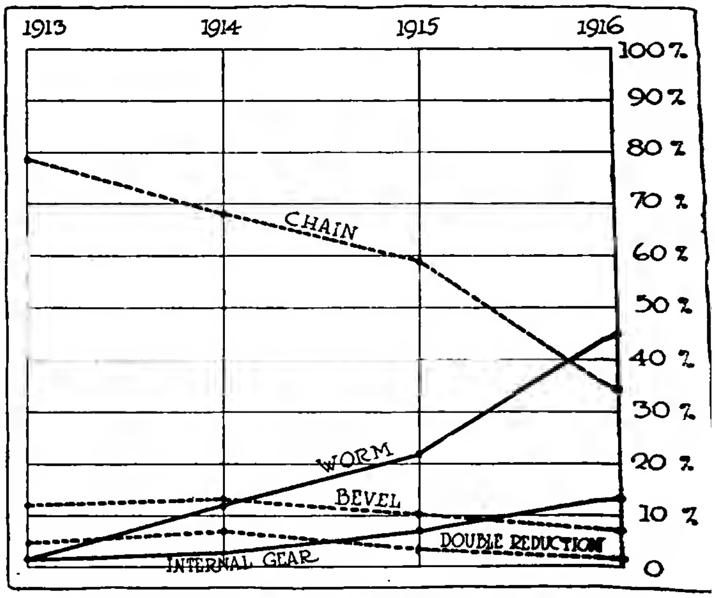
This change in the average capacity is more significant than that it merely represents an increase in the size of the body and the springs on the part of the maker. The manufacturer must supply what the consumer demands, and the fact that the capacity is higher shows that the consumer is buying larger trucks—not because the individual loads moved are any greater than they were a year ago, but because he is willing to pay relatively more for the truck and get what is economically correct.

Coming to the other great development of the year, shaft drive: this is another instance where the purchasers' wants are expressed in tangible form. Public opinion demands the worm drive, and the result is that chain drive has fallen from 58.7 per cent in 1915 to 33.4 per cent in 1916. Worm drive has increased from 21.5 per cent to 44.7. Internal-gear drive has increased from 7.3 to 12.2 per cent, while bevel drive has fallen from 10 to 7. Silence in truck operation has been demanded, and shaft drive is proving to be the answer. When a man buys a commercial vehicle he looks at the question from a business standpoint. In the first place he wants good service from the vehicle. This, in the light of present development, he has a right to expect, and he will receive it. He also wants ease of riding as a protection to the chassis and of the load, should the latter be fragile.

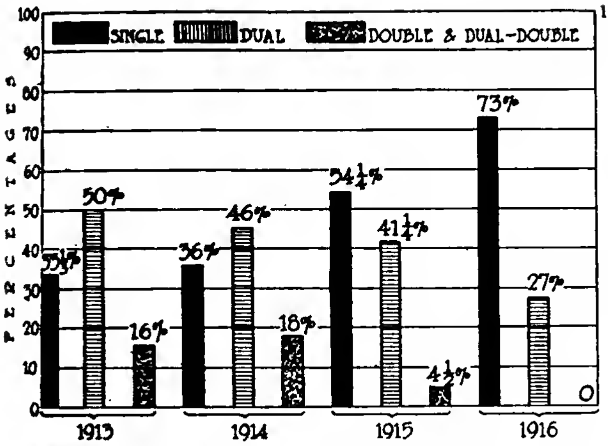
Noise, parts to clean, parts to replace and other inconve-



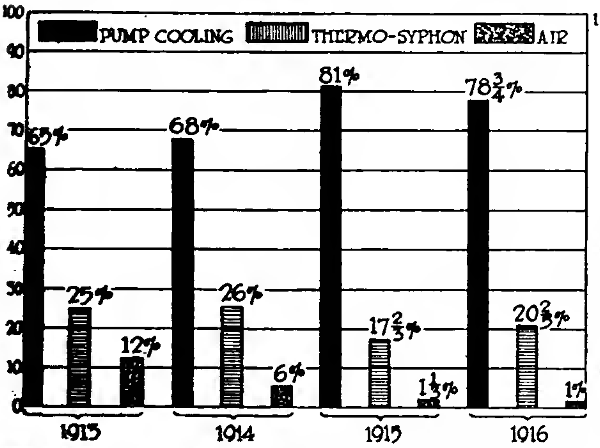
There is a marked trend toward the motor-under-hood construction



A feature of the year is the great gain of shaft drive



Progress in ignition shows a trend toward single systems



Pump cooling has fallen off slightly in favor of thermo-syphon, due to improved radiator construction

siences must be eliminated. When an intending purchaser is shown two trucks both doing their work equally well, one in silence and the other with noisy effort, he quickly turns to the quieter; this also for good business reasons.

As happens in every industry, as developments go on prices can be cut. More efficient tools, better design and big production have been the factors which have cut the prices in the manufacture of motor trucks. In 1915 the average price of a truck was $2,528. For 1916 the price is close to $2,413.

Better Trucks at Lower Prices

Trends in truck design follow somewhat along the lines of those in passenger-car work. The careful concentration on higher efficiency carries the two branches of motor car design along lines that are, in many instances, parallel. This is evidenced in the power plant to a great degree. In the first place the location of the motor under the hood instead of in less accessible locations is growing. Last year, 77 per cent of the chassis had the motors under the hood and in 1916 the percentage is 86. The gain in the under-hood location has been due to the falling off of the under-floor type. This has dropped from 13 per cent in 1915 to 4.2 per cent in 1916.

It would hardly be expected that the multi-cylinder motor would find favor in the truck field. This supposition is borne out and over 96 per cent of all gasoline commercial vehicles have four-cylinder motors. Sixes are represented by 1 per cent and twos by 2.4 per cent. This is the first year in a long time that there has been no representation of the three-cylinder two-cycle design, but it has now dropped to zero. The Duryea two-cylinder two-cycle delivery vehicle is the sole survivor of the two-stroke tribe.

Another way in which power plant design for the commercial vehicle parallels that of the passenger car is in the size. It is becoming smaller as time goes on and greater efficiency is obtained from smaller displacements. The average of all 1915 motors had a bore of 4.16 and a stroke of 5.25 in. The average 1916 truck motor is a 4 by 5.20 in. The smaller motor represents the trend toward compactness and this is further carried out by an increase in the percentage of block-cast cylinders from 54.2 in 1915 to 59 for 1916. To further increase the compactness of the average motor the T-head percentage is suffering in comparison with the gains made by the L-head. There are only 14 per cent which are T-heads now as compared to 17.5 per cent a year ago. The L-head is used on 82.3 per cent.

With the compact block casting with the neat L-head cylinder shape representing the average of truck design due to its preponderance in the percentage tables, it will not be surprising to note that the same trends toward compactness and simplicity will be found throughout the chassis. Take for illustration thermo-syphon cooling which shows a slight gain, and another point of great importance, the unit power plant which has jumped in one year from one-third of the installations to over one-half, the percentage readings for 1915 and 1916, respectively, being 33 and 52.2; the amidships location has gained 5.75 per cent over a year ago, this being due to the more extensive use of worm drive. This involves in some cases great shaft lengths which may very conveniently be reduced by placing the gearset mid-length of it, thus cutting down the free length. The unit jackshaft locations loss has been commensurate with the reduction in the number of chain-driven models.

Apropos of the question of driveshaft lengths, this is a problem introduced by shaft drive which is as yet unsolved. A shaft of too great length will whip and whirl in action, to the great detriment of its universals and the end bearings. One

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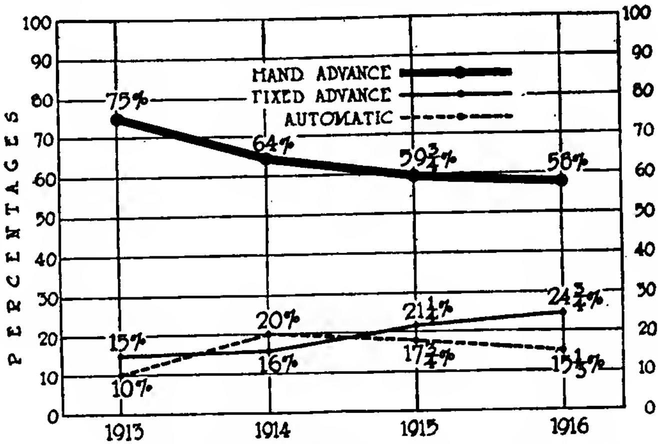
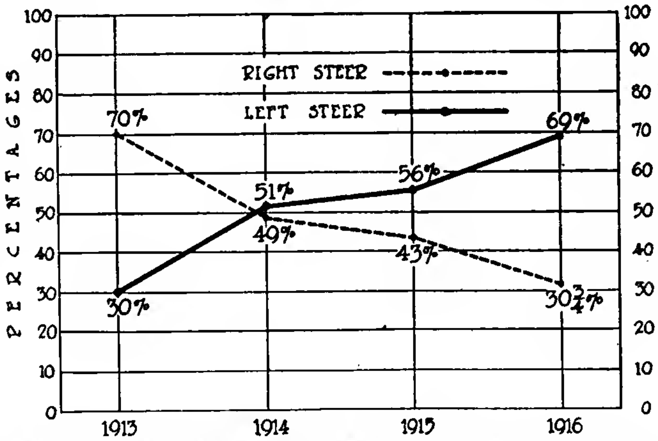


Hand spark control is declining, due to the increase in fixed spark systems



Left steer's gain has been consistent. Right steer survives mainly for export sale

Italian Truck Makers Flourishing

Plants Are Able to Supply Other Countries as Well as Italian Army—Many New Designs—Fiats Predominate

By W. F. Bradley

Paris correspondent of THE AUTOMOBILE, *recently returned from examining the busy and prosperous automobile and motor truck industry in Italy. The following is the first of a series of articles on the subject and reviews the truck field*

Top—Scat motor for 4-ton army truck. Four-cylinder block 3.9 by 5.9-in. bore and stroke

Middle—Heavy duty Spa 3.7 by 7.8-in. bore and stroke for gun-carrying truck. Splitdorf magneto is fitted

Bottom—Lancia 2-ton truck, 3.9 by 5.5-in. bore and stroke motor. Note wood fan of aeroplane type

WITH a 700-mile front, it is obvious that the Italian army must make a very extensive use of automobile trucks. Prior to the war Fiat was the only firm producing trucks in big quantities and, although all other firms have devoted their attention to army vehicles, Fiats still predominate. This company's output is sufficient to supply the Italian army and leave a surplus for England, France, Belgium and Russia. The biggest type used in the Italian army is a 4-ton truck, which is of course a specially designed truck proposition; the smallest are 1-ton trucks on pneumatic tires, generally with twin tires on the rear wheels.

All Fiat trucks of 2-ton capacity and upward have inclosed chain drive; Spa, another big maker of trucks, also uses inclosed chains for final drive. Scat, the only other firm specializing in trucks, uses internal gear drive. These three firms are the only ones having paid really serious attention to truck design before the war, and building a truck which is not a touring car development. These firms, as well as all the others in Italy, are building shaft and bevel drive trucks of 1-, 1½- and 2-ton capacity, which are really nothing more than heavy touring cars. The greater proportion of these 1,- 1½- and 2-ton trucks are equipped with pneumatic tires, singles on the front wheels and twins on the rear.

No European army employs such a proportion of pneumatic-tired trucks as the Italian. The explanation is that the authorities wished to make use of trucks built in the country, and it was quicker for the manufacturers to fit a special rear axle and strengthen up the touring chassis generally, equipping it with twin pneumatics, than to get out special truck designs. It is certain that the arrangement is not the most economical, for all the Italian trucks are driven too fast and tire upkeep must be enormous.

Disk Wheels for Small Trucks

One of the distinctive features of Italian construction is the use of disk wheels for trucks up to 2-ton load. These wheels are detachable by unscrewing five or six nuts, and are very easy and cheap to construct, for they consist merely of a stamped steel disk riveted, and welded to a steel rim. The same type of wheel has been put on the market in France by Michelin, and is being used to a moderate extent for touring cars, but very little for trucks. In Italy, on the other hand, the disk wheel is used on all Fiat light trucks, this firm manufacturing them in its own shops, and on about 80 per cent of the entire Italian output of trucks up to 2-ton capacity. Cast steel wheels are employed almost exclusively for the heavier trucks, although the high price of the castings at the present time—about 17 cents per pound—has caused some attention to be paid to wood wheels. It is found, however, that there is very little saving in price.

It appears to be a general practice for the Italian makers to use close grained cast iron instead of aluminum for their heavy truck crankcases. This is done by both Fiat and Spa. This latter firm does not use paper gaskets at the base of the cylinders and between crankchamber and oil pan. The surfaces are so finely ground that they can be put together without any joint between them, and there is absolutely no oil leakage. This is done on trucks as well as on touring cars. The interiors of cast-iron crankchambers are painted as a protection against rust.

No Four-Wheel Drives

There appear to be no four-wheel drive tractors in Italy; at any rate none are being made by the Italian manufacturers. Heavy gasoline tractors, intended to operate away from made roads, and designed primarily for the haulage of heavy artillery, are being produced by several firms, notably Fiat, Isotta-Fraschini and Spa, and are claimed to give results equal to those obtained with the all-wheel drive type. The Fiat tractor is a chain-driven machine with 70-hp. motor under a hood, four-speed gearbox, jackshaft and incased chains driving large diameter cast-steel wheels with ribbed faces. Front wheels are fitted with Goodrich single-band tires.

The motor, which has a bore and stroke of 5.1 by 7.8 in., is L-type with cylinders cast in pairs, and is the only non-monobloc casting seen in Italy. Except for the pair casting it does not differ appreciably from Fiat truck motors. It is carried on a sub-frame and has half compression device which automatically retards the magneto, the advance being given with full compression and remaining fixed. On a cold morning it is not likely to be an easy matter to start a motor of these dimensions, and in consequence the starting handle is made of sufficient length for three men to get hold of it.

The position of the water pump is somewhat distinctive on the right-hand side of the motor, in a central position, with an inlet pipe to each group of cylinders. The magneto is immediately to the rear of the pump and driven off the same shaft. The gilled tube radiator is mounted in trunnions, and has a whistle in the filler gap, so as to give warning to the driver if steam begins to form.

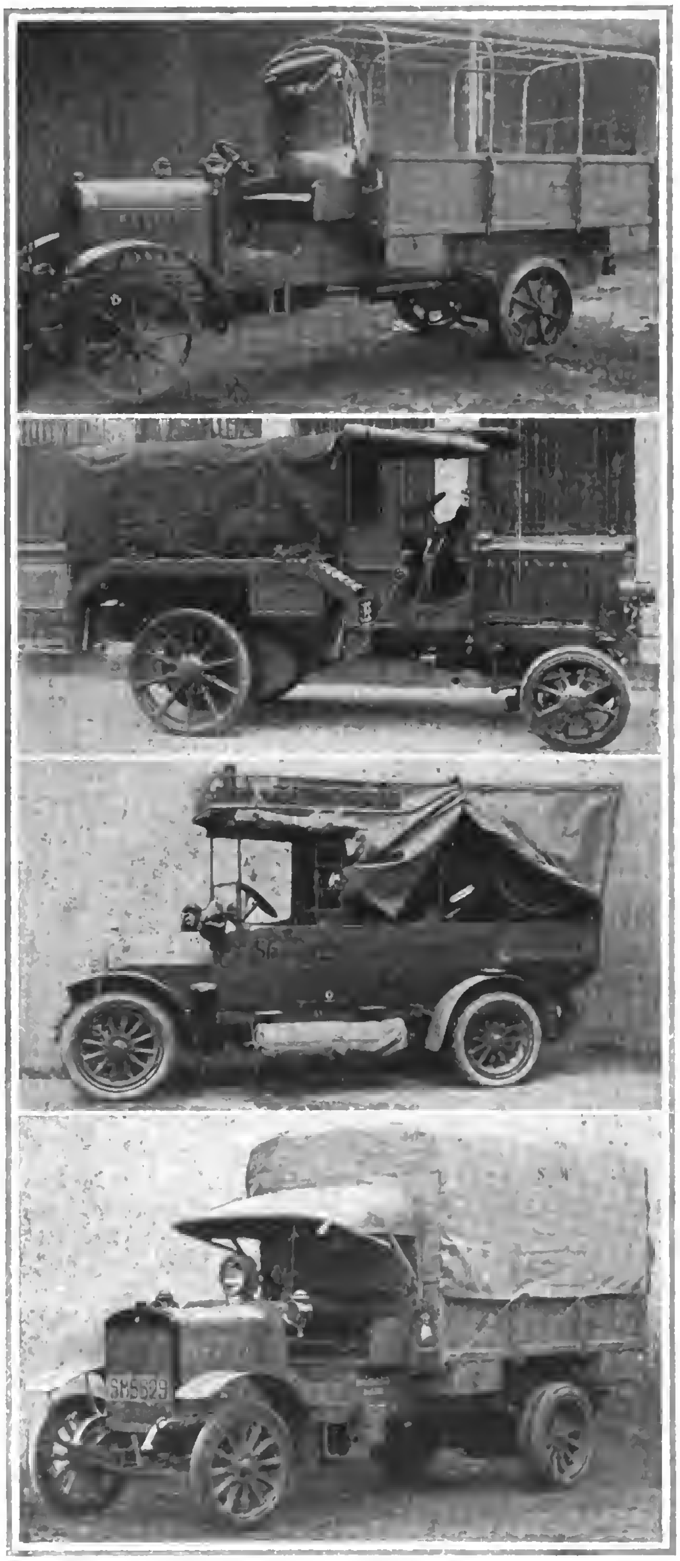
Cross-Members and Gussets for Strength

A very rigid chassis construction is obtained by closely placed cross-members and gussets. Between the motor and gearbox is a cast-iron housing attached direct to the frame members, containing the gearshifter mechanism, the brake control, and silent chain drive from main shaft to the winch shaft running alongside the left-hand frame member. It is by means of a dog-clutch, operated by the change speed lever, that the driving chain can be put into motion, all the gears then being locked in neutral.

Differential Lock on Fiat Tractor

The winch is mounted horizontally within the rear of the chassis and has about 50 yd. of ½-in. steel cable. There are guides on the chassis to allow the cable to be brought forward for hauling a vehicle in front without touching any of the mechanism. A differential lock is fitted; there are two water-cooled brakes on the jackshaft and on the rear wheels. The jackshaft brakes are operated together by pedal through a balance lever, but have a special mechanism by which they can be applied separately when going round sharp mountain turns. The chain cases are a stout casting, with sheet metal facing, having the radius rods combined with them and capable of taking the weight of the vehicle if the road wheels sink in soft ground.

All shackle pins are of big diameter and are bronze bushed. The rear spring shackles have a big oil reservoir cast with them, so that lubricant is automatically fed to the shackle pins. Spring clips are not often used on Italian trucks. Instead, the springs have a groove down their full length, to prevent them splaying sideways, and are assembled by being forced into a forged box, which is bolted to the spring seating on the axles. This does away with the center bolt and by rea-



A group of products of the Italian motor truck factories which are designed especially for use by the Italian army and comprising motor trucks, tractors for hauling heavy guns and special constructions for searchlight work. Note the camparatively short wheelbases of the vehicles and their simple but substantial construction, rendering them eminently suitable for field work of the roughest sort. Some of the chassis details are illustrated on pages 62 and 63

Top—Itala army type 3-ton truck

Upper Middle—Fiat military tractor used in the Alps for hauling heavy guns. Note flexible band for attaching to rear wheels. Goodrich band tires are used in front

Lower Middle—Fiat automobile searchlight for Italian army

Bottom—Diatto 3-ton truck for Italian army son of the bigger surface holds the leaves together more effectively than a single bolt. Scat has extended this idea to touring cars by putting the springs through the axle.

Can Be Caterpillar at Will

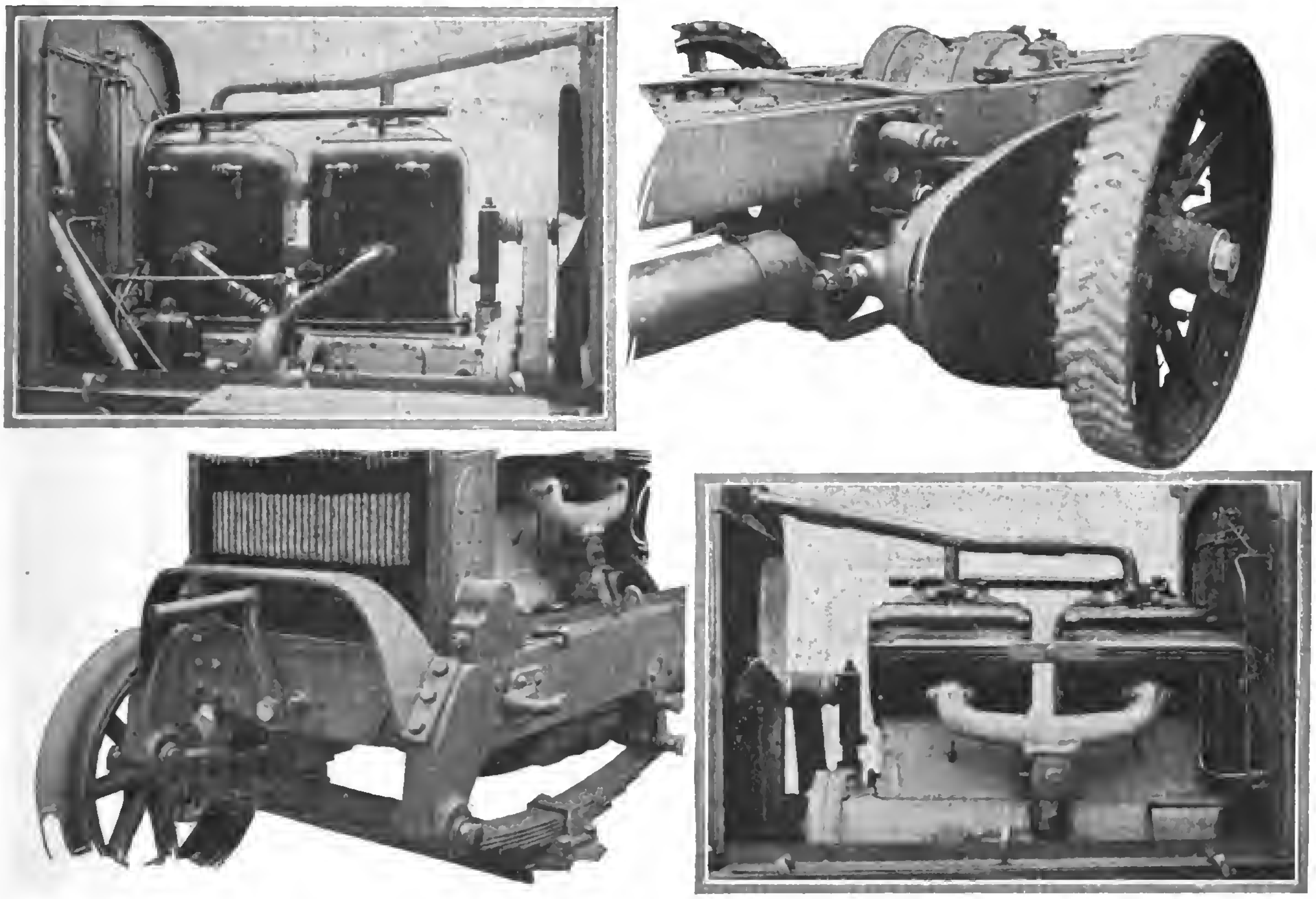
One of the patented features of the Fiat tractor is the caterpillar band attached to the driving wheels. When working under normal conditions, these bands are carried on a kind of platform forming a rear wheel fender. There are projecting studs from the inner face of the rear wheels, by means of which the bands are attached to the wheels. By means of these bands the tractor is able to operate across

Although similar in external appearance to the touring car type, the truck motor differs by reason of the external exhaust manifold, cast iron instead of aluminum for crankchamber, and the lower number of revolutions at which it is designed to run. Transmission is through four-speed gearbox to jackshaft, with double water-cooled brakes mounted on it, and final drive by inclosed side chains.

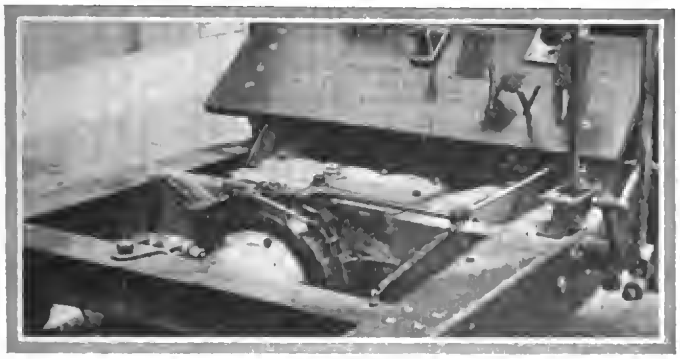
Many Special Army Trucks

A large number of special vehicles for military operations are being produced by the Italian factories. Fiat is build-

Above—Motor of Scat 2-ton army truck. Note cylinder casting does not have separate water header. Middle—Scat 3-ton truck army type. Right—Aluminum dash used on the Scat truck. Note corrugated steering wheel



Four views of the Fiat army tractor, showing some of its constructional features. Upper left—Motor of 5.1 by 7.8-in. bore and stroke. Note position of water pump and inlet pipes. Upper right—Rear of chassis. Note cast-steel wheels, which set across frame and spring shackle, forming oil reservoir. Lower left—Radiator is mounted in trunnions with substantial guard. The starting crank is large enough for three men to take hold at once. Note spring assembly. Lower right—The other side of the motor. Note the neat arrangement of the exhaust manifold



Lancia 2-ton chassis used by the British and Italian armies as an armored car

ing numbers of searchlights carried on a 2-ton chassis using pneumatic tires. The dynamo is mounted over the gearbox and driven by inclosed silent chain. The searchlight, which has a face diameter of 35 in. is mounted on a wire-wheel bogey. It is brought out of the car on rails and can operate several hundred yards from the generating car. A similar type of chassis is employed for wireless telegraphy. The English and French method of carrying gasoline is by means of 2-gal. cans. The Italians are making use of tank wagons, with pump and measuring instrument mounted on the rear end of the tank, this proving a much more economical and satisfactory manner of handling gasoline than the use of cans. Armored cars, generally fitted with two machine guns, are being produced in moderately large quantities for the Italian and other armies.

The armor plating is chrome-nickel steel 5 mm. thick capable of turning a rifle bullet at close range. Practically all these cars have twin pneumatic tires on the rear, with a housing around them brought as low as possible compatible with clearance. In some cases band tires are fitted on the front wheels, without any protection, the wheels being either cast steel or steel disk type. Other special machines are motor workshops, aeroplane tenders and trailers.

Before the war Italy did not possess a great number of automobile drivers, for practically her entire fleet of automobiles consisted of passenger cars. Thus, since the army has put into service several thousands of automobiles and trucks, it has been necessary to train drivers for them, with the result that more or less green men have been in charge of military material. The situation, however, has not been as difficult as in England and France, where there is in addition to the military fleet a very important commercial motor fleet for which drivers are found with difficulty.

When war broke out the Italian military authorities requisitioned practically all private cars. This part of the Italian military organization does not appear to have been managed in a very satisfactory manner. It is declared that the officers alone were judges of the value of a car, with the result that in some cases a fancy price would be paid, and in others the owner would get much less than the real value of his machine. Experience has shown that the best scheme is that in force in France, where the impressment officers have to work to a definite scale, based on the number of cylinders, horsepower, age, type of body, nature of tires, etc. Under this scheme the owner is at a disadvantage if his car has just come out of the factory or has just been completely overhauled, and the state loses if the car has been run as long as possible without extensive repairs.

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear	Location	No. of Cylinders	No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING Water Circulation	COOLING Radiator Core and Case	IGNITION Type	IGNITION Make	IGNITION Spark Advance
Little Giant 15	1,500	1,500	120	p & a	34x4½	34x3½	under hood	4	3	3½x4	19.61	block	right	thermo	fin-sheet	dual	Eisemann	hand
Little Giant H	3,000	1,450	110	solid	37x3½	37x4	under flr	4	3	3½x5¼	19.61	block	right	thermo	fin-sheet	dual	Eisemann	hand
Little Giant 16	4,000	2,500	144	solid	36x4	36x3½d	under hood	4	3	4⅛x5¼	27.20	block	right	thermo	fin-sheet	dual	Eisemann	hand
Lincoln D	1,500	000	122	pneu	33x5	33x5	under hood	4	3	3¾x5	22.50	block	head	thermo	fin-cast	sing	Bosch	fixed
Locomobile B	6,000	3,500	150	solid	36x5	36x5d	under hood	4	6	4¼x6	29.00	pairs	opp	cent	cell-sheet	dual	Bosch	hand
Locomobile BB	8,000	3,650	150	solid	36x5	36x6d	under hood	4	5	4¼x6	29.00	pairs	opp	cent	cell-sheet	dual	Bosch	hand
Lombard	10,000	......	......	steel	40x6	creeper	under hood	4	......	......	......	pairs	......	cent	fin-sheet	dual	......	hand
Maccar K	2,000	2,100	150*	solid	36x4	36x5	under hood	4	3	4⅛x5¼	27.20	block	left	cent	cell-sheet	sing	......	hand
Maccar L	2,000	2,100	150*	solid	36x4	36x5	under hood	4	3	4⅛x5¼	27.20	block	left	cent	cell-sheet	sing	......	hand
Maccar J	4,000	2,600	162*	solid	36x4	36x4d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-sheet	sing	opt	hand
Maccar H	4,000	2,600	162*	solid	36x4	36x4d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-sheet	sing	opt	hand
Maccar O	7,000	3,250	174*	solid	36x5	36x5d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-sheet	sing	opt	hand
Maccar M	7,000	3,250	174*	solid	36x5	36x5d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-sheet	sing	opt	hand
Mack AB	2,000	2,000	144*	solid*	36x4*	36x3½d*	under hood	4	3	4 x5	25.60	pairs	right	cent	cell-sheet	sing	Bosch	fixed
Mack AB	3,000	2,350	144*	solid*	36x4*	36x3½d*	under hood	4	3	4 x5	26.60	pairs	right	cent	cell-sheet	sing	Bosch	fixed
Mack AB	4,000	2,700	144*	solid*	36x4*	36x4d*	under hood	4	3	4 x5	25.60	pairs	right	cent	cell-sheet	sing	Bosch	fixed
Mack AC	7,000	3,400	168*	solid	36x5	40x5d	under hood	4	3	5 x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Mack AC	11,000	4,000	168*	solid	36x5	40x6d	under hood	4	3	6 x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Mack AC	16,000	4,500	180	solid	37x7	41x7d	under hood	4	3	5 x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Mack Tractor AC	30,000	4,000	116½	solid	36x5	40x6d	under hood	4	3	6 x6	40.00	pairs	right	cent	ring-cast	dual	Bosch	hand
Mais C&D	3,000	2,600	132*	solid	36x4	36x5	under hood	4	3	4 x5½	25.60	block	opp	cent	cell-sheet	sing	Eisemann	auto
Mais E&F	4,000	2,800	145*	solid	36x5	36x7	under hood	4	3	4 x5½	25.60	block	opp	cent	cell-sheet	sing	Eisemann	auto
Mais K, L&H	6,000	3,300	132*	solid	36x5	36x5d	under hood	4	......	4 5/16x5½	29.75	block	opp	cent	cell-sheet	sing	Eisemann	auto
Mais M	8,000	3,750	145*	solid	36x6	36x6d	under hood	4	......	4 5/16x5½	29.75	block	opp	cent	cell-sheet	sing	Eisemann	auto
Martin R	2,000	2,050	130	solid	36x3½	36x4	under hood	4	3	4 x5	25.60	block	left	cent	fin-sheet	dual	Bosch	hand
Martin S	4,000	2,160	121	solid	36x3½	40x4	under flr	4	3	4 x5	25.60	block	left	cent	fin-sheet	dual	Bosch	hand
Martin E	6,000	2,800	135	solid	36x4	40x3½d	under flr	4	3	4¼x5	29.00	pairs	opp	cent	fin-sheet	dual	Bosch	hand
Martin L	8,000	3,300	145	solid	36x5	40x4d	under flr	4	3	4¾x5½	36.15	pairs	opp	cent	fin-sheet	dual	Bosch	hand
Menominee E	1,500	1,125	124	solid	34x3½	34x3½	under hood	4	3	3¾x5	22.50	block	right	thermo	fin-sheet	sing	Bosch	hand
Menominee F	2,500	1,576	130*	solid	36x3½	36x5	under hood	4	3	3¾x5¼	22.50	block	left	cent	fin-sheet	sing	Bosch	hand
Menominee D	4,000	2,240	144	solid	36x4	36x6*	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-sheet	sing	Bosch	hand
Mercury P	1,000	650	85	solid	34x2	36x2	under body	2	2	4¼x4	14.60	sing	top	air	none	dual	Remy	2-pt
Mercury..Bulley Tract A	......	3,400	71	solid	3-wheel	......	under hood	4	6	4½x5	32.40	pairs	opp	cent	cell-sheet	......	......	hand
Mercury..Bulley Tractor	......	3,400	71	solid	34x4	......	under hood	4	5	4½x5	32.40	pairs	opp	cent	cell-sheet	......	......	hand
Modern T	2,000	......	132*	solid	36x3	36x4	under hood	4	3	3½x5	19.61	block	right	thermo	fin-cast	sing	Bosch	fixed
Modern N	3,000	......	144*	solid	36x3½	36x5	under hood	4	3	3¾x5	22.60	block	right	cent	fin-cast	sing	Bosch	fixed
Modern R	4,000	......	150*	solid	36x4	36x4d	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-cast	sing	Bosch	fixed
Modern B	7,000	......	176*	solid	38x5	38x5d	under hood	4	3	4¾x6¼	36.15	pairs	right	cent	fin-cast	sing	Eisemann	fixed
Moon B	3,000	1,650	140*	solid	36x3½	36x5	under hood	4	3	3¾x5¼	22.50	block	l & h	cent	sq-t-sheet	dual	Bosch	hand
Moore	5,000	2,500	162½	solid	36x4	36x3½d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-sheet	dual	Splitdorf	hand
Moore	10,000	4,500	175	solid	36x3	42x6d	under hood	4	3	5¼x7	44.20	pairs	opp	cent	fin-sheet	dual	Splitdorf	hand
Moreland	2,000	1,550	126	solid	34x3½	34x4	under hood	4	3	3¾x5	22.50	block	left	thermo	cell-cast	sing	Bosch	hand
Moreland	3,000	1,850	126*	solid	34x3½	34x5	under hood	4	3	4⅛x5¼	27.20	block	right	cent	cell-cast	sing	Bosch	hand
Moreland	5,000	2,400	168*	solid	34x4	34x4d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-cast	sing	Bosch	hand
Moreland	8,000	3,200	186*	solid	36x5	38x5d	under hood	4	3	4¾x6¼	36.16	pairs	left	cent	cell-cast	sing	Bosch	hand
Morton	6,000	......	112	solid	40x6	40x6	btw seats	4	3	4¾x6¼	36.15	pairs	left	cent	cell-sheet	dual	Dixie	hand
Nelson & LeMoon E1	2,000	1,700	opt	solid	36x3	36x4	under hood	4	3	3¾x5¼	22.50	block	left	cent	sq-t-sheet	sing	Bosch	......
Nelson & LeMoon E2	4,000	2,250	opt	solid	36x4	36x7	under hood	4	3	4⅛x5¼	27.20	block	left	cent	sq-t-sheet	dual	Bosch	......
Nelson & LeMoon E3	6,000	2,950	opt	solid	36x5	38x5d	under hood	4	3	4½x5½	32.40	pairs	left	cent	sq-t-sheet	dual	Bosch	auto
Netco C	3,000	2,250	144*	solid	36x3½	36x5	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-cast	sing	Eisemann	fixed
Netco D	4,000	2,350	144*	solid	36x4	36x6	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-cast	sing	Eisemann	fixed
New York L	3,000	1,800	129*	solid	36x3½	36x5	under hood	4	3	3¾x5¼	22.50	block	left	cent	sq-t-sheet	sing	Bosch	fixed
Old Reliable	3,000	1,950	138*	solid	34x3½	36x6	under hood	4	3	3¾x5	22.50	block	left	cent	fin-sheet	sing	Bosch	hand
Old Reliable	4,000	2,760	120*	solid	34x4	36x4d	under flr	4	3	4¼x5	29.00	pairs	opp	cent	fin-sheet	sing	Bosch	hand
Old Reliable	8,000	3,760	126*	solid	36x5	36x5d	under flr	4	3	4¾x5½	36.15	pairs	opp	cent	fin-sheet	sing	Bosch	hand
Old Reliable	10,000	4,250	126*	solid	36x6	36x6d	under flr	4	3	4¾x5½	36.15	pairs	opp	cent	fin-sheet	sing	Bosch	hand
Old Reliable	12,000	4,500	126*	solid	36x6	40x7d	under flr	4	3	4¾x6¼	36.15	pairs	left	cent	fin-sheet	sing	Bosch	hand
Overland 83	800	750-c	106	pneu	33x4	33x4	under hood	4	5	4⅛x4½	27.20	sing	left	thermo	cell-sheet	sing	Splitdorf	hand
Packard 1D	2,000	2,200	126*	solid	34x3½	34x6	under hood	4	4	4 x5½	25.60	block	right	cent	cell-sheet	dual	Dixie	hand
Packard 1½D	3,000	2,500	126*	solid	34x3½	34x3½d	under hood	4	4	4 x5½	25.60	block	right	cent	cell-sheet	dual	Dixie	hand
Packard 2D	4,000	2,800	144*	solid	34x4	34x4d	under hood	4	4	4 x5½	25.60	block	right	cent	cell-sheet	dual	Dixie	hand
Packard 3D	6,000	3,400	156*	solid	36x5	36x5d	under hood	4	4	4½x5½	32.40	block	right	cent	cell-sheet	dual	Dixie	hand
Packard 4D	8,000	3,800	156*	solid	36x5	40x5d	under hood	4	4	4½x5½	32.40	block	right	cent	cell-sheet	dual	Dixie	hand
Palmer	2,000	1,350	115½	pneu*	35x4½*	35x4½*	under hood	4	3	3¾x5	22.50	block	right	thermo	cell-cast	sing	Bosch	fixed
Palmer	4,000	1,975	144	solid	36x3½	36x3½d	under hood	4	3	4⅛x5½	27.20	block	left	cent	cell-cast	sing	Bosch	fixed
Palmer-Moore K	1,500	1,150	106	solid*	36x3*	36x3½*	under hood	4	3	3½x5¼	19.61	block	r & h	thermo	fin-cast	sing	Bosch	auto
Palmer-Moore M	2,000	1,350	126	solid*	36x3½*	36x4*	under hood	4	3	3¾x5¼	22.60	block	r & h	thermo	fin-cast	sing	Bosch	auto
Paulding D1	1,500	976	120*	solid	36x3	36x3	under hood	4	3	3¼x5	16.92	block	right	thermo	z-z-t-sheet	dual	Kingston	hand
Paulding G-G1	2,000	1,300	120*	solid	36x3½	36x4	under hood	4	3	4 x5	25.60	block	right	thermo	z-z-t-sheet	dual	Kingston	hand
Paulding E-E1	3,000	1,600	130*	solid	36x4	36x5	under hood	4	4	4 x6	25.60	block	right	thermo	z-z-t-sheet	dual	Kingston	hand
Paulding H-H1	4,000	1,950	160*	solid	36x4	36x4d	under hood	4	4	4¼x6	29.00	block	right	thermo	z-z-t-sheet	dual	Kingston	hand

ABBREVIATIONS: General, *, *with other option;* opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind, Pneu,** *pneumatic;* Cush, *cushion;* p&s, *pneumatic in front and solid in rear;* s & st, *solid in front and steel in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** btw seats, *between seats;* under flr, *under floor.* **Cylinders Cast,** sing, *singly or individually.* **Location of Valves,** opp, *opposite or T-head type;* top (two-cylinder motors only), *L-head cylinder laid horizontal with valves up;* r & h, *at right and in head, L-head cylinder;* l & h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle Motor, no valves.* **Water Circulation,** cent, *centrifugal pump;* gear, *gear pump;* thermo, *thermo-syphon circulation;* air, *air-cooled, no water.* **Radiator Type and Case,** fin-sheet, *finned-tube core with sheet metal casing;* fin-cast, *finned-tube core with cast aluminum casing;* sq-t-sheet, *square tube or flat tube core with sheet metal casing;* sq-t-cast, *square tube core with cast aluminum casing;* cell-sheet, *cellular or honeycomb core with sheet metal casing;* cell-cast, *cellular core with cast aluminum casing;* z-z-t-sheet, *zig-zag tube core with sheet metal casing;* z-z-t-cast, *zig-zag tube core with cast aluminum casing;* ring-cast, *copper tube core arranged in a ring about a centrifugal fan with a cast aluminum casing.* **Ignition, Type,** sing, *single;* doub, *double.* **Make of Magneto** (or other sparking device), Atw. Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* auto-h, *automatic advance with hand adjustment;* 2-pt, *two-point fixed, battery circuit fixed in retard magneto in advance*

line Commercial Vehicles for 1916

Chassis Produced by 150 American Manufacturers, with mission, Control and Equipment

MOTOR						TRANSMISSION								SPRINGS		CONTROL		
GOVERNOR		SPEED					GEARSET											
Type	Drive	Motor in r.p.m	Truck in m.p.h.	Carbureter Make	Lubrication	Clutch Type	Type	Location	Speeds	Total Gear Reduction in High	Final Drive	Torque Taken By	Propulsion Taken By	Front	Rear	Steer	Levers	Name and Mode
none	none			Schebler	circ-spl	none	elec	amid	2	28.00 -1	int-g-f	rad-rd	rad-rd	½-ell	½-ell	right	right	A & B
none	none			Schebler	circ-spl	none	elec	amid	2	28.00 -1	int-g-f	rad-rd	rad-rd	½-ell	½-ell	right	right	A & B
cent	motor	1,200	17	Rayfield	spl-press	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Acme
cent	motor	2,200	25	Zenith	circ-spl	dry-d	selec	unit-j	3	7.45 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Adams A
cent	motor	2,200	20	Zenith	circ-spl	dry-d	selec	unit-j	3	7.45 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Adams D
cent	motor	2,200	18	Zenith	circ-spl	dry-d	selec	unit-j	3	8.40 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Adams E
none	none	1,600	16	Schebler	circ-spl	dry-d	selec	unit-m	3	8.00 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Armleder HC
none	none	1,600	16	Schebler	circ-spl	dry-d	selec	unit-m	3	8.00 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Armleder HW
none	none	1,600	14	Schebler	circ-spl	dry-d	selec	unit-m	3	9.00 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Armleder EC
none	none	1,500	13	Schebler	circ-spl	dry-d	selec	unit-m	3	8.75 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Armleder HW
cent	motor	1,200	16½	Zenith	circ-spl	dry-d	selec	unit-m	4	7.75 -1	top worm	springs	springs	½-ell	½-ell	right	right	Atterbury 6B
cent	motor	1,200	15½	Zenith	circ-spl	dry-d	selec	unit-m	4	8.50 -1	top worm	springs	springs	½-ell	½-ell	right	right	Atterbury 6C
cent	motor	1,125	13	Zenith	circ-spl	dry-d	selec	unit-m	4	10.30 -1	top worm	springs	springs	½-ell	½-ell	right	right	Atterbury 6D
none	none	1,800	25	Stromberg	splash	dry-p	prog	amid	3	7.10 -1	doub-red	springs	springs	½-ell	plat	right	right	Autocar 21F
cent	motor	1,200	18	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.00 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Available
cent	motor	1,200	15	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Available
cent	motor	1,200	14	Stromberg	circ-spl	dry-d	selec	unit-m	3	10.33 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Available
cent	motor	1,200	15	Rayfield	spl-press	dry-d	selec	unit-m	3	7.75 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Avery C
l-b	motor	1,200	14½	Rayfield	spl-press	dry-d	selec	unit-j	3	3.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Avery B
cent	motor	1,200	13	Rayfield	spl-press	dry-p	selec	unit-j	3	3.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Avery B
cent	motor	1,200	12	Rayfield	spl-press	dry-d	selec	unit-j	3	3.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Avery A
cent	motor	1,000	10	Schebler	spl-press	wet-d	selec	unit-j	3	12.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Avery B
none	none	1,500	27	Stromberg	spl-press	dry-p	selec	unit-m	4		top worm	springs	springs	½-ell	½-ell	left	cent	Barker U
none	none	1,500	20	Stromberg	spl-press	dry-p	selec	unit-m	4		top worm	springs	springs	½-ell	½-ell	left	cent	Barker V
none	none	1,500	25	Bauer	circ-spl	wet-d	selec	unit-m	3		doub-red	tor-arm	tor-arm	½-ell	ellip	left	cent	Bauer A
none	none	1,500	25	Bauer	circ-spl	wet-d	selec	unit-m	3		doub-red	tor-arm	tor-arm	½-ell	ellip	left	cent	Bauer B
none	none		21	Rayfield	circ-spl	dry-d	selec	unit-m	3	6.50 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Bessemer G
cent	motor	1,140	16½	Rayfield	circ-spl	cone	selec	amid	3	7.20 -1	dbl chn		rad-rd	½-ell	plat	left	cent	Bessemer A
cent	motor	1,140	15	Rayfield	circ-spl	cone	selec	amid	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Bessemer D
cent	motor	1,090	12	Rayfield	circ-spl	cone	selec	amid	3	10.33 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Bessemer E
cent	motor	1,100	15	Schebler	circ-spl	cone	ind-c	amid	3	7.67 -1	top worm	sub-f	sub-f	½-ell	½-ell	right	right	Blair 2C
cent	motor	1,100	14	Schebler	circ-spl	cone	ind-c	amid	3	8.67 -1	top worm	sub-f	sub-f	½-ell	½-ell	right	right	Blair 2D
cent	motor	1,000	12	Schebler	circ-spl	cone	ind-c	amid	3	9.33 -1	top worm	sub-f	sub-f	½-ell	½-ell	right	right	Blair 2E
cent	motor	1,100	10	Schebler	circ-spl	cone	ind-c	amid	3	12.00 -1	top worm	sub-f	sub-f	½-ell	½-ell	right	right	Blair 2F
elec		1,200	18	Schebler	circ-spl	wet-d	selec	unit-m	3	6.00 -1	int-g-4	tor-arm	tor-arm	½-ell	¾-ell	left	cent	Bellstrom A
none	none	1,500	30	Carter	circ-spl	none	fric	unit-j	3	4.00 -1	dbl chn		rad-rd	½-ell	½-ell	left	left	Brasie Packet
none	none	1,200	20	Stromberg	circ-spl	dry-d	selec	unit-m	3	6.20 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Brinton H
cent	motor	1,200	35	Stromberg	circ-spl	dry-d	selec	unit-m	3	8.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Brinton F
suct	motor	1,300	15	Schebler	circ-spl	cone	selec	unit-j	3	8.25 -1	dbl chn		rad-rd	½-ell	plat	left	cent	Brockway H
suct	motor	1,300	15	Schebler	circ-spl	dry-d	selec	unit-m	3	8.67 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Brockway J
suct	motor	1,300	15	Schebler	circ-spl	cone	selec	unit-j	3	8.25 -1	dbl chn		rad-rd	½-ell	plat	left	cent	Brockway I
suct	motor	1,300	15	Schebler	circ-spl	dry-d	selec	unit-m	3	8.67 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Brockway K
none	none	1,750	30	Marvel	circ-spl	cone	selec	unit-m	3	6.00 -1	bevel	tor-t	tor-t	½-ell	ellip	left	cent	Buick D4
		1,200	15	Zenith	spl-press	cone	selec	unit-m	3	8.50 -1	int-gear	springs	springs	½-ell	½-ell	right	cent	Burford O
		1,000	13	Zenith	spl-press	dry-d	selec	amid	4	8.75 -1	top worm	springs	rad-rd	½-ell	½-ell	right	right	Burford D
suct	motor	1,200	20	Holley	spl-press	dry-p	selec	unit-m	3	6.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Chase A
cent	motor	1,200	18	Holley	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Chase R
cent	motor	1,200	14	Holley	circ-spl	dry-d	selec	unit-m	4	9.25 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Chase O
cent	motor	1,000	15	Schebler	pressure	dry-p	selec	unit-m	3		top worm	springs	springs	ellip	½-ell	right	right	Coleman J
cent	motor	1,000	12	Schebler	pressure	cone	selec	unit-j	3		dbl chn		rad-rd	ellip	plat	right	right	Coleman H
none	none		30	Breeze	circ-spl	cone	selec	unit-m	3	6.00 -1	bevel	tor-arm	springs	½-ell	½-ell	left	cent	Commerce N
cent	motor	1,150	12	Stromberg	pressure	none	elec	unit-m	2		int-g-4	springs	rad-rd	½-ell	½-ell	left	cent	C.T.
cent	motor	1,350	10	Stromberg	pressure	none	elec	unit-m	2		int-g-4	springs	rad-rd	½-ell	½-ell	left	cent	C.T.
cent	motor	1,350	10	Stromberg	pressure	none	elec	unit-m	2		int-g-4	springs	rad-rd	½-ell	½-ell	left	cent	C.T. Tractor
suct	motor			Stromberg	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Continental (C) FL
suct	motor			Stromberg	circ-spl	dry-d	selec	unit-m	3	9.25 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Continental (C) HL
suct	motor			Stromberg	circ-spl	dry-d	selec	unit-m	3	9.25 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Continental (C) J
suct	motor		18	Stromberg	circ-spl	dry-d	selec	unit-m	3	10.50 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Continental (C) M
cent	motor	1,100	16	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Corbitt B
cent	motor	1,100	15	Stromberg	circ-spl	dry-d	selec	unit-m	3	8.67 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Corbitt A

ABBREVIATIONS: (continued). **Governor Type,** cent, *centrifugal;* l-b, *loose-ball;* suct, *suction;* hyd, *hydraulic;* elec, *electric.* **Governor Drive,** motor, *from motor;* d-shaft, *from driving shaft;* f-wheel, *from front wheel;* duplex, *from both the motor and driving shaft by overrunning clutches.* **Lubrication,** splash, *non-circulating or simple splash;* circ-spl, *circulating splash;* spl-press, *splash-pressure;* fuel-inj, *fuel injection, oil mixed with fuel;* pressure, *pressure feed, no splash.* **Clutch Type,** dry-p, *dry plate;* dry-d, *dry multiple disk;* wet-d, *wet disk or disk-in-oil;* wet-p, *wet plate or plate-in-oil;* r-cone, *reversed cone or inverted cone;* cont-b, *contracting band;* exp-s, *expanding shoe.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh, individual-clutch;* fric, *friction;* elec, *electric.* **Gearset Location,** amid, *amidships;* unit-m, *unit with motor;* unit-j, *unit with jackshaft;* unit-x, *unit with axle.* **Gearset Speeds,** inf, *infinite number.* **Final Drive,** int-g, int-gear, *internal-gear;* sing chn, *single chain;* dbl chn, *double chain;* doub-red, *double reduction;* spur-g, *spur gears;* sp-bev, *spiral bevel;* f, *front wheel or wheels;* 4, *four-wheel driven.* **Torque Taken By,** rad-rd, *radius rods;* tor-arm, *torque arm;* tor-t, *torsion tube;* sub-f, *sub-frame.* **Propulsion Taken By,** rad-rd, *radius rod;* tor-t, *torsion tube;* tor-arm, *torque arm;* sub-f, *sub-frame.* **Springs,** ellip, *elliptic;* ½-ell, *half elliptic;* ¼-ell, *quarter elliptic;* ¾-ell, *three-quarters elliptic;* plat, *platform;* cant, *cantilever.* **Control Levers,** cent, *center;* c & r, *gearshift center, brake right;* c & l, *gearshift center, brake left.*

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	No. of Cylinders	No. of Crankshaft Bearings	Bore and Stroke	N.A.C.C. Hp.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear								Water Circulation	Radiator Core and Case	Type	Make	Spark Advance
Peerless TC2	4,000	....	145	solid	36x4	36x4d	under hood	4	3	4½x6½	32 40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Peerless TC3	6,000	....	151*	solid	36x4	40x4d	under hood	4	3	4½x6½	32.40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Peerless TC4	8,000	....	151*	solid	36x5	40x5d	under hood	4	3	4½x6½	32 40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Peerless TC5	10,000	....	151*	solid	38x6	42x6d	under hood	4	3	4½x6½	32.40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Peerless TC6	12,000	....	151*	solid	38x7	42x7d	under hood	4	3	4½x6½	32.40	pairs	opp	gear	fin-sheet	dual	Remy	hand
Pierce-Arrow	4,000	3,000	150*	solid	36x4	36x4d	under hood	4	....	4 x5½	25.60	pairs	opp	cent	fin-cast	dual	Bosch	hand
Pierce-Arrow	10,000	4,500	168*	solid	36x5	40x6d	under hood	4	....	4⅞x6	38.25	pairs	opp	cent	fin-cast	dual	Bosch	hand
Reo F	1,500	1,000	120	pneu	34x4½	34x4½	under hood	4	3	4⅛x4½	27.20	pairs	r & h	cent	fin-sheet	sing	Remy	hand
Reo J	4,000	1,650	146	solid	36x4	36x3½d	under hood	4	3	4⅛x4½	27.20	pairs	r & h	cent	fin-cast	dual	National	hand
Republic F	1,500	995-c	124	solid*	34x3*	34x3½*	under hood	4	3	3½x5	19.61	block	right	thermo	fin-sheet	sing	Bosch	fixed
Republic E	2,000	1,275	144	solid*	34x3*	34x4*	under hood	4	3	3¾x5	22.50	block	right	thermo	fin-sheet	sing	Bosch	fixed
Republic A	4,000	1,475	144	solid	34x4	34x6*	under hood	4	3	4⅛x5¼	27.20	block	right	cent	fin-sheet	sing	Bosch	fixed
Republic T	6,000	2,400	165*	solid	36x5	36x5d	under hood	4	3	4¼x5½	29.00	block	right	cent	fin-sheet	sing	Bosch	hand
Rowe CW	2,000	2,450	130	solid	34x3½	34x4	under hood	4	3	3¼x5	16.92	block	left	cent	sq-t-sheet	sing	Bosch	hand
Rowe CDW	4,000	2,800	144	solid	34x4	36x3½d	....	4	3	4 x5	25 62	block	left	cent	sq-t-sheet	sing	Bosch	....
Rowe DFW	6,000	3,400	156	solid	36x5	36x5d	under hood	4	3	4¼x5	29 00	pairs	opp	cent	sq-t-sheet	sing	Bosch	....
Rowe TW	10,000	4,500	156	solid	36x6	40x6d	under hood	4	3	4¾x5½	36 15	pairs	opp	cent	sq t-sheet	sing	Bosch	hand
Royal A	7,000	3,500	148	solid	36x5	38x5d	under hood	4	3	4¼x5	29.00	pairs	opp	cent	fin-cast	dual	Bosch	fixed
Royal A	10,000	4,500	138*	solid	36x6	40x6d	under hood *	4	3	4¾x5½	36 15	pairs	opp	cent	fin-cast	dual	Bosch	fixed
Royal A	12,000	4,800	140	solid	36x6	40x6d	under seats	4	3	5 1/16x5½	41.61	pairs	opp	cent	fin-cast	dual	Bosch	fixed
R-S	350	305	65	pneu	28x3	28x3	amid	2	2	3⅜x3½	9.12	sing	back	air	none	sing	Bosch	hand
Salvador	4,000	2,000	124*	cush	36x4½	36x6	btw seats	4	3	4 x4½	25.60	pairs	left	cent	cell-cast	sing	Eisemann	auto
Sandow	3,000	1,800	150*	solid	36x3	36x4	under hood	4	3	3¾x5¼	22.50	block	left	cent	cell-sheet	sing	Bosch	hand
Sandow	4,000	2,350	171*	solid	36x4	36x4d	under hood	4	3	4⅛x5¼	27 20	block	left	cent	cell-sheet	sing	Bosch	hand
Sandow	4,000	2,000	171*	solid	36x4	36x4d	under hood	4	3	4⅛x5½	27 20	block	left	cent	cell-sheet	sing	Bosch	hand
Sandow	6,000	3,000	186*	solid	36x5	36x5d	under hood	4	3	4½x5½	32 40	pairs	left	cent	cell-sheet	sing	Bosch	hand
Sandow	6,000	2,500	186*	solid	36x5	40x5d	under hood	4	3	4½x5½	32.40	pairs	left	cent	cell-sheet	sing	Bosch	hand
Sanford O	1,500	1,290	120	pneu*	34x4½*	35x5*	under hood	4	3	3½x5¼	19.61	block	right	cent	fin-cast	sing	Splitdorf	fixed
Sanford P	2,000	1,350	138	pneu*	34x4½*	35x5*	under hood	4	3	3½x5¼	19 61	block	right	cent	fin-cast	sing	Splitdorf	fixed
Sanford M	4,000	1,910	140	solid	36x4	36x6	under hood	4	3	4 x4¾	25.60	pairs	right	cent	fin-cast	sing	Splitdorf	2-pt
Saurer	10,000	4,800	153½	solid	36x5	42x5d	under hood	4	3	4⅜x5½	30.65	pairs	opp	cent	cell-sheet	sing	Bosch	hand
Saurer	13,000	5,800	156½	solid	36x5	42x6d	under hood	4	3	4⅜x5½	30.65	pairs	opp	cent	cell-sheet	sing	Bosch	hand
Saxon	400	395	96	pneu	28x3	28x3	under hood	4	2	2¾x4	12.08	block	left	thermo	cell-sheet	sing	Atw. Kent	auto
Selden T	2,000	1,700	126½*	solid	34x3	34x3d	under hood	4	3	3½x5	19 61	block	left	thermo	sq-t-sheet	sing	Bosch	fixed
Selden JC	4,000	2,000	150	solid	36x4	36x4d	under hood	4	3	3¾x5¼	22 50	block	right	cent	sq-t-sheet	sing	Bosch	fixed
Selden JWL	4,000	2,250	150*	solid	36x4	36x4d*	under hood	4	3	4⅛x5	27 20	block	right	cent	sq-t-sheet	sing	Bosch	fixed
Selden N	7,000	2,950	164	solid	36x5	36x5d	under hood	4	3	4½x5½	32 40	pairs	left	cent	sq-t-sheet	sing	Eisemann	fixed
Service 120	2,000	1,375	135	solid	34x3	34x4	under hood	4	3	3½x5¼	19 61	block	right	thermo	fin-sheet	sing	Bosch	hand
Service QW	3,000	2,200	150	solid	36x3½	36x5	under hood	4	3	4⅛x5¼	27 20	block	right	cent	fin-sheet	sing	Eisemann	hand
Service PW	4,000	2,500	160*	solid	36x4	36x4d	under hood	4	3	4⅛x5¼	27 20	block	right	cent	fin-sheet	sing	Eisemann	hand
Service HW	7,000	3,000	171*	solid	36x5	36x5d	under hood	4	3	4½x6	32 40	block	right	cent	fin-cast	dual	Eisemann	hand
Service HX	10,000	4,000	171*	solid	36x6	40x6d	under hood	4	3	4¾x6½	36.15	pairs	left	cent	cell-sheet	dual	Eisemann	hand
Signal F	2,000	1,550	144*	solid	34x3	36x4	under hood	4	3	3¾x5¼	22 50	block	left	cent	fin-cast	sing	Eisemann	fixed
Signal H	3,000	1,750	144*	solid	34x3½	36x5	under hood	4	3	3¾x5½	22 50	block	left	cent	fin-cast	sing	Eisemann	fixed
Signal J	4,000	2,100	150	solid	34x4	36x4d	under hood	4	3	4⅛x5½	27 20	block	left	cent	fin-cast	sing	Eisemann	fixed
Signal M	7,000	3,000	168*	solid	40x5	40x5d	under hood	4	3	4½x5½	32 40	pairs	left	cent	fin-cast	sing	Eisemann	fixed
South Bend 30	1,500	1,475	128*	pneu	34x4½	34x4½	under hood	4	3	3¾x5	22 50	block	left	thermo	cell-sheet	dual	Bosch	hand
South Bend 40	3,000	1,750	130*	solid	36x3½	36x5	under hood	4	3	4 x5	25 60	block	left	cent	cell-sheet	dual	Bosch	hand
South Bend 40-2	4,000	2,000	142	solid	36x4	36x3½d	under hood	4	3	4 x5	25 60	block	left	cent	cell-sheet	dual	Bosch	hand
South Bend 60	7,000	3,250	160*	solid	36x6	36x5d	under hood	4	3	4¾x5½	36.15	pairs	opp	cent	cell-sheet	dual	Bosch	hand
Standard 70	4,000	2,000	140	solid	36x4	36x6	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-sheet	sing	Eisemann	auto
Standard 60	7,000	2,850	144*	solid	36x5	36x5d	under hood	4	3	4½x5½	32 40	pairs	left	cent	fin-sheet	sing	Eisemann	auto
Standard 40	8,000	3,025	144*	solid	36x5	36x5d	under hood	4	3	4½x5½	32 40	pairs	left	cent	fin-sheet	sing	Eisemann	auto
Standard 50	10,000	3,400	144*	solid	36x5	40x6d	under hood	4	3	4¼x5½	29.00	pairs	left	cent	fin-sheet	sing	Eisemann	auto
Standard Tractor B	12,000	3,250	72	solid	36x5	36x5d	btw seats	4	3	4¾x6¾	36 15	pairs	left	cent	sq-t-sheet	dual	Bosch	hand
Standard Tractor D	20,000	4,000	76	solid	36x5	40x6d	btw seats	4	3	4¾x6¾	36.15	pairs	left	cent	sq-t-sheet	dual	Bosch	hand
Stearns	10,000	3,800	144*	solid	34x5	38x5d	under hood	4	5	4¼x5½	29.00	pairs	sleeve	cent	cell-sheet	dual	Bosch	hand
Stegeman	3,000	1,900	150	solid	34x3½	36x5	under hood	4	3	4⅛x5¼	27 20	block	....	cent	sq-t-sheet	sing	Eisemann	auto
Stegeman	5,000	2,500	144*	solid	34x4	36x4d	under hood	4	3	4⅛x5¼	27 20	block	left	cent	sq-t-sheet	sing	Eisemann	auto
Stegeman Special	5,000	2,500	142*	solid	40x4	40x6	under hood	4	3	4⅛x5¼	27 20	block	left	cent	sq-t-sheet	sing	Eisemann	auto
Stegeman	7,000	....	156	solid	36x4	40x5d	under hood	6	....	3¾x5¼	33.75	threes	left	cent	—cast	sing	Eisemann	auto
Sterling	1,500	895	127	pneu	34x4	34x4	under hood	4	2	3⅛x4½	15 64	block	right	thermo	fin-cast	sing	Bosch	hand
Sterling	4,000	2,800	148*	solid	36x4	36x4d	under hood	4	3	4 x5¾	25 60	pairs	right	cent	fin-cast	sing	Eisemann	auto
Sterling	7,000	3,400	158*	solid	36x4	36x5d	under hood	4	3	4¼x5¾	29 00	pairs	right	cent	fin-cast	sing	Eisemann	auto
Sterling	10,000	4,500	178	solid	36x6	40x6d	under hood	4	3	4½x6¾	32 40	pairs	right	cent	fin-cast	dual	Eisemann	auto
Sterling	10,000	4,500	178	solid	36x6	40x6d	under hood	4	3	4½x6¾	32 40	pairs	right	cent	fin-cast	dual	Eisemann	auto
Sterling	14,000	4,750	178	solid	36x6	40x7d	under hood	4	3	4¾x6¾	36.15	pairs	right	cent	fin-cast	dual	Eisemann	auto
Stewart (B) 3	1,500	....	118*	pneu	34x4½	34x4½	under hood	4	3	3½x5¼	19.61	block	right	thermo	cell-sheet	sing	Bosch	fixed
Stewart (B) 4	2,500	....	128	solid	35x3½	35x4	under hood	4	3	3½x5¼	19.61	block	right	thermo	cell-sheet	sing	Bosch	fixed
Stewart (C) A	2,000	700	96	solid	36x3	36x3	under flr	2	2	5 x5½	20.00	sing	....	cent	cell-sheet	dual	Kingston	hand
Studebaker SF	1,000	785	112	pneu	34x4	34x4	under hood	4	3	3⅞x5	24.22	block	left	cent	fin-sheet	sing	battery	hand
Studebaker 7	2,000	....	125	pneu	35x5	35x5	under hood	4	3	3⅞x5	24.22	block	left	cent	fin-sheet	sing	battery	hand

ABBREVIATIONS: General, *, *with other options*; opt, *optional*. Price, -c, *complete with body*. Tires, Kind, Pneu, *pneumatic*; Cush, *cushion*; p&s, *pneumatic in front and solid in rear*; s & st, *solid in front and steel in rear*. Tire Sizes, d, *dual*. Motor Location, btw seats, *between seats*; under flr, *under floor*. Cylinders Cast, sing, *singly or individually*. Location of Valves, opp, *opposite or T-head type*; top (two cylinder motors only), *L-head cylinder laid horizontal with valves up*; r & h, *at right and in head, L-head cylinder*; l & h, *at left and in head, L-head cylinder*; 2-cyc, *two cycle motor, no valve*. Water Circulation, cent, *centrifugal pump*; gear, *gear pump*; thermo, *thermo-syphon circulation*; air, *air-cooled, no water*. Radiator Type and Case, fin-sheet, *finned-tube core with sheet metal casing*; fin-cast, *finned-tube core with cast aluminum casing*; sq-t-sheet, *square tube or flat tube core with sheet metal casing*; sq-t-cast, *square tube core with cast aluminum casing*; cell-sheet, *cellular or honeycomb core with sheet metal casing*; cell-cast, *cellular core with cast aluminum casing*; z-z-t-sheet, *zig-zag tube core with sheet metal casing*; z-z-t-cast, *zig-zag tube core with cast aluminum casing*; ring-cast, *copper tube core arranged in a ring about a centrifugal fan with a cast aluminum casing*. Ignition, Type, sing, *single*; doub, *double*. Make of Magneto (or other sparking device), Atw. Kent, *Atwater Kent*. Spark Advance, auto, *automatic*; auto-h, *automatic advance with hand adjustment*; 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.*

Commercial Vehicles for 1916—Continued

MOTOR						TRANSMISSION								SPRINGS		CONTROL		Name and Model
GOVERNOR		SPEED		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear Reduction in High	Final Drive	Torque Taken By	Propulsion Taken By	Front	Rear	Steer	Levers	
Type	Drive	Motor in r.p.m.	Truck in m.p.h.				Type	Location	Speeds									
cent	motor			Stromberg	splash	cone	selec	amid	3	6.00 -1	top worm	springs	springs	½-ell	½-ell	right	right	Peerless TC2
cent	motor	925	14½	Stromberg	splash	cone	selec	unit-j	4	7.45 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Peerless TC3
cent	motor			Stromberg	splash	cone	selec	unit-j	4	8.70 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Peerless TC4
cent	motor			Stromberg	splash	cone	selec	unit-j	4	10.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Peerless TC5
cent	motor			Stromberg	splash	cone	selec	unit-j	4	10.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Peerless TC6
cent	motor	1,050	16	Pierce-A.	pressure	cone	selec	unit-m	3	7.00 -1	top worm	tor-arm	rad-rd	½-ell	½-ell	right	right	Pierce-Arrow
cent	motor	950	14	Pierce-A.	pressure	cone	selec	amid	3	7.80 -1	top worm	tor-arm	rad-rd	½-ell	½-ell	right	right	Pierce-Arrow
none	none		22	Johnson	circ-spl	dry-d	selec	amid	3	4.00 -1	bevel	tor-arm	springs	½-ell	½-ell	left	cent	Reo F
hyd	motor	1,200	15	Johnson	circ-spl	dry-d	selec	amid	3	8.70 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Reo J
suct	motor	1,200	18	Stromberg	spl-press	dry-d	selec	unit-m	3	7.00 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Republic P
suct	motor	1,000	15	Stromberg	spl-press	dry-d	selec	unit-m	3	7.00 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Republic E
suct	motor	1,100	13	Stromberg	spl-press	dry-d	selec	unit-m	3	9.00 -1	int-gear	springs	springs	½-ell	½-ell	left		Republic A
		1,100	11	Stromberg	spl-press	dry-d	selec	unit-m	4	11.00 -1	int-gear	springs	springs	½-ell	½-ell	left		Republic T
cent	motor	1,200				dry-d	selec	unit-m	4		top worm	springs	springs	½-ell	½-ell	left	cent	Rowe CW
cent	motor	1,100		Rayfield	pressure	dry-d	selec	unit-m	4		top worm	springs	springs	½-ell	½-ell	left	c & l	Rowe CDW
cent	motor	1,000		Rayfield	pressure		selec	amid	4		top worm	springs	rad-rd	½-ell	½-ell	left	cent	Rowe DFW
cent	motor				pressure	wet-d	selec	amid			top worm	springs	rad-rd	½-ell	½-ell	left	cent	Rowe TW
suct	motor	900	15	Stromberg	pressure	wet-d	ind-c	amid	3		top worm	springs	springs	½-ell	½-ell	right	right	Royal A
suct	motor	900	12	Stromberg	pressure	wet-d	ind-c	amid*	3		top worm*	springs	springs*	½-ell	½-ell	right	right	Royal A
suct	motor	900	10	Stromberg	pressure	wet-d	ind-c	unit-j	3		dbl chn		rad-rd	½-ell	½-ell	right	right	Royal A
none	none	3,200	35	Schebler	splash	wet-d	prog	amid	3	11.32 -1	sing chn		sub-f	½-ell	ellip	cent	cent	R-S
cent	d-shaft	1,200	16	Zenith	pressure	wet-d	selec	unit-m	3	7.00 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Salvador
suct	motor	1,000	20	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Sandow
suct	motor	1,000	18	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Sandow
suct	motor	1,000	18	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Sandow
suct	motor	1,000	12	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Sandow
suct	motor	1,000	12	Stromberg	circ-spl	dry-d	selec	unit-m	3	9.45 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Sandow
none	none	1,500	18	Schebler	circ-spl	dry-d	selec	unit-m	3	6.83 -1	int-gear	springs	springs	½-ell	½-ell	left		Sanford O
none	none	1,500	18	Schebler	circ-spl	dry-d	selec	unit-m	3		int-gear	springs	springs	½-ell	½-ell	left	cent	Sanford P
cent	motor	1,500	14	Schebler	circ-spl	dry-d	selec	unit-m	3	8.99 -1	int-gear*	springs*	springs*	½-ell	½-ell	left	cent	Sanford M
cent	motor	1,000	12½	Saurer	spl-press	cone	selec	unit-j	4	10.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Saurer
cent	motor	1,000	9½	Saurer	spl-press	cone	selec	unit-j	4	13.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Saurer
none	none	2,000	47	Mayer	circ-spl	dry-d	prog	unit-x	3	3.50 -1	bevel	tor-t	tor-t	cant	cant	left	cent	Saxon
cent	motor	1,130	17	Stromberg	circ-spl	dry-d	selec	unit-m	3	6.75 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Selden T
cent	motor	1,146	13	Stromberg	circ-spl	dry-d	selec	unit-m	3	9.45 -1	int-gear	springs	springs	½-ell	½-ell	left*	cent	Selden JC
cent	motor	1,150	13	Stromberg	circ-spl	dry-d	selec	unit-m	3	9.25 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Selden JWL
cent	motor	1,250	13	Stromberg	circ-spl	dry-d	selec	unit-m	4	10.33 -1	top worm	springs	rad-rd	½-ell	½-ell	right	cent	Selden N
none	none	1,200	18	Stromberg	spl-press	dry-d	selec	unit-m	3	6.70 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Service 120
cent	motor	1,000	14	Stromberg	spl-press	dry-p	selec	amid	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Service QW
cent	motor	870	12	Stromberg	spl-press	dry-p	selec	amid	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Service PW
cent	motor	900	11	Stromberg	pressure	dry-p	selec	amid	4	8.75 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Service HW
cent	motor	900	10	Stromberg	spl-press	cone	selec	unit-j	4	9.00 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Service HX
suct	motor	1,200	15	Stromberg	spl-press	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Signal F
suct	motor	1,295	15	Stromberg	spl-press	dry-d	selec	unit-m	3	9.25 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Signal H
suct	motor	1,295	15	Stromberg	spl-press	dry-d	selec	unit-m	3	9.25 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	Signal J
suct	motor	1,300	15	Stromberg	spl-press	dry-d	selec	unit-m	3	10.33 -1	top worm	springs	rad-rd	½-ell	½-ell	left*	cent	Signal M
none	none	1,800	25	Stromberg	circ-spl	wet-d	selec	unit-m	3	6.50 -1	top worm	springs	springs	½-ell	½-ell	right		South Bend 30
none	none	1,800	25	Stromberg	circ-spl	wet-d	selec	unit-m	3	8.50 -1	top worm*	springs	springs*	½-ell	½-ell	right		South Bend 40
none	none	1,800	22	Stromberg	circ-spl	wet-d	selec	unit-m	3	8.50 -1	top worm*	springs	springs	½-ell	½-ell	right		South Bend 40-2
suct	f-wheel	1,800	15	Stromberg	circ-spl	wet-d	selec	amid	3	11.50 -1	top worm	springs	springs	½-ell	½-ell	right		South Bend 60
suct	motor	1,100	15	Schebler	circ-spl	cone	selec	amid	3	7.75 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Standard 70
suct	motor	1,050	12	Stromberg	circ-spl	dry-d	selec	unit-m	3	10.33 -1	top worm	springs	rad-rd	½-ell	½-ell	left	cent	Standard 60
suct	motor	1,050	12	Stromberg	circ-spl	dry-d	selec	unit-m	3	9.50 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Standard 40
suct	motor	1,050	9	Stromberg	circ-spl	dry-d	selec	unit-m	3	13.00 -1	top worm	tor-arm	rad-rd	½-ell	½-ell	left	cent	Standard 50
none	none	1,000	12	Holley	circ-spl	dry-p	ind-c	amid	3	9.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Standard Tractor B
none	none	1,000	6½	Holley	circ-spl	dry-p	ind-c	amid	3	18.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Standard Tractor D
none	none	1,000	12	Stromberg	spl-press	dry-d	selec	amid	4	9.00 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Stearns
cent	motor	1,100	18	Stromberg	spl-press	dry-d	selec	unit-m	3		top worm*	springs	springs*	½-ell	½-ell	left	c & l	Stegeman
cent	motor	1,100	15	Stromberg	spl-press	dry-d	selec	unit-m	3		top worm*	springs	springs*	½-ell	½-ell	left	c & l	Stegeman
cent	motor	1,100	15	Stromberg	spl-press	dry-d	selec	unit-m	3		top worm*	springs	springs*	½-ell	½-ell	left	c & l	Stegeman Special
cent	motor	1,100	12	Stromberg	spl-press	dry-d	selec	unit-m	3	10.33 -1	top worm*	springs	springs*	½-ell	½-ell	left	c & l	Stegeman
none	none	1,333	20	Schebler	circ-spl	dry-d	prog	unit-m	3	7.00 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Sterling
cent	motor	1,040	14½	Holley	circ-spl	dry-d	selec	unit-m	3	7.70 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Sterling
cent	motor	1,040	13	Holley	circ-spl	dry-d	selec	unit-m	3	8.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Sterling
cent	motor	975	10	Holley	circ-spl	dry-d	selec	unit-m	4	11.20 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Sterling
cent	motor	975	10	Holley	circ-spl	dry-d	selec	unit-m	4	11.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Sterling
cent	motor	975	10	Holley	circ-spl	dry-d	selec	unit-m	4	11.20 -1	dbl chn	tor-arm	rad-rd	½-ell	½-ell	left	cent	Sterling
none	none	1,500	25	Zenith	circ spl	dry-d	selec	unit m	3	6.00 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Stewart (B) 3
none	none	1,500	20	Zenith	circ spl	dry-d	selec	unit-m	3	7.00 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Stewart (B) 4
none	none		18	Schebler	pressure	dry-p	plan	unit-m	2	7.00 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Stewart (C) A
none	none			Schebler	circ-spl	cone	selec	unit-x	3	4.58 -1	bevel	tor-arm	rad-rd	½-ell	½-ell	left	cent	Studebaker SP
cent	f-wheel	960	20	Schebler	circ-spl	cone	selec	unit-x	3	5.00 -1	bevel	tor-arm	rad-rd	½-ell	½-ell	left	cent	Studebaker 7

ABBREVIATIONS: (continued). **Governor Type,** cent, *centrifugal;* l-b, *loose-ball;* suct, *suction;* hyd, *hydraulic;* elec, *electric.* **Governor Drive,** motor, *from motor;* d-shaft, *from driving shaft;* f-wheel, *from front wheel;* duplex, *from both the motor and driving shaft by overrunning clutches.* **Lubrication,** splash, *non-circulating or simple splash;* circ-spl, *circulating splash;* spl-press, *splash-pressure;* fuel-inj, *fuel injection, oil mixed with fuel;* pressure, *pressure feed, no splash.* **Clutch Type,** dry-p, *dry plate;* dry-d, *dry multiple disk;* wet-d, *wet disk or disk-in-oil;* wet-p, *wet plate or plate-in-oil;* r-cone, *reversed cone or inverted cone;* cont-b, *contracting band;* exp-s, *expanding shoe.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh, individual-clutch;* fric, *friction;* elec, *electric.* **Gearset Location,** amid, *amidships;* unit-m, *unit with motor;* unit-j, *unit with jackshaft;* unit-x, *unit with axle.* **Gearset Speeds,** inf, *infinite number.* **Final Drive,** int-g, int-gear, *internal-gear;* sing chn, *single chain;* dbl chn, *double chain;* doub-red, *double reduction;* spur g, *spur gears;* sp-bev, *spiral bevel;* f, *front wheel or wheels;* 4, *four-wheel driven.* **Torque Taken By,** rad-rd, *radius rods;* tor-arm, *torque arm;* tor-t, *torsion tube;* sub-f, *sub-frame.* **Propulsion Taken By,** rad-rd, *radius rod;* tor-t, *torsion tube;* tor-arm, *torque arm;* sub-f, *sub-frame.* **Springs,** ellip, *elliptic;* ½-ell, *half elliptic;* ¼-ell, *quarter elliptic;* ¾-ell, *three-quarters elliptic;* plat, *platform;* cant, *cantilever.* **Control Levers** cent, *center;* c & r, *gearshift center, brake right;* c & l *gearshift center, brake left.*

Technical Specifications of Gasoline

Name and Model	Capacity in Pounds	Price of Chassis	Wheel-base in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	No. of Cylinders	No. of Crank-shaft Bearings	Bore and Stroke	N.A. C.C. Hp.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear								Water Circulation	Radiator Core and Case	Type	Make	Spark Advance
Sullivan G	3,000	1,600	129	solid	36x3	36x4	under hood	4	....	3¾x4½	22.50	block	r & h	thermo	fin-sheet	sing	Bosch	fixed
Sullivan E	4,000	2,250	150	solid	36x4	36x6	under hood	4	3	4⅛x5¼	27.20	block	r & h	cent	fin-sheet	sing	Bosch	fixed
Superior A	2,000	1,350	124	solid*	34x3½*	34x4*	under hood	4	3	3½x5	19.61	block	head	thermo	cell-sheet	sing	Eisemann	fixed
Superior C	4,000	1,800	144	solid	36x4	36x6	under hood	4	3	3¾x5	22.50	block	head	cent	cell-sheet	sing	Eisemann	fixed
Tiffin A-AC	1,500	1,400*	112	solid	34x3	34x3	under hood	4	3	3½x5	19.61	block	right	thermo	fin-sheet	sing	Bosch	hand
Tiffin AI	2,000	1,600	112	solid	34x3	34x4	under hood	4	3	3½x5	19.61	block	right	thermo	fin-sheet	sing	Bosch	hand
Tiffin GI-GC	3,000	1,800*	128	solid	36x3½	36x5	under hood	4	3	3¾x5¼	22.50	block	left	cent	fin-sheet	sing	Bosch	hand
Tiffin MW-MC	4,000	2,600*	140	solid	36x4	36x3½d	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-sheet	sing	Bosch	hand
Tiffin RW-R	10,000	4,250*	168	solid	36x5	42x5d	under hood	6	3	3¾x5¼	33.75	threes	right	cent	fin-sheet	sing	Bosch	hand
Tiffin SW-S	12,000	4,550*	168	solid	36x6	42x6d	under flr	6	3	3¾x5¼	33.75	threes	right	cent	fin-sheet	sing	Bosch	hand
Tower	4,000	1,600	135	solid	34x3½	34x3½d	under hood	4	....	3½x5	19.61	block	left	thermo	sq-t-sheet	sing	Bosch	hand
Transit E	2,000	2,000	130	solid	36x3½	36x3½d	under flr	4	3	4½x5½	32.40	pairs	left	cent	sq-t-sheet	sing	Bosch	hand
Transit F	4,000	2,850	144	solid	36x4	36x4d	btw seats	4	3	4½x5½	32.40	pairs	left	cent	sq-t-sheet	sing	Bosch	hand
Transit T	7,000	3,500	144*	solid	36x5	36x5d	btw seats	4	3	4½x5½	32.40	pairs	left	cent	sq-t-sheet	sing	Bosch	hand
Transit V	10,000	4,500	144*	solid	36x6	40x6d	btw seats	4	3	4½x5½	32.40	pairs	left	cent	sq-t-sheet	sing	Bosch	hand
Transport Tractor T	10,000	2,500	80	solid	34x4	34x3½d	htw seats	4	3	3½x5¼	19.61	block	right	thermo	cell-sheet	sing	Bosch	fixed
Trumbull 16D	500	340	80*	pneu	28x3	28x3	under hood	4	2	2⅞x4	13.37	block	right	thermo	fin-sheet	sing	Splitdorf	hand
Twin City	2,000	1,350	104*	solid	34x3	36x3½	under seats	2	2	5 x5	20.00	sing	opp	thermo	fin-sheet	sing	K.-W	hand
Twin City	4,000	1,500	104*	solid	34x3	36x3½	under seats	4	5	3½x5	19.61	block	left	thermo	fin-sheet	sing	K.-W	hand
Universal G	3,000	1,950	130*	solid	34x3½	34x5	under hood	4	3	3¾x5¼	22.50	block	right	gear	fin-cast	sing	Eisemann	hand
Universal D	4,000	2,800	132*	solid	36x4	36x4d	under flr	4	3	4 x5¼	25.60	pairs	opp	cent	cell-sheet	dual	Eisemann	hand
Universal A	6,000	3,400	132*	solid	36x5	36x4d	under flr	4	3	4 x5¼	25.60	pairs	opp	cent	cell-sheet	dual	....	hand
United AG	3,000	....	144	solid*	34x3½	34x5	under hood	4	....	3¾x5	22.50	block	right	cent	sq-t-sheet	sing	Eisemann	fixed
United BSW	4,000	2,250	144*	solid	36x4	36x4d	under hood	4	3	4⅛x5	27.20	block	left	cent	sq-t-sheet	sing	Eisemann	fixed
United CSW	7,000	2,900	144*	solid	36x5	36x5d	under hood	4	3	4½x5¼	32.40	pairs	left	cent	sq-t-sheet	sing	Eisemann	fixed
United ESW	10,000	3,500	144*	solid	36x6	40x6d	under hood	4	3	5 1/16x5½	41.61	pairs	opp	cent	sq-t-sheet	sing	Eisemann	fixed
U. S. H	4,000	2,700	138	solid	34x4	36x4d	under hood	4	3	4⅛x5½	27.20	block	left	cent	sq-t-sheet	dual	Bosch	hand
U. S. J	7,000	3,400	162	solid	36x5	40x5d	under hood	4	3	4½x5	32.40	pairs	left	cent	sq-t-sheet	dual	Bosch	hand
U. S. K	10,000	4,200	168	solid	36x5	40x6d	under hood	4	3	4½x5	32.40	pairs	left	cent	sq-t-sheet	dual	Bosch	hand
Velie 25	3,000	2,250	150	solid	36x4	36x5	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-cast	sing	Bosch	hand
Velie 26	7,000	3,350	172	solid	36x5	40x5d	under hood	4	3	4½x5¼	32.40	pairs	left	cent	fin-cast	sing	Bosch	hand
Vim 18	1,000	620	100	pneu	31x4	31x4	under hood	4	3	3 x4½	14.40	block	right	thermo	fin-sheet	sing	Dixie	hand
Voltz C	6,000	2,750	142	solid	36x5	38x5d	under hood	4	3	4½x5¼	32.40	pairs	left	cent	cell-sheet	dual	Eisemann	auto
Voltz T	10,000	3,600	142	solid	36x6	40x6d	under hood	4	3	5 x5½	40.00	pairs	opp	cent	cell-sheet	dual	Eisemann	auto
Vulcan	4,000	2,750	150*	solid	36x4	34x3½d	under hood	4	3	4⅓x5½	30.00	pairs	left	thermo	sq-t-cast	dual	Remy	hand
Vulcan	6,000	3,250	156*	solid	36x5	34x4d	under hood	4	3	4⅓x5½	30.00	pairs	left	thermo	sq-t-cast	dual	Remy	hand
Vulcan	10,000	4,500	165*	solid	36x6	36x6d	under hood	4	3	4⅓x5½	30.00	pairs	left	thermo	sq-t-cast	dual	Remy	hand
Walter	10,000	4,750	144*	solid*	40x6	40x5d	under hood	4	3	4⅜x6	30.65	block	right	cent	fin-sheet	sing	Eisemann	auto
Walter	12,000	5,000	144*	solid	40x6	40x6d	under hood	4	3	4⅜x6	30.65	block	right	cent	fin-sheet	sing	Eisemann	auto
Walter	15,000	5,250	144*	solid	40x6	40x6d	under hood	4	3	4⅜x6	30.65	block	right	cent	fin-sheet	sing	Eisemann	auto
Walter Tractor	24,000	5,000	108*	solid	40x4d	40x4d	under hood	4	3	4⅜x6	30.65	block	right	cent	fin-sheet	sing	Eisemann	auto
Watson	10,000	....	158	s & st	40x4d	53x5	under hood	4	3	4⅜x6	30.65	block	right	cent	fin-sheet	sing	Eisemann	auto
White GBBE	1,500	2,100	133½	pneu	34x4½	34x4½	under hood	4	2	3¾x5¼	22.50	block	right	cent	sq-t-sheet	sing	Bosch	hand
White TBC	3,000	3,000	145½	pneu	36x4½	36x4½d	under hood	4	2	3¾x5¼	22.50	block	right	cent	sq-t-sheet	sing	Bosch	hand
White TAD	6,000	3,700	163	solid	36x5	40x5d	under hood	4	2	3¾x5¼	22.50	block	right	cent	sq-t-sheet	sing	Bosch	hand
White TCD	10,000	4,500	169	solid	36x5	40x6d	under hood	4	3	4¼x6½	29.00	block	right	cent	sq-t-sheet	sing	Bosch	hand
Wichita A	2,000	1,650	110*	solid	34x3	34x4	under hood	4	2	3¼x5	16.92	block	left	thermo	cell-sheet	sing	Dixie	hand
Wichita K	2,000	1,650	118*	solid	36x3	36x4	under hood	4	2	3½x5	19.61	block	left	thermo	cell-sheet	sing	Dixie	hand
Wichita L	3,000	1,800	118*	solid	36x3	36x5	under hood	4	2	3½x5	19.61	block	left	thermo	cell-sheet	sing	Dixie	hand
Wichita B	4,000	2,100	118*	solid	34x3½	34x3d	under hood	4	2	3½x5	19.61	block	left	thermo	cell-sheet	sing	Dixie	hand
Wichita M	4,000	2,100	118*	solid	36x3½	36x3*	under hood	4	2	3½x5	19.61	block	left	thermo	cell-sheet	sing	Dixie	hand
Wichita O	7,000	3,250	165	solid	36x5	36x5d	under hood	4	3	4¼x5½	29.00	pairs	left	cent	cell-sheet	sing	Dixie	hand
Wilcox T	1,000	1,000	115	pneu	34x4	34x4	under hood	4	3	3½x5	19.61	block	left	thermo	fin-sheet	sing	Bosch	hand
Wilcox N	1,500	1,200	120	pneu	35x4½	35x4½	under hood	4	3	3½x5	19.61	block	left	thermo	fin-sheet	sing	Bosch	hand
Wilcox S	2,000	1,600	128	pneu*	35x5*	35x5*	under hood	4	3	3¾x5	22.50	block	left	....	fin-sheet	sing	Bosch	hand
Wilcox R	3,000	1,800	134	solid	36x4	36x5	under hood	4	3	4¼x5	29.00	pairs	right	cent	fin-sheet	sing	Bosch	hand
Witt-Will WD1	2,240	....	120	solid	36x3	36x4	under hood	4	3	3¾x5¼	22.50	block	left	cent	fin-sheet	sing	Eisemann	auto
Witt-Will WD2	4,480	2,250	144	solid	36x3½	36x3½d	under hood	4	3	4⅛x5¼	27.20	block	left	cent	fin-sheet	sing	Eisemann	auto

Received Too Late to Classify

Name and Model	Capacity in Pounds	Price of Chassis	Wheel-base in Inches	Kind	Front	Rear	Location	No. of Cylinders	No. of Crank-shaft Bearings	Bore and Stroke	N.A. C.C. Hp.	Cylinders Cast	Valves Placed	Water Circulation	Radiator Core and Case	Type	Make	Spark Advance
Acason	4,000	2,350	150	solid	34x3½	36x3½d	under hood	4	3	4¼x5½	29.00	pairs	left	cent	fin-cast	sing	Dixie	hand
Acason	7,000	3,000	170	solid	36x4	36x5d	under hood	4	3	4¼x5½	29.00	pairs	left	cent	fin-cast	sing	Dixie	hand
Mogul LM	3,000	1,600	125*	solid	36x4	36x5	under hood	4	....	3¾x5¼	22.50	block	left	cent	cell-cast	sing	Bosch	fixed
Mogul LW	4,000	2,000	138*	solid	36x5	38x4d	under hood	4	....	4⅛x5¼	27.20	block	left	cent	cell-cast	sing	Bosch	fixed
Mogul L	5,000	2,250	138*	solid	36x5	38x4d	under hood	4	....	4⅛x5¼	27.20	block	left	cent	cell-cast	sing	Bosch	fixed
Mogul T	7,000	2,550	165*	solid	36x5	36x5d	under hood	4	....	4½x5½	32.40	pairs	left	cent	cell-sheet	sing	Bosch	fixed
Phoeni: Centiped	....	....	....	steel	....	creeper	under hood	4	5	5½x7	48.48	single	r & h	cent	sq-t-sheet	sing	Swiss	hand
Wilson E	4,000	2,000	144	solid	36x4	36x4d	under hood	4	....	4⅛x5¼	27.20	block	....	cent	fin-..—	sing	....	fixed

ABBREVIATIONS: General *, *with other options;* opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Cush, *cushion;* p&s, *pneumatic in front and solid in rear;* s & st, *solid in front and steel in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** htw seats, *between seats;* under flr, *under floor.* **Cylinders Cast,** sing, *singly or individually.* **Location of Valves,** opp, *opposite or T-head type;* top (two-cylinder motors only), *L-head cylinder laid horizontal with valves up;* r & h, *at right and in head, L-head cylinder;* l & h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves.* **Water Circulation,** cent, *centrifugal pump;* gear, *gear pump;* thermo, *thermo-syphon circulation;* air, *air-cooled, no water.* **Radiator Type and Case,** fin-sheet, *finned-tube core with sheet metal casing;* fin-cast, *finned-tube core with cast aluminum casing;* sq-t-sheet, *square tube or flat tube core with sheet metal casing;* sq-t-cast, *square tube core with cast aluminum casing;* cell-sheet, *cellular or honeycomb core with sheet metal casing;* cell-cast, *cellular core with cast aluminum casing;* z-z-t-sheet, *zig-zag tube core with sheet metal casing;* z-z-t-cast, *zig-zag tube core with cast aluminum casing;* ring-cast, *copper tube core arranged in a ring about a centrifugal fan with a cast aluminum casing.* **Ignition, Type,** sing, *single;* doub, *double.* **Make of Magneto** (or other sparking device), Atw. Kent, *Atwater Kent.* **Spark Advance,** auto, *automatic;* auto-h, *automatic advance with hand adjustment;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.*

Commercial Vehicles for 1916—Continued

MOTOR						TRANSMISSION								SPRINGS		CONTROL		Name and Model
GOVERNOR		SPEED		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear Reduction in High	Final Drive	Torque Taken By	Propulsion Taken By	Front	Rear	Steer	Levers	
Type	Drive	Motor in r.p.m.	Truck in m.p.h.				Type	Location	Speeds									
				Holley	spl-press	cone	selec	unit-j	3		dbl chn		rad-rd	½-ell	plat	left	cent	Sullivan G
				Holley	spl-press	dry-p	selec	unit-m	3		top worm	springs	springs	½-ell	½-ell	left	cent	Sullivan E
suct	motor	1,200	17	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.00 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Superior A
suct	motor	1,100	15	Stromberg	circ-spl	dry-d	selec	unit-m	3	7.75 -1	int-gear	springs	springs	½-ell	½-ell	left	cent	Superior C
cent	motor	1,000	15½	Schebler	spl-press	cone	selec	unit-m*	3	9.60 -1	int-gear*	tor-arm	rad-rd	½-ell	½-ell	left	cent	Tiffin A-AC
cent	motor	1,000	15	Schebler	spl-press	cone	selec	unit-m	3	9.60 -1	int-gear	tor-arm	rad-rd	½-ell	½-ell	left	cent	Tiffin AI
cent	motor	1,000	13½	Schebler	spl-press	cone	selec	unit-m*	3	8.00 -1	int-gear*	tor-arm	rad-rd	½-ell	½-ell	left	cent	Tiffin GI-GC
cent	motor	1,000	12	Schebler	spl-press	cone	selec	amid*	3	8.80 -1	top worm*	tor-arm	rad-rd	½-ell	½-ell	left	cent	Tiffin MW-MC
cent	motor	1,000	10	Schebler	spl-press	dry-p	selec	amid*	4	12.20 -1	top worm*	tor-arm	rad-rd	½-ell	½-ell	left	cent	Tiffin RW-R
cent	motor	1,000	10	Schebler	spl-press	dry-p	selec	amid*	4	12.20 -1	top worm*	tor-arm	rad-rd	½-ell	½-ell	left	cent	Tiffin SW-S
		1,200	15	Stromberg	circ-spl	dry-d	selec	unit-m	3	8.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Tower
cent	motor	1,200	16	Rayfield	circ-spl	wet-d	selec	unit-j	3	7.50 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Transit E
cent	motor	1,200	14	Rayfield	circ-spl	wet-d	selec	unit-j	3	9.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Transit F
cent	motor	1,200	12	Rayfield	circ-spl	wet-d	selec	unit-j	3	10.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Transit T
cent	motor	1,200	10	Rayfield	circ-spl	wet-d	ind-c	unit-j	3	13.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Transit V
cent	d-shaft	1,300	10	Zenith	circ-spl	dry-d	selec	unit-m	3	13.60 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Transport Tractor T
none	none	2,200	45	Zephyr	circ-spl	dry-d	selec	unit-x	3	3.60 -1	bevel	tor-t	tor-t	½-ell	cant	left*	cent	Trumbull 16D
		1,500	15	Schebler	circ-spl	dry-d	plan	unit-j	2	10.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Twin City
		1,500	15	Schebler	circ-spl	dry-d	prog	unit-j	3	10.00 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Twin City
cent	motor	1,160	15	opt	circ-spl	dry-p	selec	unit-m	3	7.83 -1	top worm	tor-arm	rad-rd	½-ell	½-ell	left	cent	Universal G
l-b	motor	1,123	13		circ-spl	cone	selec	amid	3	9.25 -1	dbl chn		rad-rd	½-ell	½-ell	left		Universal D
cent	motor	1,057	10½	opt	circ-spl	cone	selec	unit-j	3	10.33 -1	dbl chn		rad-rd	½-ell	½-ell	left		Universal A
suct	motor		18	Stromberg	spl-press	dry-d	selec	unit-m	3		top worm	springs	springs	½-ell	½-ell	left	cent	United AG
suct	motor	1,500	15	Stromberg	spl-press	dry-d	selec	unit-m	3	8.75 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	United BSW
suct	motor	1,600	12	Stromberg	spl-press	dry-d	selec	unit-m	3	8.75 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	United CSW
cent	d-shaft	1,800	10	Stromberg	spl-press	dry-d	selec	amid	4	11.75 -1	top worm	springs	springs	½-ell	½-ell	right	right	United ESW
cent	motor	1,200	15	Stromberg	circ-spl	cone	ind-c	amid	3	8.66 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	U. S. H
cent	motor	1,170	12	Stromberg	circ-spl	cone	ind-c	amid	3	11.70 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	U. S. J
cent	motor	1,196	11	Stromberg	circ-spl	cone	ind-c	amid	3	13.00 -1	top worm	springs	springs	½-ell	½-ell	left*	cent	U. S. K
cent	motor	1,000	18	Stromberg	spl-press	dry-d	selec	amid	4	6.80 -1	top worm	springs	springs	½-ell	½-ell	right	right	Velie 25
cent	motor	1,100	14	Stromberg	spl-press	dry-d	selec	amid	4	10.30 -1	top worm	tor-arm	rad-rd	½-ell	½-ell	right	right	Velie 26
none	none	1,230	25	Stromberg	spl-press	cone	selec	unit-m	3	4.50- 1	bevel	springs	springs	½-ell	½-ell	left	cent	Vim 18
cent	motor	1,000	15	Rayfield	circ-spl	wet-d	selec	unit-j	3	6.60 -1	dbl chn		rad-rd	plat	plat	left	cent	Volta C
cent	motor	1,000	13	Rayfield	circ-spl	wet-d	selec	unit j	3	7.59 -1	dbl chn		rad rd	plat	plat	left	cent	Volta T
cent	motor	1,200	15½	Stromberg	circ spl	cone	selec	unit j	3	7.87 -1	dbl chn		rad rd	½-ell	½-ell	right	right	Vulcan
cent	motor	1,200	15½	Stromberg	circ-spl	cone	selec	unit-j	3	7.87 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Vulcan
cent	motor	1,200	10	Stromberg	circ-spl	cone	selec	unit-j	3	12.80 -1	dbl chn		rad-rd	½-ell	½-ell	right	right	Vulcan
cent	motor			Zenith	circ-spl	cone	selec	unit-m	4		spur-g-4	springs	springs	½-ell	½-ell	left	cent	Walter
cent	motor			Zenith	circ-spl	cone	selec	unit-m	4		spur-g-4	springs	springs	½-ell	½-ell	left	cent	Walter
cent	motor			Zenith	circ-spl	cone	selec	unit-m	4		spur-g-4	springs	springs	½-ell	½-ell	left	cent	Walter
cent	motor			Zenith	circ-spl	cone	selec	unit-m	4		spur-g-4	springs	springs	½-ell	½-ell	left	cent	Walter Tractor
cent	motor		14	Zenith	circ-spl	cone	selec	unit-m	4		spur-g-f	springs	springs	½-ell	coil	left	cent	Watson
none	none			White	spl-press	wet-p	selec	amid	4		bevel	springs	rad-rd	½-ell	½-ell	left	c & l	White GBBE
none	none			White	spl-press	wet-p	selec	amid	4		doub-red	springs	rad-rd	½-ell	½-ell	left	c & l	White TBC
none	none			White	spl-press	wet-p	selec	amid	4		dbl chn		rad-rd	½-ell	½-ell	left	c & l	White TAD
none	none			White	spl-press	wet-p	selec	amid	4		dbl chn		rad-rd	½-ell	½-ell	left	c & l	White TCD
none	none	1,080	15	Stromberg	spl-press	cone	selec	unit-j	3	7.32 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Wichita A
none	none	1,085	15	Stromberg	spl-press	cone	selec	amid	3	7.80 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Wichita K
none	none	1,200	15	Stromberg	spl-press	cone	selec	amid	3	8 66 -1	top worm	springs	springs	½-ell	½-ell	right	cent	Wichita L
none	none	1,050	13	Stromberg	spl-press	cone	selec	unit-j	3	8.24 -1	dbl chn		rad-rd	½-ell	½-ell	right	cent	Wichita B
none	none	1,280	13	Stromberg	spl-press	cone	selec	amid	3	10.67 -1	top worm	springs	springs	½-ell	½-ell	right		Wichita M
cent	motor	1,200	11	Stromberg	circ-spl	cone	selec	amid	3	11.75 -1	top worm	springs	springs	½-ell	½-ell	right		Wichita O
cent	motor	1,500	20	opt	circ-spl	dry-d	selec	unit-m	3	6 00 -1	bevel	tor-t	tor-t	½-ell	½-ell	left	cent	Wilcox T
cent	motor	1,500	20	opt	circ-spl	dry-d	selec	unit-m	3	6.20 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Wilcox N
cent	motor	1,500	18	opt	circ-spl	dry-d	selec	unit-m	3	6 50 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Wilcox S
cent	motor	1,000	16	opt	circ-spl	cone	selec	amid	3	7.70 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Wilcox R
cent	motor	1,008	18	Zenith	circ-spl	dry-d	selec	unit-m	3	6.00 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Witt-Will WD1
cent	motor	1,085	15	Zenith	circ-spl	dry-d	selec	unit-m	3	7.75 -1	top worm	springs	springs	½-ell	½-ell	left	cent	Witt-Will WD2

Received Too Late to Classify

cent	motor	1,200	18	Schebler	circ-spl	dry-d	selec	unit-m	4		top worm	springs	springs	½-ell	½-ell	right	cent	Acason
cent	motor	1,200	15	Schebler	circ-spl	dry-d	selec	unit-m	4		top worm	springs	springs	½-ell	½-ell	right	cent	Acason
cent	motor	1,200	15	Carter	spl-press	dry-p	selec	unit-m	3	7.75 -1	top worm	tor-t	rad-rd	½-ell	½-ell	left	cent	Mogul LM
cent	motor	1,200	15	Carter	spl-press	dry p	selec	unit-m	3	7.75 -1	top worm	tor-t	rad-rd	½-ell	½-ell	left	cent	Mogul LW
cent	motor	1,200	15	Carter	spl-press	dry-p	selec	amid	3	7.75 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Mogul L
cent	motor	1,200	15	Carter	spl-press		selec	amid	3	7.75 -1	dbl chn		rad-rd	½-ell	½-ell	left	cent	Mogul T
cent	motor	700	5	Kingston	splash	exp-s	ind-c	unit-j	3		int-gear	springs		coil	coil	right		Phoenix Centiped
cent	motor	1,200	15		circ-spl	cone	selec	amid	3		top worm	springs	springs	½-ell	½-ell	left	cent	Wilson E

ABBREVIATIONS: (continued). **Governor Type,** cent, *centrifugal;* l-b, *loose-ball;* suct, *suction;* hyd, *hydraulic;* elec, *electric.* **Governor Drive,** motor, *from motor;* d-shaft, *from driving shaft;* f-wheel, *from front wheel;* duplex, *from both the motor and driving shaft by overrunning clutches.* **Lubrication,** splash, *non-circulating or simple splash;* circ-spl, *circulating splash;* spl-press, *splash-pressure;* fuel-inj *fuel injection, oil mixed with fuel;* pressure, *pressure feed, no splash.* **Clutch Type,** dry-p, *dry plate;* dry-d, *dry multiple disk;* wet-d, *wet disk or disk-in-oil;* wet-p, *wet plate or plate-in-oil;* r-cone, *reversed cone or inverted cone;* cont-b, *contracting band;* exp-s, *expanding shoe.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh, individual-clutch;* fric, *friction;* elec, *electric.* **Gearset Location,** amid, *amidships;* unit-m, *unit with motor;* unit-j, *unit with jackshaft;* unit-x, *unit with axle.* **Gearset Speeds,** inf, *infinite number.* **Final Drive,** int-g, int-gear, *internal-gear;* sing chn, *single chain;* dbl chn, *double chain;* doub red, *double reduction;* spur-g, *spur gears;* sp-bev, *spiral bevel;* f, *front wheel or wheels;* 4, *four-wheel driven.* **Torque Taken By,** rad-rd, *radius rods;* tor-arm, *torque arm;* tor-t, *torsion tube;* sub-f, *sub-frame.* **Propulsion Taken By,** rad-rd, *radius rod;* tor-t, *torsion tube;* tor-arm, *torque arm;* sub-f, *sub-frame.* **Springs,** ellip, *elliptic;* ½-ell, *half elliptic;* ¼-ell, *quarter elliptic;* ¾-ell, *three-quarters elliptic;* plat, *platform;* cant, *cantilever.* **Control, Levers,** cent, *center;* c & r, *gearshift center, brake right;* c & l, *gearshift center, brake left.*

Prices of 1916 Gasoline Motor Trucks

Classified According to Load Capacity and Combined with Salient Features of Chassis

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Brasie Packet	500	$450-c	100	pneu	12.08	fric	dbl chn
Kearns L	500	375	90	pneu	12.08	selec	bevel
Overland 83	800	750-c	106	pneu	27.20	selec	bevel
R-S	350	305	65	pneu	9.12	prog	sing chn
Saxon	400	395	96	pneu	12.08	prog	bevel
Trumbull 16D	500	300	80*	pneu	13.37	selec	bevel

TRUCKS OF ½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Bauer A	1,000	720	100	solid*	22.50	selec	doub-red
Brinton H	1,200	815	98	cush*	16.92	selec	top worm
Croce 16	1,000	800	104	pneu	16.02	selec	bevel
Crowther 10-30	1,000	600	110	pneu	22.50	rollers	rollers
Detroit B	1,000		112	pneu	22.50	selec	bevel
Dispatch L	1,200	900	120	pneu	22.50	fric	dbl chn
Duryea	1,000	600	84	solid		rollers	rollers
Falcon A	1,000	715	106	pneu	14.40	selec	bevel
Hanger B	1,000	875	110*	pneu	16.02	selec	top worm
Henderson C	1,200	1,100	106*	pneu	19.61	selec	top worm
Hannibal A	1,000	550	106	pneu	16.92	selec	
I.H.C. MA	1,000	600-c	90	solid*	20.00	ind-c	dbl chn
I.H.C. MW	1,000	710-c	90	solid*	16.20	ind-c	dbl chn
Kearns D	1,000	600	107	pneu	16.92	selec	bevel
Kisselkar	1,000	950	115	pneu	24.22	selec	bevel
Kosmath 15	1,000	675	100	pneu	15.65	selec	bevel
Lambert V1	1,000	900	106*	pneu	19.61	fric	dbl chn
Lippard-Stewart M	1,000	1,000	106	pneu	14.40	selec	top worm
Mercury P	1,000	650	85	solid	14.50	plan	dbl chn
Studebaker SF	1,000	785	112	pneu	24.22	selec	bevel
Vim 18	1,000	620	100	pneu	14.40	selec	bevel
Wilcox T	1,000	1,000	115	pneu	19.61	selec	bevel

TRUCKS OF ¾-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Bauer B	1,500	840	110	solid*	22.50	selec	doub-red
Bessemer G	1,500	975	124	solid	19.61	selec	int-gear
Bollstrom A	1,500	1,200	125*	pneu*	15.64	selec	int-g-4
Buick D4	1,500	1,150	122	pneu	22.50	selec	bevel
Commerce N	1,500	875	120	pneu	19.61	selec	bevel
Dart BB	1,500	1,300	124	solid	10.61	prog	top worm
Denby U	1,500	890-c	119	solid	15.64	selec	int-gear
Diamond-T JA-JB	1,500	1,175	126*	solid	19.61	selec	top worm
Dorris 1A4	1,500	1,900	144*	pneu	30.65	selec	bevel
Gabriel H	1,500	1,600	126	pneu	27.20	selec	bevel
Garford 64	1,500	1,350	120	p&s	19.61	selec	dbl chn
G.M.C. 15	1,500	1,090	122	pneu	19.61	selec	bevel
Geneva 1	1,500		96	solid	22.10	plan	dbl chn
I.H.C. E	1,500	950-c	102	solid*	16.20	ind-c	dbl chn
Independent F	1,500	1,285	128*	solid*	19.61	selec	top worm
Krebs F	1,500	1,600	120	pneu	22.50	selec	top worm
Lippard-Stewart W	1,500	1,600	125*	pneu*	22.50	selec	top worm*
Little Giant 15	1,500	1,500	120	p&s	19.61	selec	top worm
Lincoln D	1,500	900	122	pneu	22.50	selec	bevel
Menominee E	1,500	1,125	124	solid	22.50	selec	sp-bev
Palmer-Moore K	1,500	1,150	106	solid*	19.61	selec	int-gear
Paulding D1	1,500	975	120*	solid	16.92	selec	int-gear
Reo F	1,500	1,000	120	pneu	27.20	selec	bevel
Republic F	1,500	995-c	124	solid*	19.61	selec	int-gear
Sanford O	1,500	1,290	120	pneu*	19.61	selec	int-gear
South Bend 30	1,500	1,475	128	pneu	22.50	selec	top worm
Sterling	1,500	895	127	pneu	15.64	prog	top worm
Stewart (B) 3	1,500		118*	pneu	19.61	selec	int-gear
Tiffin A-AC	1,500	1,400*	112	solid	19.61	selec	int-gear*
White GBBE	1,500	2,100	133½	pneu	22.50	selec	bevel
Wilcox N	1,500	1,200	120	pneu	19.61	selec	top worm

TRUCKS OF 1-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Adams A	2,000	1,850	136*	solid	22.50	selec	dbl chn
Atterbury 6B	2,000	1,775	140½	solid	22.50	selec	top worm
Available	2,000	1,500	132*	solid	22.50	selec	top worm
Avery C	2,000	1,690	128	solid	27.20	selec	dbl chn
Barker U	2,000	2,000	130	solid	25.60	selec	top worm
Brockway H	2,500	1,600	124*	solid	22.50	selec	dbl chn
Brockway J	2,500	1,825	124*	solid	22.50	selec	top worm
Chase A	2,000	1,650	140	solid	19.61	selec	top worm
Continental (C) FL	2,000	1,550	144*	solid	22.50	selec	top worm
Corbitt B	2,000	2,250	130	solid	22.50	selec	top worm
Dart B	2,000	1,400	138*	solid	19.61	selec	dbl chn
Denby B	2,000	1,475	120	solid	19.61	selec	int-gear
Fargo K	2,000	1,175	130	solid	22.50	selec	int-gear
Gabriel O	2,000	1,800	136	pneu	27.20	selec	top worm
Garford 75	2,000	1,450	120	p&s	19.61	selec	top worm
G.M.C. 25	2,500	1,800	144*	solid	22.50	selec	dbl chn
G.M.C. 26	2,500	1,800	144*	solid	22.50	selec	top worm
Gramm-Bernstein	2,000	1,500	118	solid	19.61	ind-c	top worm
Henderson D	2,000	1,500	124*	pneu*	22.50	selec	top worm
I.H.C. F	2,000	1,500	128	solid*	19.61	selec	int-gear
Indiana S	2,000		128	solid*	19.61	selec	top worm
Kelly-Springfield K-30	2,000	2,000	120	solid*	22.50	selec	dbl chn
Kisselkar	2,000	1,500	125	pneu*	24.22	selec	top worm
Koehler K	2,000	870	129	solid	19.61	selec	int-gear
Krebs G	2,000	2,000	144	solid	22.50	selec	top worm
Lambert V3	2,000	1,800	120	solid	32.40	fric	dbl chn
Landshaft G1	2,000	1,250	124*	solid	19.61	selec	int-gear
Lange C	2,000	1,750	130*	solid	22.50	ind-c	dbl chn
Lippard-Stewart H	2,000	2,000	145	solid	22.50	selec	top worm
Maccar K	2,000	2,100	150*	solid	27.20	selec	dbl chn
Maccar L	2,000	2,100	150*	solid	27.20	selec	top worm
Mack AB	2,000	2,000	144*	solid*	25.60	selec	top worm
Martin R	2,000	2,050	130	solid	25.60	selec	dbl chn*
Menominee F	2,500	1,575	130*	solid	22.50	selec	top worm
Modern T	2,000		132*	solid	19.61	selec	top worm
Moreland	2,000	1,550	126	solid	22.50	selec	top worm
Nelson & LeMoon E1	2,000	1,700	opt	solid	22.50	selec	top worm
Packard 1D	2,000	2,200	126*	solid	25.60	prog	top worm
Palmer	2,000	1,350	115½	pneu*	22.50	selec	int-gear
Palmer-Moore M	2,000	1,350	126	solid*	22.50	selec	int-gear
Paulding G-G1	2,000	1,300	120*	solid	25.60	selec	int-gear
Republic E	2,000	1,275	144	solid*	22.50	selec	int-gear
Rowe CW	2,000	2,450	130	solid	16.92	selec	top worm
Sanford P	2,000	1,350	138	pneu*	19.61	selec	int-gear

ABBREVIATIONS: General, *, *with other options;* opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** pneu, *pneumatic;* cush, *cushion;* sol-st, *solid in front steel in rear;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* **Final Drive,** bevel, *direct bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 1-TON CAPACITY (Cont'd)

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Selden T	2,000	1,700	126½*	solid	19.61	selec	top worm
Service 126	2,000	1,375	135	solid	19.61	selec	top worm
Signal F	2,000	1,550	144*	solid	22.50	selec	top worm
Stewart (B) 4	2,500		128	solid	19.61	selec	int-gear
Stewart (C) A	2,000	700	96	solid	20.00	plan	dbl chn
Studebaker 7	2,000		125	pneu	24.22	selec	bevel
Superior A	2,000	1,350	124	solid*	19.61	selec	int-gear
Tiffin A1	2,000	1,600	112	solid	19.61	selec	int-gear
Transit E	2,000	2,000	130	solid	32.40	selec	dbl chn
Twin City	2,000	1,350	104*	solid	20.00	plan	dbl chn
Wichita A	2,000	1,650	110*	solid	16.92	selec	dbl chn
Wichita K	2,000	1,650	118*	solid	19.61	selec	top worm
Wilcox S	2,000	1,600	128	pneu	22.50	selec	top worm
Witt-Will WD1	2,240		120	solid	22.50	selec	top worm

TRUCKS OF 1½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Adams D	3,000	2,300	136*	solid	27.20	selec	dbl chn
Bessemer A	3,000	1,800	136	solid	27.20	selec	dbl chn
Continental (C) HL	3,000	1,750	144	solid	22 60	selec	top worm
Croce	3,000	1,800	120*	solid	25.60	selec	top worm
DeKalb D1	3,000	1,950	134*	solid	27.20	selec	top worm*
Denby D	3,000	1,685	144*	solid	22.60	selec	int-gear
Diamond-T J2	3,000	2,050	160*	solid	27.20	selec	top worm
Federal M	3,000	1,800	144*	solid	27.20	selec	top worm
F.W.D. G	3,000	3,600	124	solid	32.40	ind-c	bevel-4
Gabriel M	3,000	2,200	144	pneu	27.20	selec	top worm
Garford 66	3,000	1,800	142*	solid	22.50	selec	top worm
G.M.C. 31	3,000	1,900	144*	solid	22.60	selec	top worm
Gramm-Bernstein	3,000	1,800	130*	solid	19.61	ind-c	top worm
Horner F-G	3,000		145*	solid	27.20	selec	top worm*
Indiana D	3,000		135	solid	27.20	selec	top wom
Kelly-Springfield K-31	3,000	2,050	144*	solid	22.50	selec	dbl chn
Kleiber 1	3,000	2,250	140*	solid	27.20	selec	top worm
Larrabee	3,000	1,950	132	solid	27.20	selec	top worm
Lippard-Stewart F	3,000	2,300	145	solid	27 20	selec	top worm
Little Giant H	3,000	1,450	110	solid	19.61	selec	dbl chn
Mack AB	3,000	2,350	144*	solid*	25 60	selec	top worm
Maia C&D	3,000	2,600	132*	solid	25.60	prog	int-gear
Modern N	3,000		144*	solid	22 50	selec	top worm
Mogul LM	3,000	1,600	125*	solid	22 50	selec	top worm
Moon B	3,000	1,650	140*	solid	22.50	prog	bevel
Moreland	3,000	1,850	126*	solid	27.20	selec	top worm
Netco C	3,000	2,250	144*	solid	27.20	selec	top worm
New York L	3,000	1,800	129*	solid	22.50	selec	top worm*
Old Reliable	3,000	1,950	138*	solid	22.50	selec	top worm
Packard 1½D	3,000	2,500	126*	solid	25.60	prog	top worm
Paulding E-E1	3,000	1,600	130*	solid	25.60	selec	int-gear*
Sandow	3,000	1,800	160*	solid	22 50	selec	top worm
Service QW	3,000	2,200	150	solid	27.20	selec	top worm
Signal H	3,000	1,750	144	solid	22 60	selec	top worm
South Bend 40	3,000	1,750	130*	solid	25 60	selec	top worm*
Stegeman	3,000	1,900	150	solid	27 20	selec	top worm*
Sullivan G	3,000	1,600	129	solid	22.50	selec	dbl chn
Tiffin GI-GC	3,000	1,800*	128	solid	22.50	selec	int-gear*
Universal G	3,000	1,950	130*	solid	22.50	selec	top worm
United AG	3,000		144	solid*	22.50	selec	top worm
Velie 25	3,000	2,250	150	solid	27.20	selec	top worm
White TBC	3,000	3,000	145½	pneu	22 50	selec	doub-red
Wichita L	3,000	1,800	118*	solid	19 61	selec	top worm
Wilcox R	3,000	1,800	134	solid	29 00	selec	top worm

TRUCKS OF 2-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Acason	4,000	2,100	160	solid	29.00	selec	top worm
Acme	4,000	2,000	148	solid	27.20	selec	top worm
Armleder HC	4,000	2,500	148*	solid	27.20	selec	dbl chn
Armleder HW	4,000	2,800	148*	solid	27.20	selec	top worm
Atterbury 6C	4,000	2,376	153½	solid	27.20	selec	top worm
Autocar 21F	4,000	1,650	97	solid*	18.10	prog	doub-red
Available	4,000	2,000	144*	solid	27.20	selec	top worm
Avery B	4,000	2,700	128	solid	36.15	selec	dbl chn
Barker V	4,000	2,400	136	solid	25.60	selec	top worm
Bessemer D	4,000	2,000	136	solid	27.20	selec	top worm
Blair 2C	4,000	2,850	121*	solid	22.50	ind-c	top worm
Brockway 1	4,000	1,900	140*	solid	27.20	selec	dbl chn

TRUCKS OF 2-TON CAPACITY (Cont'd)

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Brockway K	4,000	2,125	140*	solid	27.20	selec	top worm
Burford O	4,000	2,000	132*	solid	22.50	selec	int-gear
Chase R	4,000	2,200	160*	solid	27.20	selec	top worm
Coleman J	4,000	2,400	132	solid	25 60	selec	top worm
Continental (C) J	4,000	2,100	146	solid	27.20	selec	top worm
Corbitt A	4,000	2,500	145*	solid	27.20	selec	top worm
Dart C	4,000	1,900	144*	solid	27.20	selec	dbl chn
Dayton U	4,000	2,650	118½	solid	29.00	selec	dbl chn
Denby E	4,000	1,985	144*	solid	22.50	selec	int-gear
Diamond-T J3	4,000	2,200	160*	solid		selec	top worm
Dorris 1AW	4,000	2,500	162*	solid	30 65	selec	top worm
Duplex C	4,000	2,800	130*	solid	27.20	selec	int-g-4
Duplex E	4,000		130*	solid	29.00	selec	int-g-4
Fargo N	4,000	1,675	156	solid	27.20	prog	int-gear
Garford 70	4,000	2,300	142*	solid	29 00	selec	top worm
G. A. Schacht	4,000	2,800	138*	solid	29 00	selec	top worm
G.M.C. 40	4,000	2,376	158*	solid	27.20	selec	dbl chn
G.M.C. 41	4,000	2,375	158*	solid	27.20	selec	top worm
Headley	4,000	3,000	145	solid	27.20	selec	dbl chn-4
Horner F-G	4,000		145*	solid	27.20	selec	top worm*
Independent G	4,000	1,800	144	solid	27.20	selec	top worm
Jaffery 4015	4,000	2,760	124	solid	22.60	ind-c	int-g-4
Kelly-Springfield K-35	4,000	2,750	144*	solid	22.60	selec	dbl chn
Kisselkar	4,000	2,100	144	solid	29 00	selec	top worm
Knickerbocker 16	4,000	2,200	148*	solid	27.20	selec	top worm
Krebs H	4,000	2,460	144*	solid	27.20	selec	top worm
Lambert V5	4,000	2,000	120	solid	32.40	fric	dbl chn
Landshaft J1	4,000	1,550	144*	solid	27 20	selec	int-gear
Lange B	4,000	2,350	136*	solid	27 20	ind-c	dbl chn
Lippard-Stewart G	4,000	2,600	158	solid	27 20	selec	top worm
Little Giant 16	4,000	2,500	144	solid	27 20	selec	top worm
Maccar J	4,000	2,600	162*	solid	32.40	selec	dbl chn
Maccar H	4,000	2,600	162*	solid	32.40	selec	top worm
Mack AB	4,000	2,700	144*	solid*	25.60	selec	top worm
Maia E&F	4,000	2,800	145*	solid	25.60	prog	int-gear
Martin S	4,000	2,150	121	solid	25.60	selec	dbl chn*
Menominee D	4,000	2,240	144	solid	27 20	selec	top worm
Modern R	4,000		160*	solid	27 20	selec	top worm
Mogul LW	4,000	2,000	138*	solid	27.20	selec	top worm
Nelson & LeMoon E2	4,000	2,250	opt	solid	27 20	selec	top worm
Netco D	4,000	2,350	144*	solid	27.20	selec	top worm
Old Reliable	4,000	2,750	120*	solid	29.00	selec	dbl chn
Packard 2D	4,000	2,800	144*	solid	25.60	prog	top worm
Palmer	4,000	1,975	144	solid	27 20	selec	top worm
Paulding H-H1	4,000	1,950	160*	solid	29 00	selec	int-gear*
Peerless TC2	4,000		145	solid	32 40	selec	top worm
Pierce-Arrow	4,000	3,000	150*	solid	25.60	selec	top worm
Reo J	4,000	1,650	146	solid	27 20	selec	dbl chn
Republic A	4,000	1,475	144	solid	27 20	selec	int-gear
Rowe CDW	4,000	2,800	144	solid	25.60	selec	top worm
Salvador	4,000	2,000	124*	cush	25.60	selec	top worm
Sandow	4,000	2,350	171*	solid	27 20	selec	dbl chn
Sandow	4,000	2,000	171*	solid	27 20	selec	top worm
Sanford M	4,000	1,910	140*	solid	25 60	selec	int-gear*
Selden JC	4,000	2,000	150	solid	22 60	selec	int-gear
Selden JWL	4,000	2,250	160*	solid	27 20	selec	top worm
Service PW	4,000	2,500	160*	solid	27.20	selec	top worm
Signal J	4,000	2,100	150	solid	27 20	selec	top worm
South Bend 40-2	4,000	2,000	142	solid	25 60	selec	top worm*
Standard 70	4,000	2,000	140	solid	27.20	selec	top worm
Sterling	4,000	2,800	148*	solid	25 60	selec	top worm
Sullivan E	4,000	2,260	150	solid	27 20	selec	top worm
Superior C	4,000	1,800	144	solid	22 50	selec	int-gear
Tiffin MW-MC	4,000	2,600*	140	solid	27.20	selec	top worm*
Tower	4,000	1,600	135	solid	19 61	selec	top worm
Transit F	4,000	2,850	144	solid	32.40	selec	dbl chn
Twin City	4,000	1,500	104*	solid	19.61	prog	dbl chn
Universal D	4,000	2,800	132*	solid	25 60	selec	dbl chn
United BSW	4,000	2,250	144*	solid	27.20	selec	top worm
U.S. H	4,000	2,700	138	solid	27.20	ind-c	top worm
Vulcan	4,000	2,750	150*	solid	30.00	selec	dbl chn
Wichita B	4,000	2,100	118*	solid	19 61	selec	dbl chn
Wichita M	4,000	2,100	118*	solid	19 61	selec	top worm
Wilson E	4,000	2,000	144	solid	27.20	selec	top worm
Witt-Will WD2	4,480	2,250	144	solid	27.20	selec	top worm

TRUCKS OF 2½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Adams E	6,000	2,500	140*	solid	27.20	selec	dbl chn
Armleder EC	5,000	2,800	148*	solid	27.20	selec	dbl chn

ABBREVIATIONS: General, *, *with other options;* opt, *optional.* Price, -c, *complete with body.* Tires, Kind, pneu, *pneumatic;* cush, *cushion;* sol-st, *solid in front, steel in rear;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* Gearset Type, prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* Final Drive, bevel, *direct bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheel*

TRUCKS OF 2½-TON CAPACITY (Cont'd)

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Brinton.............F	5,000	2,250	138*	solid....	27.20	selec....	top worm
Croce................	5,000	2,600	130	solid....	25.60	selec....	top worm
Dart...............CC	5,000	2,100	150	solid....	27.20	selec....	top worm
DeKalb.............D2	5,000	2,450	136*	solid....	27.20	selec....	top worm*
Gersix...............C	5,000	2,500	148*	solid....	33.75	selec....	top worm
Gramm-Bernstein.....	5,000	2,600	156	solid....	29.00	ind-c....	top worm
Kleiber.............2	5,000	2,750	150*	solid....	27.20	selec....	top worm
Larrabee.............	5,000	2,200	140*	solid....	27.20	selec....	top worm
Martin..............E	5,000	2,800	135	solid....	29.00	selec....	dbl chn*
Mogul...............L	5,000	2,250	138*	solid....	27.20	selec....	dbl chn
Moore...............	5,000	2,500	162½	solid....	32.40	selec....	dbl chn
Moreland............	5,000	2,400	168*	solid....	32.40	selec....	top worm
Stegeman............	5,000	2,500	144*	solid....	27 20	selec....	top worm*
Stegeman......Special	5,000	2,500	142*	solid....	27.20	selec....	top worm*

TRUCKS OF 3-TON CAPACITY

A&B.................	6,000	....	144	solid....	42 64	selec....	int-g-f
Avery...............B	6,000	3,200	128	solid....	36.15	selec....	dbl chn
Avery...............A	6,000	2,500-c	140	wood....	36.15	selec....	dbl chn
Beech Creek........3A	6,000	....	132	solid....	40.00	....	bevel-4
Blair..............2D	6,000	3,250	121*	solid....	29.00	ind-c....	top worm
Coleman............H	6,000	3,000	138	solid....	36.15	selec....	dbl chn
Duplex..............D	6,000	3,300	130*	solid....	29.00	selec....	int-g-4
F.W.D..............B	6,000	4,000	124	solid....	36.15	selec....	bevel-4
G. A. Schacht.........	6,000	3,200	168*	solid....	29.00	selec....	top worm
Horner...........F-G	6,000	....	145*	solid....	32.40	selec....	top worm*
Kelly-Springfield..K-40	6,000	3,400	150*	solid....	32.40	selec....	dbl chn
Kisselkar.............	6,000	2,750	144	solid....	32.40	selec....	dbl chn
Krebs...............I	6,000	3,100	162*	solid....	27.20	selec....	top worm
Locomobile..........B	6,000	3,500	150	solid....	29.00	selec....	top worm
Mais.........K, L&H	6,000	3,300	132*	solid....	29.75	prog....	int-gear
Morton..............	6,000	....	112	solid....	36.15	selec....	top worm-4
Nelson & LeMoon...E3	6,000	2,950	opt.....	solid....	32.40	selec....	top worm
Packard...........3D	6,000	3,400	156*	solid....	32.40	prog....	top worm
Peerless..........TC3	6,000	....	151*	solid....	32.40	selec....	dbl chn
Republic............T	6,000	2,400	165*	solid....	29.00	selec....	int-gear
Rowe...........DFW	6,000	3,400	156	solid....	29.00	selec....	top worm
Sandow..............	6,000	3,000	186*	solid....	32.40	selec....	dbl chn
Sandow..............	6,000	2,500	186*	solid....	32.40	selec....	top worm
Universal...........A	6,000	3,400	132*	solid....	25.60	selec....	dbl chn
Voltz...............C	6,000	2,750	142	solid....	32.40	selec....	dbl chn
Vulcan..............	6,000	3,250	156*	solid....	30.00	selec....	dbl chn
White...........TAD	6,000	3,700	163	solid....	22.50	selec....	dbl chn

TRUCKS OF 3½-TON CAPACITY

Acason..............	7,000	2,500	170	solid....	29.00	selec....	top worm
Armleder.........HW	7,000	3,500	156*	solid....	32.40	selec....	top worm
Atterbury..........6D	7,000	3,175	167½	solid....	32.40	selec....	top worm
Available............	7,000	3,000	opt.....	solid....	32.40	selec....	top worm
Bessemer...........E	7,000	2,800	150	solid....	32.40	selec....	top worm
Burford.............D	7,000	....	175*	solid....	32.40	selec....	top worm
C.T..................	7,000	4,800	132	solid....	36.15	elec.....	int-g-4
Continental (C).....M	7,000	3,000	168*	solid ...	32.40	selec....	top worm
Couple-Gear.......HC	7,000	4,800	144	solid....	53 00	elec.....	bevel-4
Dayton.............A	7,000	3,400	136	solid ...	36.15	selec ...	dbl chn
Diamond-T..........L	7,000	3,300	164*	solid....	32 40	selec....	top worm
Federal.............L	7,000	2,800	146	solid ...	32.40	selec ...	top worm
G.M.C.............70	7,000	3,175	163*	solid....	32.40	selec....	dbl chn
G.M.C.............71	7,000	3,175	163*	solid....	32.40	selec ...	top worm
Gramm-Bernstein.....	7,000	3,400	168	solid....	29.00	ind-c ...	top worm
Hall.................	7,000	2,800	144*	solid....	32.40	prog....	dbl chn
Hall.................	7,000	2,800	144*	solid....	32.40	prog....	top worm
Harvey...........WH	7,000	2,700	168*	solid....	29.00	selec....	top worm

TRUCKS OF 3½-TON CAPACITY (Cont'd)

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
King................	7,000	2,600	120	solid....	32.40	ind-c....	dbl chn
Kleiber.............3	7,000	3,300	160*	solid....	32.40	selec....	top worm
Knickerbocker......16	7,000	2,850	164*	solid....	32.40	selec....	top worm
Maccar.............O	7,000	3,250	174*	solid....	32.40	selec....	dbl chn
Maccar.............M	7,000	3,250	174*	solid....	32.40	selec....	top worm
Mack ....AC	7,000	3,400	168*	solid....	40.00	selec....	dbl chn
Modern.............B	7,000	....	176*	solid....	36.15	selec....	top worm
Mogul..............T	7,000	2,550	165*	solid....	32.40	selec....	dbl chn
Royal...............A	7,000	3,500	148	solid....	29.00	ind-c....	top worm
Selden.............N	7,000	2,950	164	solid....	32 40	selec....	top worm
Service..........HW	7,000	3,000	171*	solid....	32.40	selec....	top worm
Signal.............M	7,000	3,000	168*	solid....	32.40	selec....	top worm
South Bend........60	7,000	3,250	160*	solid....	36.15	selec....	top worm
Standard..........60	7,000	2,850	144*	solid....	32.40	selec....	top worm
Stegeman...........	7,000	....	156	solid....	33 75	selec....	top worm*
Sterling............	7,000	3,400	158*	solid....	29 00	selec....	top worm
Transit.............T	7,000	3,500	144*	solid....	32.40	selec....	dbl chn
United..........CSW	7,000	2,900	144*	solid....	32 40	selec....	top worm
U.S.................J	7,000	3,400	162	solid....	32.40	ind-c....	top worm
Velie..............26	7,000	3,350	172	solid....	32 40	selec....	top worm
Wichita ....O	7,000	3,250	165	solid....	29.00	selec....	top worm

TRUCKS OF 4-TON CAPACITY

Blair..............2E	8,000	3,750	135*	solid....	32.40	ind-c....	top worm
Kelly-Springfield..K-45	8,000	3,600	150*	solid....	32 40	selec....	dbl chn
Kisselkar............	8,000	3,350	162	solid....	38 25	selec....	dbl chn
Locomobile.........BB	8,000	3,650	150	solid....	29.00	selec....	top worm
Mais...............M	8,000	3,750	145*	solid....	29.75	prog....	int-gear
Martin..............L	8,000	3,300	145	solid....	36.15	selec....	dbl chn*
Moreland............	8,000	3,200	186*	solid....	36.15	selec....	top worm
Old Reliable..........	8,000	3,750	126	solid....	36.15	selec....	dbl chn
Packard...........4D	8,000	3,800	156*	solid...	32.40	prog....	top worm
Peerless..........TC4	8,000	....	151*	solid....	32.40	selec....	dbl chn
Standard..........40	8,000	3,025	144*	solid....	32.40	selec....	dbl chn

TRUCKS OF 5-TON CAPACITY

A&B................	10,000	....	144	solid....	42 64	selec....	int-g-f
Avery...............B	10,000	4,500	128	solid....	44.20	selec....	dbl chn
Blair..............2F	10,000	4,500	135*	solid....	32.40	ind-c....	top worm
C.T.................	10,000	5,200	156	solid....	41.61	elec.....	int-g-4
Couple-Gear........AC	10,000	5,200	144	solid....	53.00	elec.....	bevel-4
Dayton.............B	10,000	4,500	148	solid....	44.20	selec....	dbl chn
F.W.D.............M	10,000	4,800	148	solid....	44.20	selec....	bevel-4
Garford .... D	10,000	4,300	128*	solid....	36.15	selec....	dbl chn
G.M.C............100	10,000	....	163*	solid....	32.40	selec....	dbl chn
G.M.C............101	10,000	....	163*	solid....	32.40	selec....	top worm
Hall	10,000	3,400	144*	solid....	32.40	prog....	dbl chn
Harvey...........WK	10,000	3,400	168*	solid....	32.40	selec....	top worm
Horner.............F	10,000	....	156*	solid....	44.20	selec....	dbl chn
Kelly-Springfield..K-50	10,000	4,250	150*	solid....	32.40	selec....	dbl chn
Kleiber............5	10,000	4,250	170*	solid....	44.20	selec....	top worm
Moore..............	10,000	4,500	175	solid....	44.20	selec....	dbl chn
Old Reliable	10,000	4,250	126*	solid....	36.15	selec....	dbl chn
Peerless......... TC5	10,000	....	151*	solid....	32.40	selec....	dlb chn
Pierce-Arrow.........	10,000	4,500	168*	solid....	38.25	selec....	top worm
Rowe..... ..... TW	10,000	4,500	156	solid....	36.15	selec....	top worm
Royal ....A	10,000	4,500	138*	solid....	36.15	ind-c....	top worm*
Saurer....	10,000	4,800	153½	solid....	30.65	selec....	dbl chn
Service ....HX	10,000	4,000	171*	solid....	36.15	selec....	dbl chn
Standard..........50	10,000	3,400	144*	solid....	29.00	selec....	top worm
Stearns	10,000	3,800	144*	solid....	29.00	selec....	dbl chn
Sterling............	10,000	4,500	178	solid....	32.40	selec....	dbl chn
Sterling............	10,000	4,500	178	solid....	32.40	selec....	top worm
Tiffin..........RW-R	10,000	4,250*	168	solid....	33.75	selec....	top worm*
Transit.............V	10,000	4,500	144*	solid....	32.40	ind-c....	dbl chn

BREVIATIONS: General, *, *with other options;* opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind,** pneu, *pneumatic;* cush, *cushion;* sol-st, *solid in front, steel in rear;* p&s, *pneumatic i* *front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* **Final Drive,** bevel, *direct bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* top worm, *worm gear with worm* *on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 5-TON CAPACITY (Cont'd)

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
United..........ESW	10,000	3,500	144*	solid....	41.61	selec....	top worm
U.S................K	10,000	4,200	168	solid....	32.40	ind-c....	top worm
Voltz...............T	10,000	3,600	142	solid....	40 00	selec....	dbl chn
Vulcan...............	10,000	4,500	165*	solid....	30.00	selec....	dbl chn
Walter...............	10,000	4,750	144*	solid*...	30.65	selec....	spur-g-4
Watson...............	10,000	....	158	s&st....	30 65	selec....	spur-g-f
White...........TCD	10,000	4,500	169	solid....	29.00	selec....	dbl chn

TRUCKS OF 5½-TON CAPACITY

Mack.............AC	11,000	4,000	168*	solid....	40.00	selec....	dbl chn

TRUCKS OF 6-TON CAPACITY

Doane...............	12,000	4,500-c	178	solid....	36.15	selec....	dbl chn
Garford.............F	12,000	4,500	128*	solid....	41.61	selec....	dbl chn
Gramm-Bernstein.....	12,000	4,300	168*	solid....	32.40	ind-c....	top worm
G. V. Mercedes.....FV	12,000	....	169	solid....	29.00	selec....	int-gear
Kelly-Springfield..K-60	12,000	4,500	150*	solid....	32.40	selec....	dbl chn
Kisselkar............	12,000	4,350	168	solid....	38.25	selec....	dbl chn
Old Reliable..........	12,000	4,500	126*	solid....	36.15	selec....	dbl chn
Peerless..........TC6	12,000	....	151*	solid....	32.40	selec....	dbl chn
Royal...............A	12,000	4,800	140	solid....	41.61	ind-c....	dbl chn
Tiffin...........SW-S	12,000	4,550*	168	solid....	33.75	selec....	top worm*
Walter...............	12,000	5,000	144*	solid....	30.65	selec....	spur-g-4

TRUCKS OF 6½-TON CAPACITY

Name and Mode	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive
Saurer...............	13,000	5,800	156½	solid....	30.65	selec....	dbl chn

TRUCKS OF 7-TON CAPACITY AND OVER

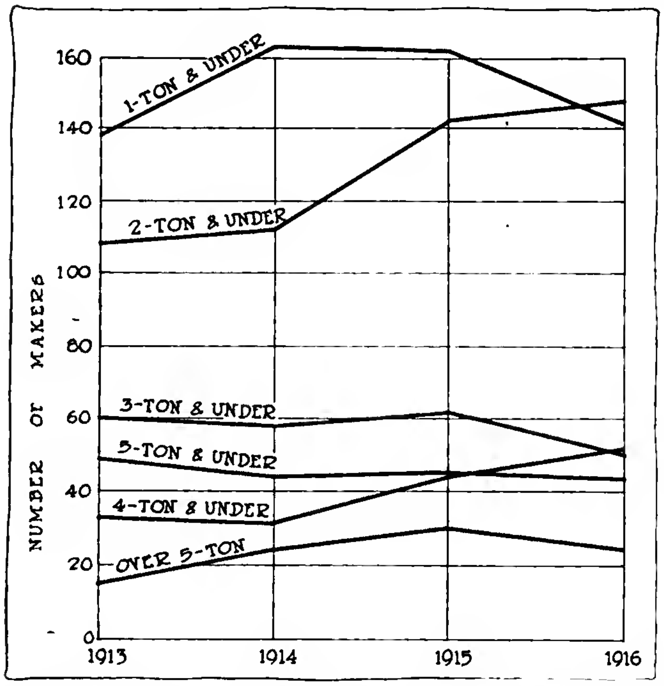
Dayton.............E	15,000	4,250	148	solid....	44.20	selec....	dbl chn
Mack.............AC	15,000	4,500	180	solid....	40.00	selec....	dbl chn
Sterling..............	14,000	4,750	178	solid....	36.15	selec....	dbl chn
Walter...............	15,000	5,250	144*	solid....	30.65	selec....	spur-g-4

TRACTORS

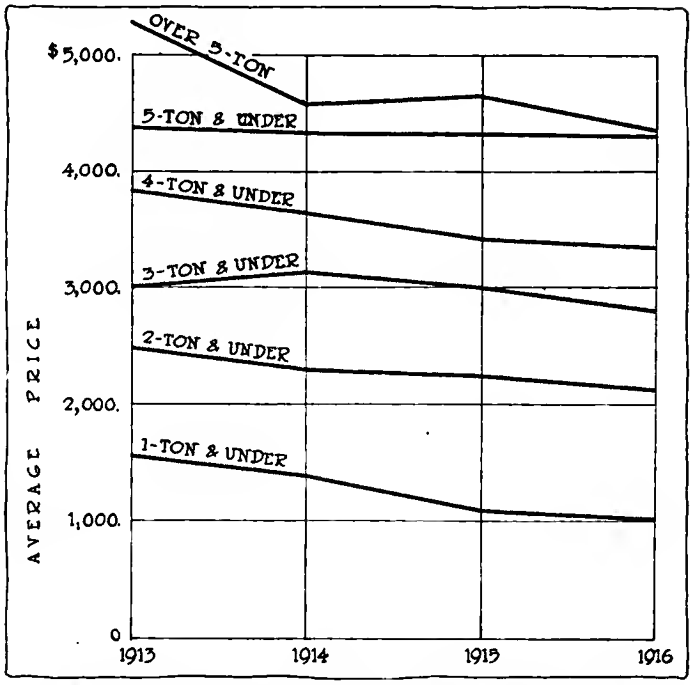
C.T...................	....	5,000	....	solid....	41.61	elec.....	int-g-4
Dominion.............	12,000	3,200	90	solid....	36.15	selec....	top worm
Knos..............35	....	4,500	108	solid....	40.00	selec....	dbl chn
Lombard............	10,000	....	....	steel....	....	....	top worm
Mack.............AC	30,000	4,000	116½	solid....	40.00	selec....	dbl chn
Mercury-Bulley......A	....	3,400	71	solid....	32.40	ind-c....	dbl chn
Mercury-Bulley.......	....	3,400	71	solid....	32.40	ind-c....	dbl chn
Phoenix Centiped.....	....	....	....	steel....	48.48	ind-c....	int-gear
Standard...........B	12,000	3,250	72	solid....	36.15	ind-c....	dbl chn
Standard...........D	20,000	4,000	76	solid....	36.15	ind-c....	dbl chn
Transport...........T	10,000	2,500	80	solid....	19.61	selec....	top worm
Walter...............	24,000	5,000	108*	solid....	30.65	selec....	spur-g-4

ABBREVIATIONS: **General**, *, *with other options;* opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind,** pneu, *pneumatic;* cush, *cushion;* sol-st, *solid in front, steel in rear;* p&s, *pneumatic in front, solid in rear;* p&c, *pneumatic in front, cushion in rear;* c&s, *cushion in front, solid in rear.* **Gearset Type,** prog, *progressive sliding gear;* selec, *selective sliding gear;* plan, *planetary;* ind-c, *constant-mesh individual clutch;* fric, *friction;* elec, *electric.* **Final Drive,** bevel, *direct bevel;* doub-red, *double-reduction, bevel and spur;* int-gear, *internal-gear;* top worm, *worm gear with worm on top;* dbl chn, *double chain;* sing chn, *single chain;* -f, *to front wheels;* -4 *to all four wheels.*

An Analysis of Tendencies in Load Capacities and Prices of Commercial Vehicles for Four Years



Above are illustrated the trends in load capacity, the number of makers of trucks of 1 ton and under jumping from 138 in 1913 to 163 in 1914 and holding to 162 the following year, the past year, however, showing a marked decrease to 141, a loss more than made up by the great increase in the number of makers of vehicles of 2 tons and under



Truck prices have been going down steadily during the past four years, the average 1-ton truck being $530.56 cheaper now than in 1913. Almost as marked a decline in price is shown in the 4-ton and under class which decreased its average price from $3,839.58 in 1913 to $3,413.64 for 1915 and $3,346.97 for 1916. There was a sharp drop in the price of the over 5-ton class during 1915

Technical Specifications of 53 Electric The American Market

Complete Details of Construction of Electric Motor turers, Including Particulars as to Battery, Motor, Giving Load Capacity and Mileage Per Charge with

Name and Model	Load Capacity in Pounds	PRICE OF CHASSIS		Wheelbase in Inches	TIRES			BATTERY								MOTOR		
		With Battery	Without Battery		Kind	SIZES IN INCHES Front	SIZES IN INCHES Rear	Location	Make and Type	No. Plates	No. Cells	No. Trays	Amp.-Hr. Capacity	MILES PER CHARGE Light	MILES PER CHARGE Loaded	Location and Number	Make	Winding
Baker........X	1,000	1,900	.....	86	solid...	36x3	36x3	amid-u...	Exide MV*........	9*	42*	6*	112*	65*	45*	rear 1....	G.E.........	series
Baker........O	2,000	2,300	.....	102	solid...	36x3½	36x3½	amid u...	Exide MV*........	11*	42*	7	140*	55*	40*	rear 1....	G.E.........	series
Baker........U	4,000	2,800	.....	120	solid...	36x4	36x3d	amid u...	Exide MV*........	13*	42*	6	168*	53*	40*	rear 1....	G.E.........	series
Baker........CC	7,000	3,500	.....	137	solid...	36x6	38x4d	amid u...	Exide MV*........	17*	42*	6	224*	50*	40*	rear 1....	G.E.........	series
Baker........EA	10,000	3,850	.....	137	solid...	36x7	38x5d	amid u	Exide MV*........	19*	42*	6	252*	40*	35*	rear 1....	G.E.........	series
Connorsville........	750	750	600	80	solid...	....	....	rear u & h	Philadelphia*......	17	16	2	204	....	....	....1....	G.E.........	series
Couple-Gear..Tractor HF1	4,000	2,250	1,850	80	solid...	36x5	30x3½	amid-u...	U.S.L.-WBT........	15	40	4	175	30	25	in wheel-1	Couple-Gear..	series
Couple-Gear........H	7,000	4,200	3,600	96	solid...	36x4d	36x4d	amid-u...	U.S.L.-WBT........	25	44	6	275	40	30	in wheel-4	Couple-Gear.	series
Couple-Gear........A	10,000	4,800	4,100	98	solid...	36x5d	36x5d	amid-u	U.S.L.-WBT........	27	44	6	300	35	25	io wheel-4	Couple-Gear..	series
Couple-Gear........AF	12,000	3,800	3,200	110*	s & st...	36x5d	60x5	amid-u...	U.S.L.-WBT........	29	48	6	325	40	35	in wheel-2	Couple-Gear..	series
C.T........	1,000	....	1,640	90*	solid...	36x2½	36x3	amid-u...	Edison-A4*........	....	60*	6*	150*	....	....	unit-x-2..	G.E.........	series
C.T........	2,000	....	2,095	100*	solid...	36x3½	36x4	amid-u...	Edisoo-A6*........	....	60*	6*	225*	....	....	unit-x-2..	G.E.........	series
C.T........	4,000	....	2,725	116	solid...	36x5	36x3½d	amid-u...	Edison-A8*........	....	60*	8*	300*	....	....	unit-x-2..	G.E.........	series
C.T........	7,000	....	3,530	115*	solid...	36x3½d	36x4d	amid-u	Edison-A10*........	....	60*	8*	375*	....	....	uoit-x-4..	G.E.........	series
C.T........	10,000	....	3,935	132*	solid...	36x4d	36x5d	amid-u...	Edison-A12*........	....	60*	8*	450*	....	....	unit-x-4..	O.E.........	series
G.M.C........1	1,000	1,580	1,200	106*	solid...	32x3	32x3½	amid-o...	Edison-A4*........	....	60*	....	150*	50*	45*	rear-1....	G.E.........	series
G.M.C........2	2,000	1,740	1,300	118*	solid...	32x3½	32x4	amid-o...	Edison-A5*........	....	60*	....	187.5*	50*	42*	rear-1....	G.E.........	series
G.M.C........3	3,000	1,940	1,450	130*	solid...	32x4	32x5	amid-o...	Edison-A6*........	....	60*	....	225*	50*	40*	rear-1....	G.E.........	series
G.M.C........4	4,000	2,200	1,650	138*	solid...	32x4	32x3½d	amid-o...	Edison-A6*........	....	60*	....	225*	40*	32*	rear-1....	G.E.........	series
G.M.C........7	7,000	2,600	2,000	150*	solid...	32x5	36x4d	amid-o...	Edison-A8*........	....	60*	....	300*	41*	32*	rear-1....	O.E.........	series
G.M.C........10	10,000	3,060	2,350	166*	solid...	36x6	36x6d	amid-o...	Edison-A10*........	....	60*	....	375*	35*	27*	rear-1....	G.E.........	series
G.M.C........12	12,000	3,720	2,500	174*	solid...	36x6	36x7d	amid-o...	Edisoo-A10*........	....	60*	....	375*	32*	24*	rear-1....	G.E.........	series
G.V........	1,000	....	....	88½	solid...	36x2½	36x2½	amid-u...	Philadelphia WTX*.	13*	44*	4*	153*	....	50*†	rear-1....	G.E.........	series
G.V........	1,000	....	....	107¾	solid...	36x3	36x3	u-hood...	Philadelphia WTX*.	15*	44*	4*	178.5*	....	65*†	amid-1...	G.E.........	series
G.V........	2,000	....	....	103	solid...	36x3½	36x3½	amid-u...	Philadelphia WTX*.	17*	44*	5*	204*	....	55*†	rear-1....	G.E.........	series
G.V........	4,000	....	....	111½	solid...	36x4	36x3d	amid-u...	Philadelphia WTX*.	21*	44*	6	225*	....	55*†	rear-1....	O.E.........	series
G.V........	7,000	....	....	184	solid...	36x6	36x6d	amid-u...	Philadelphia WTX*.	27*	44*	6	331*	....	50*†	rear-1....	G.E.........	series
G.V........	10,000	....	....	139	solid...	36x7	36x5d	amid-u...	Philadelphia WTX*.	31*	44*	6	382*	....	45*†	rear-1....	O.E.........	series
Lansden........S	750	1,850	1,175	90	cush...	34x3	34x4	u-seat....	Edison-A4........	....	60	10	....	....	60	unit-x-1..	G.E.........	series
Lanaden........M	1,000	2,310	1,500	90	solid...	36x2½	36x3	amid-u...	Edison-A4........	....	60	10	....	....	60	unit-j-1...	G.E.........	series
Lanaden........M	2,000	2,900	1,700	106	solid...	36x3	36x3½	amid-u...	Edison-A6........	....	60	10	....	....	60	unit-j-1...	G.E.........	series
Lanaden........M	4,000	3,660	2,100	120	solid...	36x4	36x3d	amid-u...	Edison-A8........	....	60	10	....	....	50	unit-j-1...	G.E.........	series
Lanaden........M	7,000	4,455	2,475	130	solid...	36x5	36x4d	amid-u...	Edison-A10........	....	60	10	....	....	50	unit-j-1...	G.E.........	series
Lanaden........M	10,000	5,190	2,850	142	solid...	36x6	36x5d	....	Edison-A12........	....	60	10	....	....	50	unit-j-1...	O.E.........	....
Laoaden........Tractor	20,000	3,660	2,100	58	solid...	30x4	30x5	amid-o...	Edison A8........	....	60	10	....	....	60	rear-1....	G.E.........	series
Walker........M	1,000	....	....	90*	solid...	34x3	36x3½	amid-u...	opt........	....	....	....	....	....	....	unit-x-1..	Westinghouse.	series
Walker........K	2,000	....	....	92*	solid...	34x3½	34x4	amid-u...	opt........	....	....	....	....	....	....	unit-x-1..	Westinghouse	series
Walker........L	4,000	....	....	107*	solid...	38x4	38x6	amid-u...	opt........	....	....	....	....	....	....	unit-x-1..	Westinghouse.	series
Walker........D	6,000	....	....	126*	solid...	36x5	38x5	amid-u...	opt........	....	....	....	....	....	....	unit-x-1..	Westinghouse.	series
Walker........E	8,000	....	....	130*	solid...	36x6	38x5d	amid-u...	opt........	....	....	....	....	....	....	unit-x-1..	Westinghnuse.	series
Walker........N	10,000	....	....	130*	solid...	36x7	38x6d	amid-u...	opt........	....	....	....	....	....	....	unit-x-1..	Westinghouse.	series
Walker Tractor........DK	20,000	....	....	74*	solid...	34x4	38x6*	rear-o....	opt........	....	....	....	....	....	....	unit-x-1..	Westinghouse.	series
Ward........WS	750	....	....	88	solid...	32x2½	32x2½	u-seat....	....	9	42	3	100	....	45	amid-1...	....	series
Ward........EO	1,000	....	....	90	solid...	32x2½	34x3	amid-u...	....	11	42	3	127	....	45	amid-1...	....	series
Ward........EA	2,000	....	....	99	solid...	34x3	36x4	amid-u...	....	13	42	....	153	....	40	amid-1...	....	series
Ward........EB	4,000	....	....	111	solid...	36x4	38x6	amid-u...	....	17	42	....	204	....	35	amid-1...	....	series
Ward........EC	7,000	....	....	132	solid...	38x6	40x3½d	amid-u...	....	23	42	....	280	....	30	amid-1...	....	series
Ward........ED	10,000	....	....	159	solid...	40x3½d	42x5d	amid-u...	....	29	42	....	357	....	25	amid-1...	....	series
Waverley........83	1,000	1,800	1,575	90	cush...	34x2½	34x2½	amid-u...	Exide*........	11	42	6	....	....	50	rear-1....	Waverley.....	series
Waverley........	2,000	2,150	....	104	solid...	35x5	35x5	amid-u...	Exide*........	15	42	....	....	....	45	rear-1....	G.E.........	series
Waverley........	4,000	3,000	....	114	solid...	37x5	37x4d	amid-u...	Exide*........	17	42	....	....	....	35	rear-1....	G.E.........	series
Waverley........	7,000	3,400	....	127	solid...	37x6	37x5d	amid-u...	Exide*........	21	42	....	....	....	35	rear-1....	G.E.........	series
Waverley........	10,000	3,950	....	136	solid...	37x7	37x7d	amid-u...	Exide*........	25	42	....	....	....	....	rear-1....	G.E.........	series

ABBREVIATIONS: General, *, *with other options;* opt, *optional.* **Tires, Kind,** cush, *cushion;* s & st, *solid in front and steel in rear.* **Tire Sizes,** d, *dual.* **Battery, Location,** amid-u, *amidships,* *below frame;* amid-o, *amidships over frame;* rear-o, *at rear, over frame;* rear-u & h, *at rear under frame and also under a hood forward;* u-hood, *under hood;* front-u, *in front, under frame;* u-seat, *under seat;* *at both ends, over frame.* **Battery, Make and Type,** Exide-Ir, *Exide-Ironclad type.* **Miles per Charge, Loaded,** †, *half way light, half loaded.* **Motor, Location and Number** ,amid, *amidships;* unit-j, *jackshaft;* unit-x, *unit with axle.* Numbers following *refer to number of motors in chassis*

ommercial Vehicle Chassis Listed on or the 1916 Season

rucks and Tractors Produced by Ten Manufac- rive, Controller, Springs, Tires and Prices, and ype of Steer and Controller Lever Arrangement

MOTOR		CONTROLLER			DRIVE					SPRINGS		CONTROL		Name and Model
SPEED IN MILES PER HOUR		Location	SPEEDS		GEARING		Total Gear Ratio	Torque Taken By	Propulsion Taken By	Front	Rear	Steer	Controller Lever	
Light	Loaded		F'w'd	Rear	First Reduction	Final Reduction								
14½	13	u-seat	5	3	s-chain	dbl chn	10 60–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Baker X**
12½	10½	u-seat	5	3	s-chain	dbl chn	10 00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Baker O**
10	9	u-seat	5	3	s-chain	dbl chn	14 00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Baker U**
9	8	u-seat	5	3	s-chain	dbl chn	16 20–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Baker CC**
8	7	u-seat	5	3	s-chain	dbl chn	19.00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Baker EA**
14			4	2	none	herring		tor-t		½-ell	½-ell	lever-l	l-seat	**Connorsville**
10	7	btw seats	4	4	none	bevel-f	25.00–1	springs	springs	½-ell	½-ell	wheel-r	btw seats	**Couple-Gear Tractor HF1**
10	8	btw seats	5	5	none	bevel-4	25 00–1	tor-arm	rad-rd	½-ell	½-ell	wheel-r	btw seats	**Couple-Gear H**
9	7	btw seats	5	5	none	bevel-4	25 00–1	tor-arm	rad-rd	½-ell	½-ell	wheel-r	btw seats	**Couple-Gear A**
7	6	btw seats	4	4	none	bevel-f	25.00–1	tor-arm	rad-rd	½-ell	½-ell	wheel-r	btw seats	**Couple-Gear AF**
15	13	u-floor	4	2	spur gear	spur gear	10.00–1	springs	rad-rd	¾-ell	½-ell	wheel-l	u-wheel	**C.T.**
14	12	u-floor	4	2	spur gear	spur gear	11.50–1	springs	rad-rd	½-ell	½-ell	wheel-l	u-wheel	**C.T.**
12	10	u-floor	4	2	spur gear	spur gear	12.14–1	springs	rad-rd	½-ell	½-ell	wheel-l	u-wheel	**C.T.**
11	9	u-floor	4	2	spur gear	spur gear-4	17.32–1	springs	rad-rd	½-ell	½-ell	wheel-l	u-wheel	**C.T.**
9	7	u-floor	4	2	spur gear	spur gear-4	20.14–1	springs	rad-rd	½-ell	½-ell	wheel-l	u-wheel	**C.T.**
	13	u-hood	5	1	bevel	dbl chn	8.40–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 1**
	12	u-hood	5	1	bevel	dbl chn	11.00–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 2**
	11	u-hood	5	1	bevel	dbl chn	12 20–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 3**
	10	u-hood	5	1	bevel	dbl chn	12 20–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 4**
	8	u-hood	5	1	bevel	dbl chn	12 70–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 7**
	7½	u-hood	5	1	bevel	dbl chn	15.70–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 10**
	6½	u-hood	5	1	bevel	dbl chn	15.70–1		rad-rd	½-ell	½-ell	wheel-l	t-wheel	**G.M.C. 12**
14	12	u-seat	5	2	s-chain	dbl chn	14.89–1		rad-rd	½-ell	½-ell	wheel-l	l-seat	**G.V.**
14	12	u-seat	5	2	nnne	top worm	9.00–1	springs	springs	½-ell	½-ell	wheel-l	l-seat	**G.V.**
12	10	u-seat	5	2	s-chain	dbl chn	10 76–1		rad-rd	½-ell	½-ell	wheel-l	l-seat	**G.V.**
11	9	u-seat	5	2	s-chain	dbl chn	11.61–1		rad rd	½-ell	½-ell	wheel-l	l-seat	**G.V.**
10	8	u-seat	5	2	s-chain	dbl chn	13.95–1		rad-rd	½-ell	½-ell	wheel-l	l-seat	**G.V.**
9	7	u-seat	5	2	s-chain	dbl chn	13.95–1		rad-rd	½-ell	½-ell	wheel-l	l-seat	**G.V.**
	15	u-hood	4	2	spur gear	bevel	12.00–1	tor-arm	springs	½-ell	½-ell	wheel-l	u-wheel	**Lansden S**
	12	u-hood	4	2	bevel	dbl chn	8 00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Lansden M**
	10	u-hood	4	2	bevel	dbl chn	10 00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Lansden M**
	9	u-hood	4	2	bevel	dbl chn	13.00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Lansden M**
	7	u-hood	4	2	bevel	dbl chn	13 00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Lansden M**
	6	u-hood	4	2	bevel	dbl chn	14.50–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Lansden M**
8	5	u-seat	4	2	s-chain	dbl chn	9.00–1		rad-rd	½-ell	½-ell	wheel-l	u-wheel	**Lansden Tractor**
13	14	u-seat	5	5	none	spur gear	17 00–1	springs	springs	½-ell	½-ell	wheel-l*	left	**Walker M**
14	13	u-seat	5	5	none	spur gear	17.00–1	springs	springs	½-ell	½-ell	wheel-l*	left	**Walker K**
12	12	u-seat	5	5	none	spur gear	17 00–1	springs	springs	½-ell	½-ell	wheel-l*	left	**Walker L**
11	10	u-seat	5	5	none	spur gear	16 00–1	springs	springs	½-ell	½-ell	wheel-l*	left	**Walker D**
11	10	u-seat	5	5	none	spur gear	16 00–1	springs	springs	½-ell	½-ell	wheel-l*	left	**Walker E**
11	10	u-seat	5	5	none	spur gear	16.00–1	springs	springs	½-ell	½-ell	wheel-l*	left	**Walker N**
8	6	u-seat	5	5	none	spur gear		springs	springs	½-ell	½-ell	wheel-l	left	**Walker Tractor DK**
	10	u-floor	4	2	none	sp-bev	6.10–1	springs	springs	½-ell	½-ell	wheel-l	u-wheel	**Ward WS**
	10	u-seat	4	2	s-chain	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Ward EO**
	8½	u-seat	4	2	s-chain	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Ward EA**
	7	u-seat	4	2	s-chain	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Ward EB**
	6	u-seat	4	2	s-chain	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Ward EC**
	5	u-seat	4	2	s-chain	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Ward ED**
	14	u-seat	4	4	s-chain	herring		springs	springs	ellip	ellip	wheel-l	left	**Waverley 83**
	11	u-seat	4	4	bevel	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Waverley**
	9	u-seat	4	4	bevel	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Waverley**
	8	u-seat	4	4	bevel	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Waverley**
	7	u-seat	4	4	bevel	dbl chn			rad-rd	½-ell	½-ell	wheel-l	left	**Waverley**

ntinued). **Controller, Location,** u-seat, *under seat;* u-floor, *under floor of cab;* u-hood, *under hood;* btw seats, *between seats.* **Drive, Gearing, First Reduction,** s-chain, *silent chain.* dbl chn, *double chain;* sp-bev, *spiral bevel gears;* herring, *herringbone gears;* -f, *to front wheels;* -4, *to all four wheels.* **Torque Taken By,** tor-arm, *torque arm;* tor-t, *torsion tube;* sub-f, *sub-frame.* Taken By, rad-rd, *radius rods;* sub-f, *sub-frame.* **Springs,** ellip, *elliptic;* ½-ell, *half-elliptic;* ¾-ell, *three-quarters-elliptic;* trans-x, *transverse X-shape or reversed elliptic.* **Control Steer,** -l, *to the left;* *the center.* **Controller Lever,** u-wheel, *under steering wheel;* t-wheel, *on top of steering wheel;* l-seat, *to left of seat;* btw seats *between seats;* cent, *center.*

A Price Guide to Electric Commercial Vehicles

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Classified According to Load Capacity and Including the Principal Points of Chassis Specification Relating to Trucks and Tractors Produced by Ten Manufacturers

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Connersville	750	$750	$600	80	rear-u&b		berring
Lansden S	750	1,850	1,175	90	u-seat	unit-x-1	bevel
Ward WS	750			88	u-seat	amid-1	sp-bev

TRUCKS OF ½-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Baker X	1,000	1,900		86	amid-u	rear-1	dbl chn
C.T	1,000		1,640	90*	amid-u	unit-x-2	spur gear
G.M.C 1	1,000	1,580	1,200	106*	amid-o	rear-1	dbl chn
G.V	1,000			88½	amid-u	rear-1	dbl chn
G.V	1,000			107½	u-hood	amid-1	top worm
Lansden M	1,000	2,310	1,500	90	amid-u	unit-j-1	dbl cbn
Walker M	1,000			90*	amid-u	unit-x-1	spur gear
Ward EO	1,000			90	amid-u	amid-1	dbl cbn
Waverley 83	1,000	1,800	1,575	90	amid-u	rear-1	berring

TRUCKS OF 1-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Baker O	2,000	2,300		102	amid-u	rear-1	dbl cbn
C.T	2,000		2,095	100*	amid-u	unit-x-2	spur gear
G.M.C 2	2,000	1,740	1,300	118*	amid-o	rear-1	dbl cbn
G.V	2,000			103	amid-u	rear-1	dbl chn
Lansden M	2,000	2,900	1,700	106	amid-u	unit-j-1	dbl chn
Walker K	2,000			92*	amid-u	unit-x-1	spur gear
Ward EA	2,000			99	amid-u	amid-1	dbl chn
Waverley	2,000	2,150		104	amid-u	rear-1	dbl cbn

TRUCKS OF 1½-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
G.M.C 3	3,000	1,940	1,450	130*	amid-o	rear-1	dbl chn

TRUCKS OF 2-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Baker U	4,000	2,800		120	amid-u	rear-1	dbl cbn
C.T	4,000		2,725	116	amid-u	unit-x-2	spur gear
G.M.C 4	4,000	2,200	1,650	138*	amid-o	rear-1	dbl cbn
G.V	4,000			111½	amid-u	rear-1	dbl cbn
Lansden M	4,000	3,660	2,100	120	amid-u	unit-j-1	dbl chn
Walker L	4,000			107*	amid-u	unit-x-1	spur gear
Ward EB	4,000			111	amid-u	amid-1	dbl cbn
Waverlay	4,000	3,000		114	amid-u	rear-1	dbl chn

TRUCKS OF 3-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Walker D	6,000			126*	amid-u	unit-x-1	spur gear

TRUCKS OF 3½-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Baker CC	7,000	3,500		137	amid-u	rear-1	dbl chn
Couple-Gaar H	7,000	4,200	3,600	96	amid-u	in wheel 4	bevel 4
C.T	7,000		3,530	115*	amid-u	unit-x-4	spur gear 4
G.M.C 7	7,000	2,600	2,000	150*	amid-o	rear-1	dbl chn
G.V	7,000			184	amid-u	rear-1	dbl chn
Lansden M	7,000	4,455	2,475	130	amid-u	unit-j-1	dbl chn
Ward EC	7,000			132	amid u	amid-1	dbl chn
Waverlay	7,000	3,400		127	amid-u	rear-1	dbl chn

TRUCKS OF 4-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Walker E	8,000			130*	amid-u	unit-x-1	spur gear

TRUCKS OF 5-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Baker EA	10,000	3,850		137	amid-u	rear-1	dbl chn
Couple-Gaar A	10,000	4,800	4,100	98	amid-u	in wheel-4	bevel 4
C.T	10,000		3,935	132*	amid-u	unit-x-4	spur-gear-4
G.M.C 10	10,000	3,060	2,350	166*	amid-o	rear-1	dbl chn
G.V	10,000			139	amid-u	rear-1	dbl chn
Lansden M	10,000	5,190	2,850	142		unit-j-1	dbl chn
Walker N	10,000			130*	amid-u	unit-x-1	spur gear
Ward ED	10,000			159	amid-u	amid-1	dbl chn
Waverlay	10,000	3,950		136	amid-u	rear-1	dbl chn

TRUCKS OF 6-TON CAPACITY

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Couple-Gear AF	12,000	3,800	3,200	110*	amid-u	in wheel-2	bevel f
G.M.C 12	12,000	3,720	2,500	174*	amid-o	rear-1	dbl chn

TRACTORS

Name and Model	Capacity in Lbs.	Chassis Price: With Battery	Chassis Price: Without Battery	Wh'l-base	Battery Location	Motor Location and Number	Final Drive
Couple-Gaar HF1	4,000	2,250	1,850	80	amid-u	in wheel-1	bevel-f
Lansdan	20,000	3,660	2,100	58	amid-o	rear-1	dbl chn
Walker DK	20,000			74*	rear-o	unit-x-1	spur gear

ABBREVIATIONS: General *, *with other options;* **Battery Location,** amid-u, *amidships, underslung below frame;* amid-o. *amidships over frame;* rear-o, *at rear, over frame;* rear-u&b, *at rear under frame and also under a hood forward;* u-hood, *under hood;* front-u, *in front, under frame;* u-seat, *under seat;* ends-o. *at both ends, over frame.* **Motor, Location and Number,** amid, *amidships;* unit-j, *unit with jackshaft;* unit-x, *unit with axle.* Numbers following *refer to number of motors in chassis.* **Final Drive,** dbl chn, *double chain;* sp-bev, *spiral bevel gears;* herring, *herringbone gears;* -f, *to front wheels;* -4, *to all four wheels.*

A Directory of Motor Truck Makers

247 Manufacturers of Gasoline, Steam and Electric Commercial Vehicles for 1916

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures refer to capacity, not number of models*														
			Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
			Gasoline Vehicles														
A. & B.	American & British Mfg. Co.	Providence, R. I.								3			5				
A. & R.	Abendroth & Root Mfg. Co.	Newburgh, N. Y.								3		4	5				
Acme	Cadillac Auto Truck Co.	Cadillac, Mich.						2									
Adams	Adams Truck, Fdy. & Machine Co.	Findlay, Ohio				1	1½		2½								
Acason	Acason Motor Truck Co.	Detroit, Mich.						2			3½						
Allis-Chalmers	Allis-Chalmers Mfg. Co.	Milwaukee, Wis.											5				
Armleder	O. Armleder Co.	Cincinnati, Ohio						2	2½		3½						
Atterbury	Atterbury Motor Car Co.	Buffalo, N. Y.				1		2			3½						
Auglaize	Auglaize Motor Car Co.	New Bremen, Ohio			¾												
Autocar	Autocar Co.	Ardmore, Pa.					1½	2									
Available	Available Truck Co.	Chicago, Ill.				1		2			3½						
Avery	Avery Co.	Peoria, Ill.				1		2		3			5				
Barker	C. L. Barker	Norwalk, Conn.				1		2									
Bauer	Bauer Machine Wks. Co.	Kansas City, Mo.		½	¾												
Beach Creek	Beach Creek Truck & Auto Co.	Beach Creek, Pa.								3							
Bell	Bell Motor Car Co.	York, Pa.		½													
Bessemer	Bessemer Motor Truck Co.	Grove City, Pa.			¾		1½	2			3½						
Blair	Blair Motor Truck Co.	Newark, Ohio						2		3		4	5				
Board	B. F. Board Motor Truck Co.	Alexandria, Va.															
Bollstrom	Bollstrom Products Sales Co.	Battle Creek, Mich.			¾												
Brasie	Brasie Motor Truck Co.	Minneapolis, Minn.	¼														
Brennan	Brennan Mfg. Co.	Syracuse, N. Y.															
Brinton	Chester County Motor Co.	Coatesville, Pa.		½					2½								
Briscoe	Briscoe Motor Co.	Jackson, Mich.		½													
Brockway	Brockway Motor Wagon Co.	Cortland, N. Y.				1¼		2									
Bucklen	H. E. Bucklen, Jr., Motor Truck Co.	Elkhart, Ind.			¾		1½		2½								
Buick	Buick Motor Co.	Flint, Mich.			¾												
Burford	H. G. Burford Co.	Fremont, Ohio						2			3½						
Carlton	Carlton-Hill Motor Car Co.	Rutherford, N. J.															
Carroll	Carroll Motor Car Co.	Strasburg, Pa.															
Casey	F. A. Casey	Billerica, Mass.		½													
Chase	Chase Motor Truck Co.	Syracuse, N. Y.				1		2			3½						
Coleman	Coleman Carriage & Harness Co.	Ilion, N. Y.						2		3							
Columbia	Columbia Motor Truck & Trailer Co.	Pontiac, Mich.						2									
Commerce	Commerce Motor Car Co.	Detroit, Mich.			¾												
C. T.	Commercial Truck Co. of America	Philadelphia, Pa.									3½		5				T
Continental (C)	Continental Motor Truck Co.	Chicago, Ill.				1	1½	2			3½						
Continental (S)	Continental Truck Mfg. Co.	Superior, Wis.					1½			3							
Corbitt	Corbitt Automobile Co.	Henderson, N. C.				1		2									
Couple-Gear	Couple-Gear Freight Wheel Co.	Grand Rapids, Mich.									3½		5				
Crawford	Crawford Automobile Co.	Hagerstown, Md.								3							
Croce	Croce Automobile Co.	Asbury Park, N. J.		½			1½		2½								
Crowther	Crowther Motor Co.	Philadelphia, Pa.		½													
Crown	Crown Commercial Car Co.	N. Milwaukee, Wis.			¾		1½		2½								
Curtis	Pittsburgh Machine Tool Co.	Braddock, Pa.						2		3							
Dain	Dain Mfg. Co.	Ottumwa, Iowa				1											
Dart	Dart Motor Truck Co.	Waterloo, Iowa			¾	1		2	2½								
Dayton	Durable Dayton Truck Co.	Dayton, Ohio						2			3½		5				7½
DeKalb	DeKalb Wagon Wks.	DeKalb, Ill.					1½		2½								
Denby	Denby Motor Truck Co.	Detroit, Mich.			¾	1	1½	2									
Detroit	Detroit Commercial Car Co.	Pontiac, Mich.		½													
Diamond-T	Diamond-T Motor Car Co.	Chicago, Ill.			¾		1½	2			3½						
Dispatch	Dispatch Motor Car Co.	Minneapolis, Minn.		¾													
Doane	Doane Motor Truck Co.	San Francisco, Cal.													6		
Dorris	Dorris Motor Car Co.	St. Louis, Mo.			¾			2									
Duffy	Duffy Bros. Motor Truck Co.	San Francisco, Cal.															
Duplex	Duplex Power Car Co.	Charlotte, Mich.						2		3							
Durocar	Amalgamated Motors Corp.	Alhambra, Cal.		½													
Duryea	Duryea Laboratories	Philadelphia, Pa.		½													
Dominion Tractor	Dominion Motor Truck Co.	Detroit, Mich.													6		T
Eastern	Eastern Power Truck Co.	Providence, R. I.															
Elbert	Elbert Motor Car Co.	Tacoma, Wash.															
Elmira	Elmira Commercial Car Co.	Elmira, N. Y.															
Erie	Erie Motor Truck Mfg. Co.	Erie, Pa.															
Falcon	Falcon Motor Truck Co.	Detroit, Mich.		½													
Fargo	Fargo Motor Car Co.	Chicago, Ill.				1		2									
Fawick	Fawick Motor Car Co.	Sioux Falls, S. D.		½	¾	1		2									
Federal	Federal Motor Truck Co.	Detroit, Mich.					1½				3½						
Forschler	Phillip Forschler Wagon Co.	New Orleans, La.					1½										
F.W.D.	Four Wheel Drive Auto Co.	Clintonville, Wis.					1½			3			5				
Franklin	Franklin Commercial Truck Co.	Franklin, Pa.															
Gabriel	Gabriel Auto Co.	Cleveland, Ohio			¾	1	1½										
Garford	Garford Motor Truck Co.	Lima, Ohio			¾	1	1½	2					5		6		
Gary	Gary Motor Truck Co.	Gary, Ind.			¾	1	1½	2									
G. A. Schacht	G. A. Schacht Motor Truck Co.	Cincinnati, Ohio						2		3							
Gay	S. G. Gay Co.	Ottawa, Ill.															
Geneva	Geneva Wagon Co.	Geneva, N. Y.			¾												
Gersix	Gerlinger Motor Car Co.	Portland, Ore.		2½													
Globe	Globe Furniture Co.	Northville, Mich.															
G.M.C.	General Motors Truck Co.	Pontiac, Mich.			¾	1¼	1½	2			3½		5				

Heavy type represents vehicles whose specifications are given in this issue.

A Directory of 247 Manufacturers of Gasoline, Stea

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures refer to capacity, not number of models*														
			Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
Gramm-Bernstein	Gramm-Bernstein Co.	Lima, Ohio				1	1½		2½		3½				6		
Great Southern	Great Southern Automobile Co.	Birmingham, Ala.						2				4					
G.V.-Mercedes	General Vehicle Co.	Long Island City, N. Y.													6		
Hahn	Hahn Motor Truck Co.	Hamburg, Pa.															
Hall	Lewis-Hall Iron Wks.	Detroit, Mich.									3½		5				
Handy Wagon	Auburn Motor Chassis Co.	Auburn, Ind.	¼	½													
Hanger	C. F. Hanger Co.	Cleveland, Ohio.		½													
Harrison	Robert Harrison Co.	So. Boston, Mass.															
Harvey	Harvey Motor Truck Co.	Harvey, Ill.									3½		5				
Henderson	Henderson Bros.	North Cambridge, Mass.		½		1											
Hercules	Hercules Motor Truck Co.	So. Boston, Mass.															
Hoadley	Hoadley Bros.	Gosport, Ind.						2									
Horner	Detroit-Wyandotte Motor Co.	Wyandotte, Mich.					1½	2		3			5				
Haughton	Haughton Sulky Co.	Marion, Ohio.				1											
Howard	R. G. Howard	Boston, Mass.			¾												
Hurlburt	Hurlburt Motor Truck Co.	New York City				1		2			3½						
Hannibal	Hannibal Motor Car Co.	Hannibal, Mo.		½													
I. H. C.	International Harvester Corp.	Akron, Ohio		½	¾	1											
Independent	Independent Motors Corp.	Port Huron, Mich.			¾			2									
Indiana	Harwood-Barley Mfg. Co.	Marion, Ind.				1	1½			3			5				
Iowa	Iowa Motor Truck Co.	Ottumwa, Iowa				1	1½										
Jeffery	Thomas B. Jeffery Co.	Kenosha, Wis.						2									
Kanawha	Kanawha Auto Truck Co.	Charleston, W. Va.															
Kearns	Kearns Motor Car Co.	Beavertown, Pa.	¼	½													
Kelly-Springfield	Kelly-Springfield Motor Truck Co.	Springfield, Ohio.				1	1½	2		3		4	5		6		
King	A. R. King Mfg. Co.	Kingston, N. Y.									3½						
Kisselkar	Kissel Motor Car Co.	Hartford, Wis.		½		1		2		3		4			6		
Kleiber	Kleiber Co., Inc.	San Francisco, Cal.					1½		2½		3½		5				
Knickerbocker	Knickerbocker Motor Truck Co.	New York City						2			3½						
Knox Tractor	Knox Motors Associates.	Springfield, Mass.															T
Koehler	H. J. Koehler S. G. Co.	Newark, N. J.				1											
Kopp	Kopp Motor Truck Co.	Buffalo, N. Y.					1½			3			5				
Kosmath	Kosmath Co.	Detroit, Mich.		½													
Krebs	Krebs Commercial Car Co.	Clyde, Ohio.			¾	1		2		3							
Lambert	Buckeye Mfg. Co.	Anderson, Ind.		½		1		2									
Landshaft	William Landshaft & Son.	Chicago, Ill.				1		2									
Lange	Lange Motor Truck Co.	Pittsburgh, Pa.				1		2									
Larrabee	Larrabee-Deyo Motor Truck Co.	Binghamton, N. Y.					1½		2½								
Lenox	Lenox Motor Car Co.	Boston, Mass.															
Lima	Lima Light Car Mfg. Co.	Lima, Ohio		½													
Lippard-Stewart	Lippard-Stewart Motor Car Co.	Buffalo, N. Y.		½	¾	1	1½	2									
Little Giant	Chicago Pneumatic Tool Co.	Chicago, Ill.			¾		1½	2									
Lincoln	Lincoln Motor Truck Co.	Detroit, Mich.			¾												
Locomobile	Locomobile Co. of America	Bridgeport, Conn.								3		4					
Lord Baltimore	Lord Baltimore Motor Truck Co.	Baltimore, Md.				1		2									
Lombard	Lombard Auto Tractor-Truck Corp.	New York City											5				
Maccar	Maccar Co.	Scranton, Pa.				1		2			3½						
Mack	International Motor Co.	New York City				1	1½	2			3½			5½			7½ T
Mais	Mais Motor Truck Co.	Indianapolis, Ind.					1½	2		3		4					
Martin	Martin Carriage Wks.	York, Pa.				1		2	2½			4					
Menominee	D. F. Poyer Co.	Menominee, Mich.			¾	1¾		2									
Mercury	Mercury Mfg. Co.	Chicago, Ill.		½													
Mercury-Bulley Tractor	Mercury Mfg. Co.	Chicago, Ill.															T
Metz	Metz Co.	Waltham, Mass.				½											
Modern	Bowling Green Motor Car Co.	Bowling Green, Ohio.				1	1½	2			3½						
Mogul	Mogul Motor Truck Co.	St. Louis, Mo.					1½	2	2½		3½						
Monitor	Monitor Automobile Wks.	Janesville, Wis.		½		1											
Moon	Joseph W. Moon Buggy Co.	St. Louis, Mo.					1½										
Moore	Pacific Metal Products Co.	Torrence, Cal.							2½				5				
Moreland	Moreland Motor Truck Co.	Los Angeles, Cal.				1	1½		2½			4					
Morton	Morton Truck & Tractor Co.	Harrisburg, Pa.								3							
Mohawk	Mohawk Motor Truck Co.	Ravenna, Ohio.															
Natco	National Motor Truck Co.	Bay City, Mich.				1											
Nelson & LeMoon	Nelson & LeMoon	Chicago, Ill.				1		2		3							
Netco	New England Truck Co.	Fitchburg, Mass.					1½	2									
Nevada	Nevada Mfg. Co.	Nevada, Iowa								3							
New York	Tegetmeier & Reipe	New York City					1½										
O. K.	O. K. Motor Truck Co.	Detroit, Mich.				1¾											
Old Hickory	Kentucky Wagon Mfg. Co.	Louisville, Ky.				1¼											
Old Reliable	Old Reliable Motor Truck Co.	Chicago, Ill.					1½	2				4	5		6		
Overland	Willys-Overland Co.	Toledo, Ohio.	¼														
Packard	Packard Motor Car Co.	Detroit, Mich.				1	1½	2		3		4					
Palmer	Palmer-Meyer Motor Car Co.	St. Louis, Mo.				1		2									
Palmer-Moore	Palmer-Moore Co.	Syracuse, N. Y.			¾	1											
Paulding	St. Louis Motor Truck Co.	St. Louis, Mo.			¾	1	1½	2									
Peerless	Peerless Motor Car Co.	Cleveland, Ohio						2		3		4	5		6		
Phoenix Centiped	Phoenix Mfg. Co.	Eau Claire, Wis.															
Pierce-Arrow	Pierce-Arrow Motor Car Co.	Buffalo, N. Y.						2					5				
Piercy	Hub Motor Truck Co.	Columbus, Ohio							2½								
Reo	Reo Motor Truck Co.	Lansing, Mich.			¾			2									
Republic	Republic Motor Truck Co.	Alma, Mich.			¾	1		2		3							
Robinson	Golden West Motors Co.	Sacramento, Cal.						2									
Rockford	Rockford Motor Truck Co.	Rockford, Ill.															
Rowe	Rowe Motor Co.	Downingtown, Pa.				1		2		3			5				
Royal	Royal Motor Truck Co.	New York City									3½		5		6		
R.-S.	Reading-Standard Co.	Reading, Pa.	½														
Salvador	Mansur Motor Truck Co.	Haverhill, Mass.						2									
Sandow	Sandow Truck Co.	Chicago, Ill.					1½	2		3							
Sanford	Sanford Motor Truck Co.	Syracuse, N. Y.			¾	1		2									
Saurer	International Motor Co.	New York City											5			6½	
Saxon	Saxon Motor Co.	Detroit, Mich.	½														

Heavy type represents vehicles whose specifications are given in this issue.

and Electric Commercial Vehicles for 1916—Continued

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures refer to capacity, not number of models*														
			Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
Schleicher	Schleicher Motor Vehicle Co	New York City						2		3			5				
Selden	Selden Motor Vehicle Co	Rochester, N. Y				1		2			3½						
Service	Service Motor Truck Co	Wabash, Ind				1	1½	2			3½		5				
Siebert	Siebert Motor Truck Co	Toledo, Ohio			¾												
Signal	Signal Motor Truck Co	Detroit, Mich				1	1½	2			3½						
Sphinx	Sphinx Motor Car Co	York, Pa		½													
South Bend	South Bend Motor Car Wks	South Bend, Ind			¾		1½	2			3½						
Standard	Standard Motor Truck Co	Detroit, Mich						2			3½	4	5				
Standard Tractor	Standard Tractor Co	Brooklyn, N. Y													6		10
Stearns	F. B. Stearns Co	Cleveland, Ohio											5				
Steele	W. M. Steele	Worcester, Mass						2		3		4	5				
Stegeman	Stegeman Motor Car Co	Milwaukee, Wis					1½		2½		3½						
Sterling	Sterling Motor Truck Co	Milwaukee, Wis			¾			2			3½		5				7
Stewart (B)	Stewart Motor Corp	Buffalo, N. Y			¾	1¼											
Stewart (C)	Stewart Iron Wks	Covington, Ky				1											
Studebaker	Studebaker Corp	Detroit, Mich			¾	1											
Sullivan	Sullivan Motor Car Co	Rochester, N. Y					1½	2									
Superior	E. G. Willingham's Sons	Atlanta, Ga				1		2									
Tiffin	Tiffin Wagon Co	Tiffin, Ohio			¾	1	1½	2					5		6		
Toeppner	Toeppner Bros	Bay City, Mich															
Toledo	Toledo Motor Truck Co	Toledo, Ohio															
Tower	Tower Motor Truck Co	Greenville, Mich						2									
Trabold	Trabold Motor Mfg. Co	Johnstown, Pa				1		2		3							
Transit	Transit Motor Car Co	Louisville, Ky				1		2			3½		5				
Transport Tractor	Transport Tractor Co	Long Island City, N. Y											5				T
Trumbull	Trumbull Motor Car Co	Bridgeport Conn	¼														
Twin City	Brasie Motor Car Co	Minneapolis, Minn				1		2									
Tulsa	Tulsa Automobile & Mfg. Co	Tulsa, Okla															
Universal	Universal Service Co	Detroit, Mich					1½	2		3							
United	United Motor Truck Co	Grand Rapids, Mich					1½	2			3½		5				
U. S.	United States Motor Truck Co	Cincinnati, Ohio						2			3½		5				
Van Winkle	Van Winkle Motor Truck Co	Atlanta, Ga															
Velie	Velie Motor Vehicle Co	Moline, Ill					1½				3½						
Vim	Vim Motor Truck Co	Philadelphia, Pa		½													
Voltz	Voltz Bros	Chicago, Ill								3			5				
Vulcan	Driggs-Seabury Ordnance Co	Sharon, Pa						2		3			5				
Walter	Walter Motor Truck Co	New York City											5		6		7½–12
Watson	Watson Wagon Co	Canastota, N. Y											5				
Ware	Twin City Four Wheel Drive Co	St. Paul, Minn								3							
Warren	Warren Motor Truck Co	Warren, Ohio															
Washington	Washington Motor Car Co	Hyattsville, Md											5		6		7
Weier-Smith	Weier-Smith Truck Co	Birmingham, Mich					1½										
West Coast	West Coast Wagon Co	Tacoma, Wash															
White	White Co	Cleveland, Ohio			¾		1½			3			5				
Wichita	Wichita Falls Motor Co	Wichita Falls, Texas				1	1½	2			3½						
Wilcox	H. E. Wilcox Motor Co	Minneapolis, Minn		½	¾	1	1½										
Wilson	J. C. Wilson Co	Detroit, Mich						2									
Wisconsin	Myers Machine Co	Sheboygan, Wis			¾	1		2									
Witt-Will	Witt-Will Co	Washington, D. C				1	1½										
Woods Mobilette	Woods Mobilette Co	Chicago, Ill	¼														
Zimmerman	Zimmerman Mfg. Co	Auburn, Ind		½													

Steam Vehicles

Name	Manufacturer	Address	Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
Stanley	**Stanley Motor Carriage Co**	**Newton, Mass**			**¾**	**1¼**											
Titan	**Titan Mntor Car Co**	**Newark, Del**															

Electric Vehicles

Name	Manufacturer	Address	Under ½	½	¾	1	1½	2	2½	3	3½	4	5	5½	6	6½	7 and over
Argo	American Electric Car Co	Saginaw, Mich		½		1											
Andover	Andover Motor Vehicle Co	Andover, Mass					1½										
Atlantic	Atlantic Vehicle Co	Newark, N. J		½		1		2			3½		5				
Baker	Baker-R. & L. Co	Cleveland, Ohio				1		2			3½		5				
Beaver	Beaver State Motor Co	Gresham, Ore															
Buffalo	Buffalo Electric Vehicle Co	Buffalo, N. Y				1											
Capitol	Capitol Truck Mfg. Co	Denver, Col															
Carl	Carl Electric Vehicle Co	Toledo, Ohio															
Connorsville	Connorsville Buggy Co	Connorsville, Ind	¼														
Couple-Gear	Couple-Gear Freight Wheel Co	Grand Rapids, Mich						2			3½		5		6		
C. T.	Commercial Truck Co	Philadelphia, Pa		½		1		2					5				
Dayton	Dayton Electric Car Co	Dayton, Ohio															
Field	Field Omnibus Co	New York City	18 to	38 p	asse	nger	hus	es									
Fritchle	Fritchle Automobile & Battery Co	Denver, Col		½													
G.M.C.	General Motors Truck Co	Pontiac, Mich		½		1	1½	2			3½			5	6		
G.V.	General Vehicle Co	Long Island City, N. Y		½		1		2			3½			5			
Lansden	Lansden Co., Ltd	Brooklyn, N. Y	¼	½		1		2			3½			5			T
Old Hickory	Kentucky Wagon Mfg. Co	Louisville, Ky				1											
Storms	Storms Electric Co	Detroit, Mich	¼														
Urban	Kentucky Wagon Mfg. Co	Louisville, Ky			¾		1½		2½				4				
Voltacar	Cyco-Lectric Car Co	New York City	¼														
Walker	Walker Vehicle Co	Chicago, Ill		½		1		2		3		4	5				T
Ward	Ward Motor Vehicle Co	Mount Vernon, N. Y	¼	½		1		2			3½		5				
Waverley	Waverley Co	Indianapolis, Ind		½		1		2			3½		5				

Heavy type represents vehicles whose specifications are given in this issue.

ENGINEERS COMPLETE WINTER SESSION

Nothing Settled by Ignition Talk

S.A.E. Discussion of Magneto versus Battery Inconclusive—Argument and Counter-Argument Leave Question Undecided

NEW YORK CITY, Jan. 6—The dominant feature of the winter professional session of the Society of Automobile Engineers, held at the Engineering Society Building here to-day, and which concluded the annual winter session of the society, was the discussion of battery vs. magneto ignition. That each has its field and its well-defined advantages was the conclusion reached by the majority of members, who were keenly interested in the discussion of this most pertinent factor of modern motor development. The session was well attended and demonstrated that the concentration of the professional work in one day is the wisest course.

The papers discussed were:

"Magneto vs. Battery Ignition," by Francis R. Hoyt, electrical engineer Simms Magneto Co., which stated the case for the magneto, claiming more power and general greater efficiency for the magneto system.

"Notes on Battery Ignition," by Alexander Churchward of the A. B. C. Starter Co., and "Battery vs. Magneto Ignition," by Frank Conrad, electrical engineer Westinghouse Electric & Mfg. Co., the two last named being opposed in their conclusions to the first paper.

Papers Taken Together

The papers were summarized in the last issue of THE AUTOMOBILE, and the discussion remained so general in character that there is no need to quote either paper in full detail.

Albion D. Libby, engineer of the Splitdorf Electrical Co., suggested that the discussion on all the ignition papers be taken together, and this was agreed to by K. W. Zimmerschied, chairman of the Standards Committee, who was presiding.

Battery Classification

Glenn S. Whitten failed to see the value of Mr. Churchward's classification of battery system, in which he mentions three different types, that having manual advance, that having automatic and that having semi-automatic advance. The proper classification he believes is the open and closed circuit.

Frank Conrad, Westinghouse electrical engineer, believes that in discussing ignition problems of to-day it is useless to bring up as an example a four-cylinder motor running at 1400 or 1500 r.p.m. The problem confronting ignition engineers now is eight- and twelve-cylinder motors running at 3000 r.p.m. Mr. Conrad declared it is not true that in the magneto the heat of the spark increases as the speed of the magneto increases. He said that this condition was merely due to the fact that there is an optical illusion in observing the discharge at the plug, because more sparks are created in a given amount of time. In justifying the claims for battery ignition, Mr. Conrad referred to the growing number using the battery ignition system.

Wm. G. Wall, National engineer, believes that all those who have used both types of ignition are likely to be prejudiced in favor of the magneto, and that he used to think magnetos were better because of the automatic advance feature, but has found that the advance is inappreciable and therefore, does not give any gain. "Of course," he went on, "the battery system has nothing to approach the automatic advance, although I think the magneto has advantages at high speed and I have had more horsepower output with magnetos. I had credited this to the follow-up current in the magneto. We see that the magneto is a self-contained instrument whereas the battery requires auxiliaries, and a generator is necessary. Furthermore, it is dependent upon the battery.

Question of Cost

"Both battery and magneto systems require power to drive them and the details are quite alike. The magneto has most of its parts near the driving system, while the battery has considerable wiring subject to troubles which may arise. There is no question that the battery system has great advantages and has been decreased greatly in cost. Therefore, many are coming to use it."

L. B. Brown of New York suggested that instead of the open-circuit and closed-circuit classification, the battery system be divided into cam-break and spring-break classes. In analyzing the advantages of the closed circuit, he stated that, if an ignition device were being designed for a single-cylinder motor, the period of contact of the primary would be made as short as possible. This same theory should apply to multi-cylinders.

R. H. Combs, Prest-O-Lite, took exception to Mr. Wall's remarks on the difficulties with battery systems due to the scattering of the units and said that as yet he has been unable to note any trouble due to this source.

Mr. Libby stated that while in his belief both battery and magneto ignition have their separate fields, it is incorrect to use a battery system on a car and then mark the switch as magneto. He also expressed himself as differing with Mr. Conrad's remark in his paper that there are space limitations with the magneto, thus cutting the voltage. He said that these remarks should not apply to the stationary-coil design on which there can be as many turns of secondary wire as are wanted.

Battery Exchange System

Regarding the battery situation, Mr. Libby said it is quite important to note the present tendency toward adjustments in battery exchange in the same way that adjustments are made on tires.

"This is a dangerous practice, as it results in the owner not giving attention to the battery, since he believes that for $5 he can secure a new battery. It often happens that owners will neglect the battery during the spring and summer and the result is that in the winter when the capacity of the battery is a limited percentage of the total rated capacity, the motor will not start." As an illustration to bring out the force of this statement, he stated that at 3 deg. above 0 deg. Fahr., the capacity of the battery is only 50 per cent of the rating.

Francis R. Hoyt took exception to Mr. Conrad's statement in saying that the spark heat does not increase with the speed on magneto ignition. He stated that this is entirely a matter of individual design and can be arranged to suit the engine. The reason for not furnishing more heat is simply that it is not necessary and not because it cannot be given. Another point which he brought out is that an error in timing of 1 deg. in the battery system is 2 deg. on the crankshaft, whereas generally magnetos are driven at crankshaft speed.

Herbert Chase, chief engineer of the Automobile Club of America, emphasized the point that in making ignition tests, the actual position of the spark in the cylinder is what should be observed and not merely the position of the spark lever on the steering wheel quadrant. He also said that Mr. Hoyt's statement that flame propagation depends upon the size of the spark has never been proved. He pointed out that once ignition is accomplished, no more effect occurs from a follow-up spark. Speaking from experience, as service manager at the Automobile Club of America, Mr. Chase said that the batteries on the car cause more trouble than any other detail.

Russell Huff, chief engineer of Dodge Bros. and president-elect of the S. A. E., said, "We are likely to lose sight of the part the carbureter plays in the successful ignition of the car. I would refer you to tests which have been made covering this identical subject. One speaker mentions the prolonged spark as a benefit. True, with poor carburetion a magneto will give more power, but when perfect mixtures are furnished it is not possible to get any more power from a magneto than from a battery. The magneto has not the range of advance of the battery system and I have found that the battery-ignited car will pull away from the magneto-ignited car on high speed. I have made tests on a motor which stood in a room 8 deg. below zero and the motor started on the third revolution of the crankshaft. I have seen this same motor fail to start in a warm atmosphere when suffering from a bad carbureter adjustment."

Examples of Large Advance

C. T. Kettering, vice-president of the Dayton Engineering Laboratories Co., cited a few examples of advance. He said that the Cadillac eight at 3000 r.p.m. and the Packard twelve at the same speed had 28 deg. advance while the Hudson six at 3000 has 27 deg. advance. Furthermore, he stated that it is not fair to attempt to analyze the whole problem from one type of ignition.

The Past and Future of the S. A. E.

President and President-Elect Review the Work Accomplished and the Tasks Ahead of the Society

NEW YORK CITY, Jan. 6—At the opening of the professional session of the S. A. E. in the Engineering Societies Building, President VanDervoort and President-Elect Russell Huff, each gave their views as to the past and future of the S. A. E.

President VanDervoort in opening the meeting made his parting address as a president of the S. A. E. He dwelt upon the accomplishments of the year and upon the outlook into the future. He stated that he had fully realized the responsibility of his position as president and that his only regret is that he was not able to accomplish more. He spoke of the importance of wisely selecting the officers and committees of the society in order that the work which has been planned will be successfully carried to a termination. Looking back over the year, Mr. VanDervoort said that the year had been one of constructive work by the society.

Following President VanDervoort, President-Elect Russell Huff told how he had taken part in the earlier development of the society and dwelt especially on the vast importance of the standardization work, saying that it had saved millions of dollars to the industry though as yet the work had but scratched the surface of what remained to be done.

Extracts from Presidentisl Address

After stating his appreciation of the position he held as president of the society Mr. VanDervoort continued:

"I have keenly appreciated the friendly and loyal support you have all given me and shall always look back upon the year of work and association with you as a most pleasant one. It has been a year of constructive work marked at every turn with that spirit of unselfishness, of cooperation and untiring effort on the part of all that has become characteristic of the entire industry of which the Society of Automobile Engineers constitutes so important an element. The story of the development of this industry reads like a fairy tale and to the engineer is due in large measure credit for the remarkable growth of the industry.

"It is to be regretted that our membership has, during the past year, fallen off somewhat. We believe, however, the standard of membership has improved. The past year included several of the very worst months of the recent business depression. Many good members found it necessary, for financial reasons, to drop out, and for the same reason much good material found it impossible to join. Again, we have systematically cleaned the membership lists of much dead material, leaving it at the present time in a most healthy condition. It has also been the policy of the council to scrutinize most carefully the qualifications of all applicants in the belief that we should first build up the quality of our membership and its work with the assurance that by so doing we will attract to the society the best membership material. I believe that although slightly weaker numerically, we have gained much in efficiency, 'By our efforts they shall know us.' Let us all look upon our membership in the Society of Automobile Engineers as an asset of no mean value and let us gain in our work that recognition which will bring the unqualified support of every engineer and manager associated with the automobile industry.

Standards Not Realized

"I fear that the managements of many of our great automobile and accessory companies are not well informed as to the work the Society of Automobile Engineers is doing. They are all interested in the work of the society, either directly or indirectly, and we should use every effort to stimulate this interest in every way possible. We must have their interest in our work and their appreciation. This society has come to be a very necessary factor in the development of this greatest of American manufacturing industries and the unqualified support of those high up in the management of the affairs of these great institutions is absolutely essential to the healthy growth and development of our society.

Value Is Great

"We must labor for a keener appreciation of the stamp of the S. A. E., impressing upon all the desirability of following those recommendations made after a careful investigation and study of the various problems that are continually arising in this work. As engineers you are devoting your full energies toward the advancement of your employers' interests and it is only right that the employer should appreciate to the fullest extent your efforts. Largely through the instrumentality of this society you are kept in accord with that which is latest in automobile engineering work. In turn you are giving to others the benefit of your experience and judgment. Impress this fact upon those for whom you labor. Impress it upon those you feel would raise the standard of the society and be benefited themselves by membership in it.

"The success of this organization is due to the fact that its membership includes many of the best engineers in this line of work; that it has accomplished much in the way of research; that it has, in a measure, received the support of those higher up in the management of automobile industrial affairs. It is now verging, I predict, upon a still greater success, as indicated by the greater activities in the various sections, the greater interest shown in the work by those who heretofore have been passive in their recognition of the society. Better work means more and better members; more financial support; the widening of our lines of activities and the keener appreciation of our work by all. The measure of our success will be very largely determined by the wisdom of the policies as laid down by our manager and the council; by the thoroughness of the work accomplished by our standards committee; by the efforts of the individual members in the papers they present for publication; by the membership committee in its endeavor to interest good material in our work; by the enthusiasm of the members in the work of the sections and by the financial support we receive.

"The detail work that has devolved upon the chairman of the standards committee has become so great that steps will shortly have to be taken to relieve this officer of a still greater portion of this work through the organization of a suitable staff to take over the details of this most important branch of our activities.

"One of the most promising indications, to my mind, lies in the very marked activities of the various sections during the past year. Enthusiastic meetings have been held by all of the several sections and much good work accomplished. These meetings while benefiting directly the members, have had an equally broad, beneficial influence on the manufacturers in the various localities, as expressed by their recognition of the work of the society.

Officers of S. A. E.

President
Russell Huff

Vice-Presidents
E. S. Foljambe
R. H. Combs

Members of Council
To Serve Two Years
David Beecroft
E. R. Hall
J. G. Utz

To Serve One Year
G. W. Dunham

Treasurer
Herbert Chase

"The Midwest section starts its career under most favorable auspices and with a full realization of its responsibility to its members, the society and the automobile industry. Its membership includes many of the most earnest workers in the society and I feel sure that the Midwest section will make a good record for itself and bring honor to the society.

"The reorganization of the Pennsylvania section is of very great importance. This section again active in the work gives the society six localized centers of activities which with the support of the parent body can be depended upon for much good work.

Navy Board Appointment

"We have been honored with the request, and have elected two of our members to serve on the Naval Department Advisory Committee appointed by Secretary of the Navy Daniels. That our society will be well represented we feel sure, and in turn we can assure this committee and our government that unqualified support of every member of the S. A. E. should their services be required.

"Along the lines of standardization, it is the desire of the society to bring about a closer relationship between the manufacturers of the United States and European countries. While we fully appreciate the many serious obstacles standing in the way of international standards, we nevertheless believe that an effort should be made toward co-operation in that direction at this time, feeling that the situation can never become more favorable than it is to-day. We have placed our views on this subject and other features of our standardization work before the United States Bureau of Standards and have assurance of its support so far as consistently possible."

Following the president, Russell Huff spoke briefly in somewhat similar strain. He said:

"I have watched the growth of this society with keen interest for many years and when I review the vast amount of good work done by it since it was organized in 1905, it makes me feel proud to be one of its members. You have bestowed upon me the highest honor the society offers to its members in electing me to the presidency for the ensuing year. I fully appreciate your good intentions in this matter and am delighted to have this opportunity of extending to you my heartiest thanks for the faith and confidence which you show in me by this election.

"There is a great work ahead of us in carrying out the comprehensive plans which have been laid down by the society in the past. While the standards committee has already accomplished wonders in the pursuit of its work, it has really only scratched the surface, as is apparent when one stops to survey the field and sees the great possibilities for standardization work which are still untouched. This standardization work is a most worthy cause, and it needs your closest attention and constant support. While it is impossible to actually estimate in dollars and cents what our standards have saved the car manufacturer, the truck manufacturer, the tire manufacturer, the parts manufacturer and last but not least the customer, we know from the promptness with which manufacturers adopt our standards, from the high esteem in which this phase of our cause is held by the captains of this big industry, and from past records that it has saved the industry and consumer millions of dollars in added convenience and lower costs.

"It is my earnest hope that we can still further increase the sphere of influence of this society. We already have six live sections and one student branch, but I believe there is room for more student branches and possibly more sections. A number of new lines of endeavor closely allied to automobile engineering should receive our attention. I have in mind the good roads movement, aeroplane and motor boat engine development, and manufacturing engineering. We also need a comprehensive library and a good engineering digest. I simply cite these few examples out of many new lines of work which this society could take up and work at for the benefit of the industry, to show the many possibilities for growth and influence."

Electric Lighting Itemized

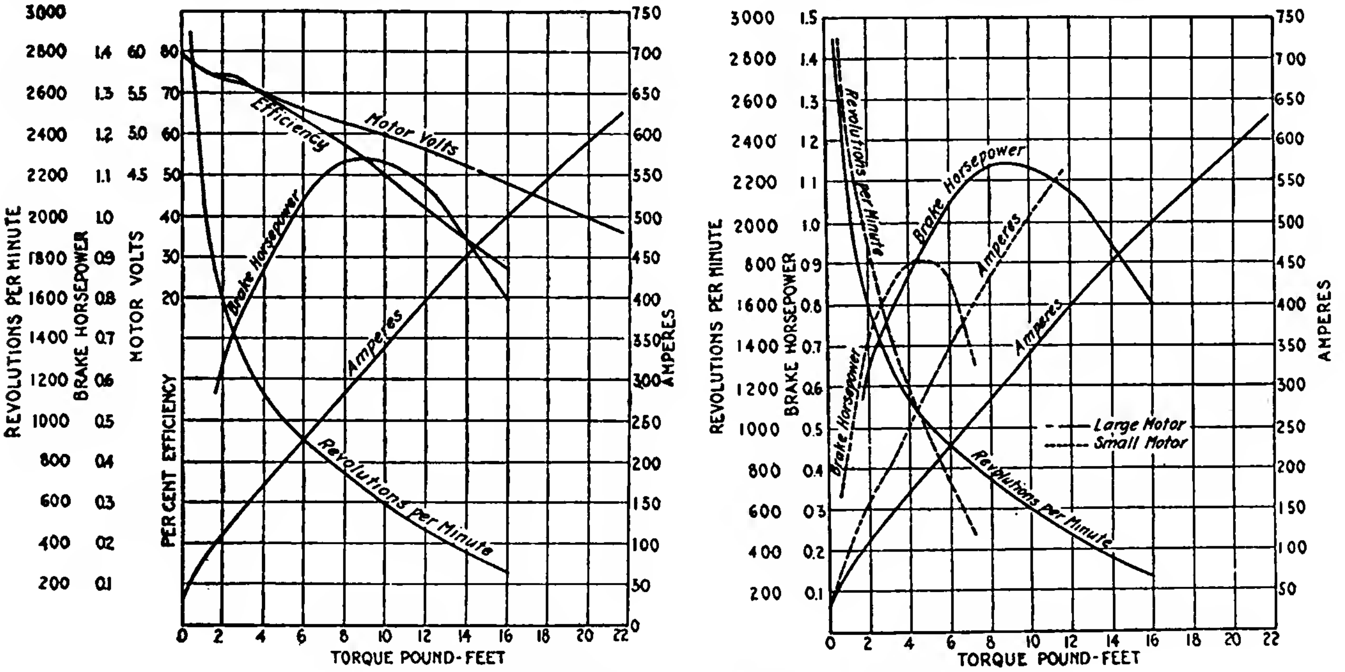
Joseph Bijur and Henry Schroeder Deal with Manufacture of Generators, Motors and Lamp Bulbs

NEW YORK CITY, Jan. 6—At the eleventh annual meeting of the S. A. E., the subject of lighting and starting was dealt with very fully by two authors who observed different sides of the manufacturing problem, these two papers making a completion of the review of automobile electricity commenced by the three other papers on the ignition systems of the day.

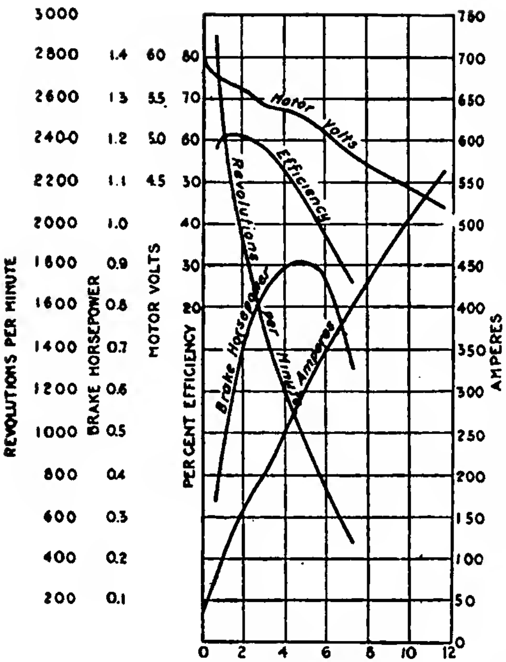
The first part of Joseph Bijur's paper dealt with the general principles of electrical equipment. The following is the second part of the paper and deals with the details of design.

Advantages of Bipolar Units

While the simplest generator to consider is a two-pole, one having a horseshoe or other shaped magnet, such generators have certain disadvantages; briefly, they have brushes 180 deg. apart, which usually means that if one brush is located so as to be accessible, the other, 180 deg. away, is necessarily inaccessible; also in such a bipolar generator the whole the flux has to pass through the entire length of the magnet circuit. If, as in a four-pole generator, we can split the flux so that we have to pass only half of it through half the length of the magnetic circuit, we can get a much more intense flux with the same amount of excitation. In such generators the brushes are 90 deg. apart at the commutator, which permits both brushes to be located in the upper or outer half-circle where both are accessible. If we consider such a four-pole generator and imagine that the exciting winding of the field magnet, known as the shunt winding, is connected across two main brushes, and that the iron always has some magnetism left in it at the beginning of rotation in the proper direction, the action will be as follows: The conductors cutting the residual flux generate a slight voltage and the sum of their added voltages appears as a difference of potential between the two brushes. Since the shunt winding is connected to these, a slight current flows through it, set up by this potential, thereby slightly increasing the excitation of the field magnet over the original residual excitation. The voltage of the armature is therefore higher, which in turn increases the field excitation, so that the voltage of the generator as a whole builds up to a value at which equilibrium is reached for any given speed of rotation. As the speed increases, the voltage of the generator rises from, say, zero to 7, at which point it is high enough to be useful in putting charge into the battery. Usually an automatic switch, excited by the generator voltage, closes at this time and connects the generator to the battery. Such a switch may be made by an arrangement of an electromagnet, having a spring-retracted armature which normally holds the circuit open, but closes it if the armature is attracted to the magnet core. The latter is energized by a fine-wire winding responsive to the voltage of the generator brushes. A coarse-wire coil of a few turns wound on the same magnet core is connected so as to be in series between the generator and the battery when the switch is closed, and its excitation by current from the generator in a direction to charge the battery, increases the pull of the fine-wire coil.



Characteristic curves for generator on left and starting motors on right



Characteristic curves of small starting motor

When the voltage of the generator falls below that of the battery, so that the battery discharges into the generator, the reversal of excitation of this coarse-wire coil neutralizes that of the fine-wire coil until the circuit is opened by the spring pulling the armature away. Assuming now that a generator and such a switch are provided, and that the switch is closed, current will pass from the generator to the battery, due to the fact that the difference of potential at the generator is higher than and overpowers the voltage of the battery. As current flows, even though the speed be not altered, the difference of potential at the generator brushes drops because the flow of current is accompanied by a resistance loss in the armature, brushes, etc., so that the increasing flow of current is accompanied by decreasing generator potential and thus equilibrium is reached. If the generator speed be now increased, a correspondingly larger current flows into the battery unless other factors enter into the operation. One of these factors is due to what is known as the reaction of the armature. The flow of current in the conductors of the armature is such that its cylindrical iron core is powerfully magnetized and opposite sides of it become strong magnetic poles. Magnetic flux is set up in this iron armature in the same way that is set up in any other iron body magnetized by a coil. With ordinary position for the brushes, this magnetic flux of the armature, or armature reaction, sets up a magnetizing force at right angle to the magnetic flux produced by the field magnets. The intensity of this cross-magnetization is proportionate to the number of turns on the armature and to the current flowing through them; that is to say, the more the turns on the armature and the greater the current they carry, the higher this cross-magnetization will be. This disurbing factor produces a resultant flux which tends to be stronger at the trailing edge of each pole and weaker at the entering edge, so that the intensity of flux is no longer distributed evenly over the air-gap between pole surface and armature, but is crowded or denser near one side of the pole than the other. In addition to this distortion, some of the armature reaction is directly opposed to the main magnetic flux of the field magnet and opposes and weakens it; thus it comes about that the rising current flow through the armature is accompanied by a distortion and weakening of the magnetic flux, which originally produced the potential from which the flow of current arose. Therefore, when current is taken out of an armature, there is a drop of potential from brush to brush, caused partly by resistance drop in the armature and partly by a loss of effective magnetic lines resulting from armature reaction.

Regulation of Generators

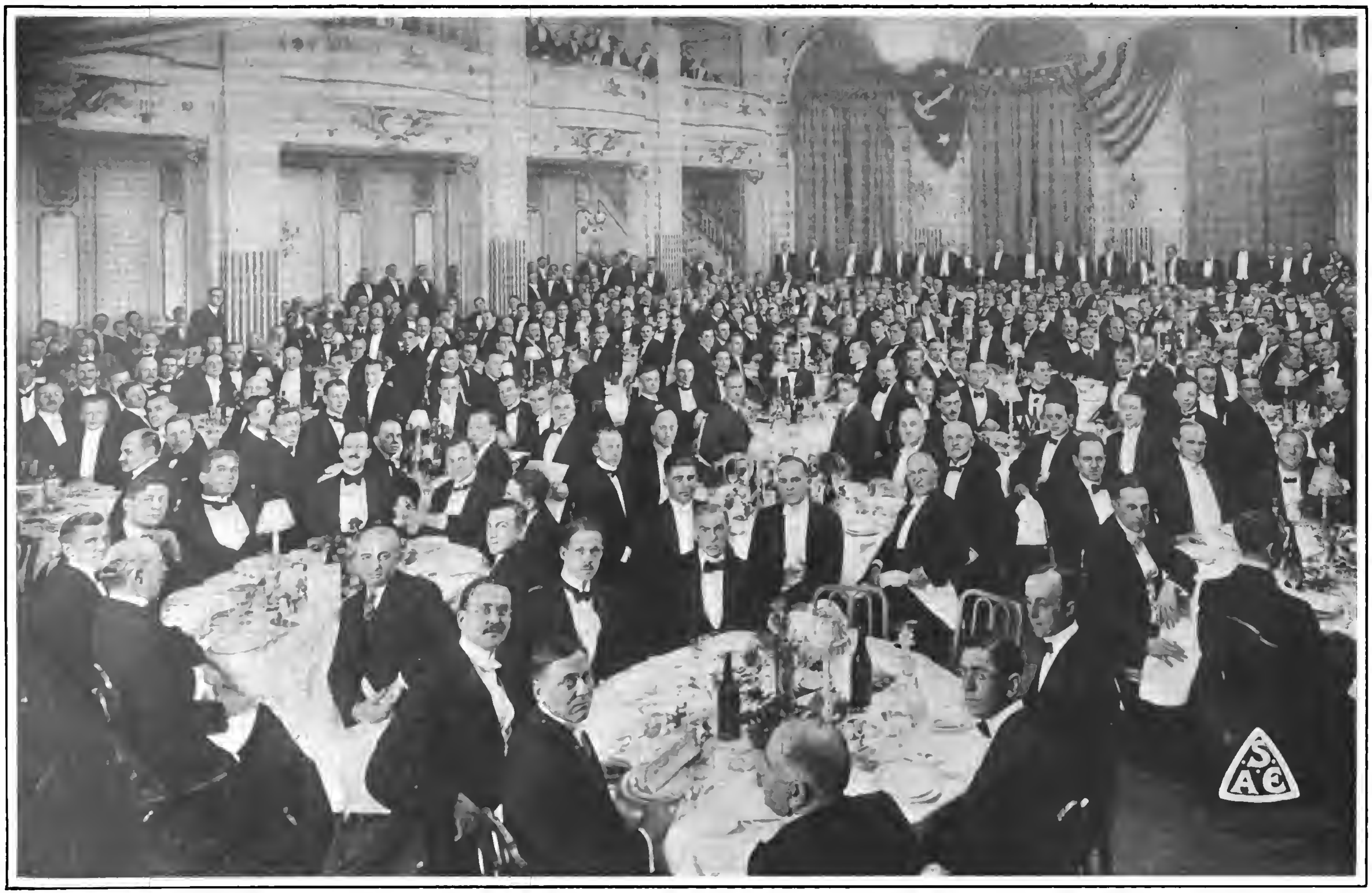
With increasing speed and therefore increasing current, we do not reach the speed at which some kind of regulation must be used until the current becomes excessive, in spite of the factors which tend to hold it down. From this point on we will either have excessive current or have to do something to diminish the useful flux which the armature conductors cut. It is conceivable that we might use a generator having so many turns of small wire and such a poorly arranged magnetic circuit, that the resistance drop of the armature and the blowing-out of the magnetic flux might alone reduce the voltage with rising speed to such an extent that the generator would not overheat and burn up. But such a machine has losses which, while helping to save it from heating at higher speeds, prevent it from giving anywhere near a good output at low speeds. Therefore, we will continue to consider the usual generators having relatively few turns on the armature and these of ample cross-section. With such a machine, to prevent a rise of voltage in the higher ranges of speed, we employ some method of weakening the magnetic field. In a general way the field is weakened by some peculiarity in the construction of the generator, such that increasing current decreases field excitation. This is known as inherent regulation. If instead, the generator itself be of the plain shunt-wound type, the weakening of the field is accomplished by the action of a separate regulator responsive to either current or voltage, or both, this regulator being arranged to vary the strength of the exciting field current. This might be termed "regulator regulation."

With inherent regulation it is difficult to make a construction in which the control of the machine is responsive to anything but current in some circuit, that is to say, either in the dynamo output circuit or in the battery branch circuit. To make such a machine regulate in response to its electrical potential alone, is so difficult or costly that machines of this type have not come into commercial use. On the other hand, when a separate regulator is employed, the regulator can be constructed to control the generator in response to either generator current or generator voltage independently of the generator current. Without at this time referring to the exact differences between the result when the generator is regulated purely in response to the voltage, and the result when it is regulated purely in response to current, it can be stated that the regulation in response to voltage alone has certain very attractive features. As just pointed out, this regulation cannot be accomplished with reasonable space and cost without using a separate regulator. On the other hand, if a separate regular is used, it can be made responsive to voltage alone in substantially the same space and at only slightly higher cost than if made responsive to current. Under these circumstances there is a tendency to regulate according to voltage whenever the circumstances warrant the cost of an independent regulator; whereas, if it is satisfactory to employ regulation responsive to current, this can be obtained without the use of a separate regulator and therefore without its cost and added parts; and in some respects the current regulation that can be had from certain types of inherently regulated machines, such as third-brush generators, is preferable to even the regulation obtainable from a separate "current" regulator. As a whole, the indication is that where the electrical load is large and the machine should be able to give out high amounts of current to take care of this load and to recharge a battery which has been subjected to this load, voltage regulation is desirable, even though it is attained at a somewhat higher cost. Where, on the contrary, the lighting load is not very high and the starting load and the drainage from standing idle constitute a larger factor in the total current consumption, current regulation can be employed to good advantage, especially when it is considered that generators for the purpose can be manufactured at less cost.

Factors Governing Size and Speed

Regardless of the method of regulation, the generator size and speed must correspond to the conditions of the car to ensure adequate current supply.

(To be concluded)



S. A. E. annual dinner held Jan. 6 at Hotel Plaza, New York City. The number present eclipsed all previous records, reaching a total of 550. Addresses were given by Secretary of the Navy Daniels and Major General Wood, U. S. A., Commander of the Department of the East.

EIGHTH annual banquet of the Motor and Accessories Manufacturers' Association, held on Wednesday evening, Jan. 5, at the Waldorf-Astoria, New York City. This was the largest gathering in the history of the association, 450 being in attendance. There were no speeches whatever, with the exception of President Lovell's announcement to the effect that the evening was to be entirely devoted to sociability and the enjoyment of the repast and the cabaret entertainment provided, which lasted till nearly midnight.

ANNUAL banquet of the National Automobile Chamber of Commerce, Inc., held at the Waldorf-Astoria, New York City, Tuesday evening, Jan. 4. This was one of the largest gatherings of automobile manufacturers in the history of the chamber, 300 men being present as representatives of the majority of the industry. As Charles Clifton, president of the chamber, was absent, owing to illness, Wilfred C. Leland, of the Cadillac company, presided. Senator Gore, of Oklahoma, was the only speaker of the evening, and his subject was "Preparedness," which he discussed from its various angles and in different phases. The menu for the banquet was in the form of a stock certificate for 1000 shares in the Blue Sky Motor Car Co., incorporated under the State of Collapse. Another novelty was the decorating of John N. Willys, Harry W. Ford, George Kissel, and John F. and Horace E. Dodge with huge burlesque medals for various accomplishments in the manufacturing field. The medals were hung about the necks of the recipients by red ribbons.

The History of the American Automobile Industry—12

Increased Activity in Steam Vehicles Follows Pecqueur's Invention of the Differential and Modern Type of Steering Gear—Adverse Laws Smother Development in England

By David Beecroft

FOLLOWING the broad inventions of the Frenchman Pecqueur in 1828 of the differential as used to-day, of the modern design of steering gear and also the two-speed planetary gearset, there was a very general increase in the wave of steam activity. Pecqueur did much to blaze the road of future progress. His startling inventions set hundreds thinking and gave an atmosphere of practicability to the steam vehicle that it had not previously possessed.

In 1833 Richard Roberts patented in Great Britain the balance gear or differential shown by Pecqueur in France in 1828. This gear was also used by F. Hill, who in 1840 built vehicles weighing 4 tons with speeds of 12 to 16 m.p.h., which were known to make 20 m.p.h. on special occasions, and 128 miles per day over difficult roads were accomplished by Hills' coaches, which was twice as fast as horse coach speed, and the expense was claimed to be but half as much. His vehicles used wheels 6½ ft. in diameter.

It is often said that any new device may know it has arrived when the joke makers and comic artists take it up. So common did the motor vehicles become in this early period that George Cruikshank, London, who has been called the father of caricature, based a number of his funniest drawings on the new vehicle, about 1828 to 1830.

John Scott Russell, in England, best known as the designer and builder of the Great Eastern steamboat, made a small model steam automobile quite early, built a half dozen full-sized soon after, and in 1834 furnished the vehicles for a steam carriage company coach line. These vehicles carried from thirty to forty passengers. He attempted to improve the steam boiler, by making it light and staying its walls together, some of his boilers having as many as 1300 stays.

Red Flag Legislation

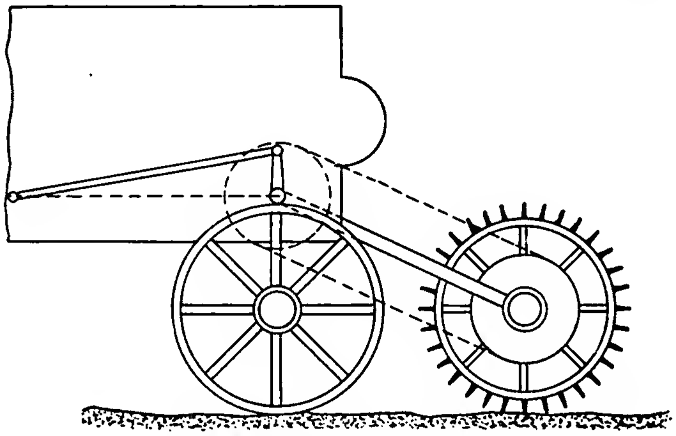
The high tolls imposed on motor vehicles in England, the constant objections of the vested interests represented by the coachmen and horse users generally, and finally a law which compelled each steam automobile to be preceded by a man carrying a red flag—all worked to suppress this promising movement with the result that although some inventors kept working, England practically disappears from the development of the automobile about 1845.

Several names appear in France keeping alive the movement there, among them being Dietz, who built an eight-wheel drag about 1834, driven by steam.

Doubtless political events had much to do with this cessation of mechanical vehicle development, but whatever the cause the steam vehicle for common roads languished. Occasional workers could not suppress their ambitions, so sporadic attempts were frequently found, but the great wave had subsided, and for the next 25 years little progress was made.

Begun as a carriage, developed into a coach, it diversified into the traction engine on the common road and the locomotive on rails. All the elements of the modern automobile that could be adapted to the traction engine or the locomotive had been developed to a fair degree of perfection during this period, so it is now possible to confine our consideration more closely to the light steam engine, to the velocipede or bicycle, to the gas engine, and to what may be termed carriage construction.

In spite of the drastic tolls and restrictive legis-



REAR-END PROPULSION

Many steam inventors were firm in their belief that some form of toothed wheel mounted back of the rear axle of a vehicle would prove the most satisfactory means of propulsion, many of these devices appearing between 1800 and as late as 1860. These rear driving wheels, resembling the paddle wheel on a Mississippi steamer, were driven by chain or belt, according to the ideas of the inventors lation and the rapid acceptance of the locomotive and traction engine, the automobile idea did not wholly die. Occasional work in spite of the restrictions kept it alive, and about 1860 there was another wave of popularity, principally marked by the work of Rickett of Buckingham, who built a number of passenger locomotives, beginning about 1858. Most of these were of the type shown, having three wheels, of which the rear wheels did the driving and most of the load carrying. They weighed 3000 lb. and carried 1200 lb. of water and 300 lb. of coal. The boiler carried 130 lb. of steam pressure and fed a two-cylinder engine. At the rear was a place for the stoker and the forward seat was wide enough for three or four.

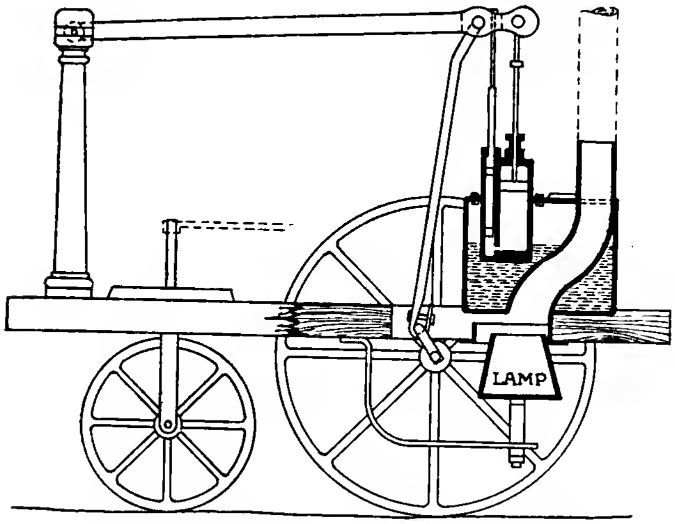
A 10-mile speed was common and grades of 10 per cent could be climbed by using the speed gear. One of these vehicles made 150 miles in 2 days in a very mountainous district and thoroughly proved its practicability. Rickett first used chains and sprockets but later used spur gears and finally connected the pistons direct to the driving wheels, as in a modern locomotive.

Steam Tractors in 1858

In 1858 Adamson & Co. of Manchester built for a customer a tractor for the purpose of hauling an omnibus. It had three wheels and ran at 8 m.p.h. Nine years later it was still in existence and had a race with a machine made by J. W. Boulton of Ashton. Boulton had built several of these and this one had a record of 90 miles in a day, carrying six to ten passengers and making no stops except for water.

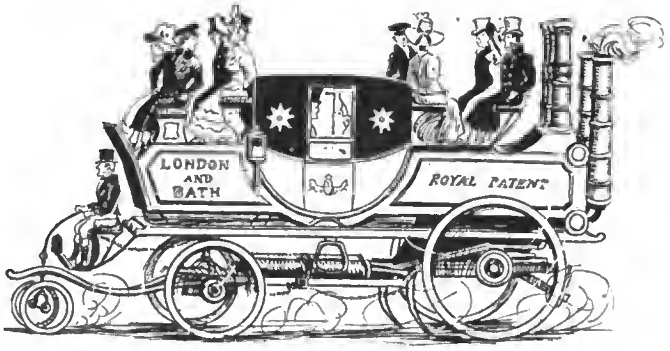
W. O. Carrett made a steam carriage in 1861 which was shown at an exhibition in 1862 and afterward sold to a London man who drove it about 800 miles, mostly at night to avoid conflict with the law. Later he rigged it up to resemble a fire engine and even provided firemen's suits for the passengers by which means he escaped interference for some months, but eventually had to give it up. It had a locomotive type boiler, carried 175 lb. of steam, the engine was geared to the rear axle which had a balance gear.

J. H. Knight constructed in 1868 a small two-cylinder vehicle weighing 3200 lb. and capable of 8 m.p.h. Its capacity was three passengers and the stoker, and it carried water for one hour and coal for three. It was afterward converted into a traction engine.



MURDOCK'S MODEL OF LOCOMOTIVE 1784

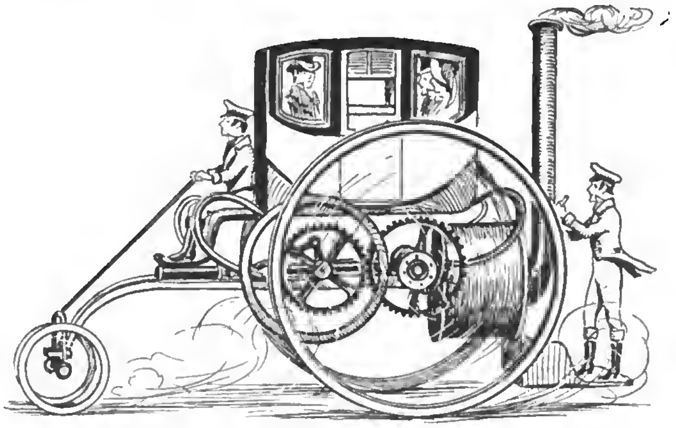
One of the early locomotives was that of William Murdock, a Scotchman, who was closely associated with James Watt in the development of the steam boiler. In 1784 Murdock built a small working model of a high-pressure locomotive engine illustrated herewith, which was satisfactory in performance. The lamp was located directly below the water boiler. In it is shown the vertical cylinder, in which is a piston connected to the overhead walking beam. From this beam a long connecting-rod coupled direct with a crank in the axle. It is interesting to note that Watt, although reposing the utmost confidence in Murdock, had no faith in the development of the steam carriage at that time and wrote that he was extremely sorry that Murdock was devoting his attention to it rather than attending to business which Watt considered of greater importance



GURNEY'S STEAM COACH OF 1827

One of the leading British inventors of steam vehicles was Goldsworthy Gurney, born in Cornwall 1793, and educated as a doctor. For several years he was a lecturer on chemistry and was a leading spirit in the highest scientific circles of his day. Besides turning his attention to steam vehicles he invented the oxy-hydrogen blowpipe, the limelight, and the steam jet for ventilating mines. He was responsible for the first lighting and ventilating system used in the British Houses of Parliament

His most famous steam coach, as illustrated herewith, was running in 1827. He carried twenty-one passengers, six inside and fifteen on the outside or top seat, some of which were in front and some in rear. It was a six-wheeler with the four main wheels practically the same as used on a horse-drawn vehicle and with two small steering wheels in front, which were guided by the operator, who sat very low in front with throttle and brake levers close at hand. This vehicle made a run of 6 miles in 35 min. and was able to climb hills at 5 miles per hour



TREVITHICK'S STEAM CARRIAGE OF 1803

To Richard Trevithick belongs the credit of producing the first practical steam vehicle illustrated herewith. He began his work in 1802, and had this vehicle operating the following year. His was the first attempt to provide a form of carriage for the passengers, although it remained for Griffith to develop what is known as the first comfortable vehicle for passengers. Trevithick made a number of journeys in this vehicle, averaging 8 or 9 m.p.h. for distances of 4 or 5 miles

The Rostrum

Says Designers Disregard Drivers' Comfort

EDITOR THE AUTOMOBILE:—During examination of cars at the New York show, I was particularly struck by the utter disregard of the driver's comfort as far as controlling the car is concerned. Most of the control levers are to be reached only with effort; and the hand brake lever frequently is at such a distance that one must leave one's position behind the wheel to reach it—or else pull it on with the foot.

Of course, this is caused by subordinating accessibility of the levers to ease in getting into and out of the seats. However, is it not more important to be able to control the car?

While modern trend toward eights and twelves may make gearshifting really unnecessary, all good drivers need the handbrake both for hilly city driving and fast driving anywhere. Hence, it should be easily reached, preferably without leaning forward to do so. A glance at the strained positions of passing drivers, some with both hands at the top of the wheel, others with elbows high and in similar grotesque positions, constantly requiring excess effort and sacrificing control, shows that it is just as impossible to make one car to fit everyone as it is to make one suit for all sizes of people. It is not expected that the same shotgun should fit everyone. On the contrary, makers recognize the variations in human architecture and supply corresponding variations in gunstocks to fit them. It is about time for the public to demand cars that are made to fit various types; shorts, and longs, stout and thin.

That this will add to safety is certain. That it will increase comfort and enjoyment is sure.

Deming, N. M. L. D.

Needs New Valve Tappets and Guides

Editor THE AUTOMOBILE:—The valve tappets on my Hupmobile model H-32 pump lubricating oil out of the base which is a big waste and a considerable loss.

Please advise if the valve spring covers could be made oil-tight to prevent this waste of oil, and if so, please show how it can be done.

Abbeville, La. S. C.

—It is believed that studs could be so arranged and a cover made with a cork gasket whereby the valve spring compartment could be made oil tight, similar to the construction of the model N Hupmobile. However, a change of this kind has never been made, and the Hupmobile company is not in position to furnish parts, or prints showing how it could be done. It is suggested that you install new valve tappets and guides, to eliminate leakage of oil.

Clutch Brake is Set Too Tight

Editor THE AUTOMOBILE:—What causes free leakage of much oil from the transmission box of the latest model 32 Hupmobile and how may it be corrected? The oil leaks only after the engine has been in operation, will stop after a few ounces, more or less, has been lost and does not leak from the union of the propeller shaft housing but rather from the union between the transmission box and the universal joint housing.

2—What causes the clutch of the model 32 Hupmobile to stop the engine when the clutch is disengaged in effort to shift gears, and how may this be corrected?

When the throttle is most open and the engine is running at a speed of about 2500 r.p.m., it is possible to shift into low gear without killing the engine. The machine has been in use long enough to wear off the new but while this feature is better yet it gives much trouble.

3—How is oil prevented from entering the starting switch on the model 32 Hupmobile and how may the apparatus be inspected to see that oil does not enter same?

4—When the clutch springs of the model 32 Hupmobile are so near the flywheel that a wrench cannot be inserted how may the springs be adjusted? Some of the springs are all right and some are as far to one side as some are to the other.

5—How much play should recoil straps have to insure easy riding?

Graysonia, Ark. F. M. B.

—In the first paragraph of your inquiry you speak of an oil leak from between the transmission box and the universal joint housing. The model 32 is not constructed along these lines.

2—The clutch stalls the engine because the clutch brake is set too tight. This may be corrected by the clutch brake adjustment. This applies also to the latter part of the second paragraph in which you speak of running your motor in high speed and finding it impossible to shift into low gear without stalling the engine.

3—The switch is so constructed that the housing over the front end prevents oil or dirt from getting into the switch contact. No trouble is experienced from this source.

4—The Hupmobile factory furnishes the owner a special wrench with each car which is to be used for adjusting the spring tension in the clutch plate. This is a combination wrench and may also be used on the spark plugs.

5—It is impossible to answer this as you do not state what kind of recoil strap it is. The Gabriel Snubber has its adjustment made by the manufacturer of same and is set before being shipped.

Wants to Change Seating Arrangement

Editor THE AUTOMOBILE:—I would like to ask your advice in regard to changing the seating on my four-passenger 1912 Cole 4-40. It has too much room in front and not enough in the rear although it has 122-in. wheelbase. I would like to install two auxiliary seats.

1—How is the front seat fastened to the body, and would it be practical to move it forward?

2—The car is equipped with Gemmer steering, and could this be shortened? Would it do to move it up or is there a better way to change the length of the column?

3—As the gear shifter will be all right, is there anything else I might have to contend with?

4—Would this make any difference in the riding of the car?

Mishawaka, Ind. W. G.

—The front seat is built into the bodywork, including the sills and the side panels and it really is not a practical thing to do to cut this seat out and build another seat into the body farther forward. However, this seat could be cut away from the bodywork and two seats could be set in the front part bolted to the floor and, if the owner desired, could be made adjustable, backwards and forwards.

2—Shortening the Gemmer steering gear is practical but it should be done by a first-class mechanic. It is not recommended that the gear be moved forward as it would entail a shortening of the fore and aft drag link, which is bad and it also would necessitate changing the front toeboard pedal arrangements, etc.

3—If you are satisfied with the gear shift locations, there is nothing else which would interfere with the body change.

4—The addition of the auxiliary seats and two passengers will evidently make the car ride easier but it will be necessary to add rubber bumpers on the rear end, to limit the play of the springs as they were not originally designed to carry this extra load.

Removing Carbon by Oxygen Satisfactory

Editor THE AUTOMOBILE:—I have two cars, a Buick six and a 1915 Ford and the young man who works for me has an oxygen carbon burning outfit which we have used on both to remove carbon, which process he learned in the Buick repair department. We had occasion to take the Ford to the local garage to take up the bearings and I noticed that the cylinders were all scored or all had longitudinal scratches on the walls which surprised me greatly, as the car has run but 700 miles and been carefully lubricated. Both the garage man and his assistant claim that every Ford or other car that they have observed that have had the process used are scored, especially Fords, finally admitting that he would not condemn its use except on a Ford.

Fenton, Mich. B. G. McG.

—If the oxygen burning machine is used in the proper manner by one thoroughly experienced in its manner of operation, it is not seen how it would affect these motors any differently than it would any other type of power plant. It is hardly believed that the scored cylinders have resulted from that work, although it is possible that the scoring dates back to the accumulations of carbon before it was removed, or perhaps the motor was run at some time or other with insufficient oil. It has always been the contention that the best way to remove carbon is by removing the head and scraping the deposits from the inside of the head and the tops of the pistons, as in that way only is it possible to give attention to the seating of the valves, which is of prime importance to the satisfactory operation of any motor.

Fitting Top to Kline Roadster

Editor THE AUTOMOBILE:—Kindly advise me where I could have a one-person top placed on my Kline roadster, model 1912, without sending it to the factory which is now located at Richmond, Va.?

Lopez, Pa. M. G.

—Any top maker in your vicinity can do this for you as the one-person sockets are now made by several forging companies. The top maker fills in a measurement blank and the proper sockets are then sent. The Kline company is supplied by the Cortland Carriage Goods Co., Cortland, N. Y.

New Cylinders and Pistons Needed

Editor THE AUTOMOBILE:—I have a 6-66 Pullman 1913, cylinders 4½ by 5½. At times there is a tap in the middle pair of cylinders. Not all the time. Will run along for miles without a tap, then tap for miles. It will tap going up hill but not on the level and then again it will not tap going up hill. Have had the motor taken down but could find nothing out of order, but have been told it was a side thrust or slap of the cylinder. It was there when the car was new and was told it was the tappet, but now I know better. I have come to the conclusion that a pair of cylinders does not get the proper lubrication. What would you advise? I am going to have new piston rings put in all the pistons and possibly a new middle block and pistons in place of middle pair of cylinders.

The later models of the Pullman 6-66 have a bore of 4¼, or 4⅜ by 5½, which made the middle wall of the pair of cylinders thicker. If I should put a pair of cylinders 4⅜ by 5½ what will be the result? The reason the bore of the later models were made smaller was to increase the thickness of wall between each pair of cylinders. I noticed that when the motor was taken down, the wall was thin and just a perceptible crack crosswise of the cylinder and below the water line.

Dover, N. H. H. G. H.

—You are correct in stating that the tap is not in the plungers, but lies in the cylinders and pistons. In 1913 the bore was changed to 4⅜, thereby increasing the walls of the cylinders which eliminates, to a great extent, the warping of them. The only real solution for this trouble that can be given is to have a complete set of 4⅜-in. cylinders and pistons placed in this car. It is not possible to use a pair of these and having the other two pairs 4½ in.

Use of Kerosene in Lubricating Oil

Editor THE AUTOMOBILE:—Will you please inform me whether kerosene would be injurious to the motor, commutator or magneto of the Ford car when used with lubricating oil, in the proportion of 15 to 25 per cent kerosene?

I have been using such a mixture for four months with a great deal of satisfaction. Before beginning the use of kerosene with the lubricating oil I had considerable difficulty in starting the motor when cold, and also experienced a great deal of trouble with carbonized spark plugs, cylinders and valves. I had the carbon removed from all parts of the motor before beginning the use of kerosene, but this did not remove the difficulty of starting the motor, besides the spark plugs would become carbonized in a few hours. I began the use of kerosene with the motor in bad condition, but the misfiring soon disappeared and I have had no trouble in starting the motor at any time. The car has been run 1500 miles since the carbon was removed from the motor, but it still functions like a new motor.

Washington, D. C. R. W. C.

—Kerosene can be used in some ways with good results, in the care of the Ford motor. However, we would not recommend mixing it with the motor lubricating oil. It is a good plan to use a 25 per cent mixture of kerosene with the commutator lubricating oil in cold weather so as to thin the oil sufficiently to prevent congealing on the commutator contacts which causes difficult starting of the motor. Also, we recommend draining the old oil from the crankcase approximately every 3000 miles, washing out the case with kerosene oil, draining that off and replenishing with fresh oil. It also is entirely practicable to remove the spark plugs when the motor is warm and put in a little kerosene in the spark plug holes which relieves carbon deposits to some extent.

In your case you are using a very heavy motor lubricating oil which, congealed between the clutch discs, causes trouble in starting the motor, and by putting in the kerosene you have thinned the oil sufficiently to eliminate that difficulty. Our idea is that the trouble can be traced directly to the grade of oil being used rather than to any condition which existed in the power plant. Taking this into consideration you will readily see that for general use it would not be practicable to put in kerosene with the motor lubricating oil, and if a proper grade of oil were used the kerosene would thin it entirely too much. You had better call at the Ford branch in your city and obtain oil that is adapted to the motor and that will enable you to discontinue your present practice.

Truck Design Shows Many Changes

(*Continued from page* 59)

remedy for this has been the division of the shaft at its middle, the fitting of three universals and a center bearing. An alternative to this has been the substitution of a tube for the usual shaft, the tube being much stiffer for its weight and strength than the solid shaft. The duty on the universals in long tubular driving members, however is more severe and so for success, rather more robust joints are required.

More Reserve Power in New Motors

This smaller and more compact unit power plant does not by any means signify that the truck of 1916 is not so powerful as that of 1915. On the other hand the efficiency of the motor and driving units has increased to such a degree that although the formula horsepower would show a falling off of several per cent, this would not be by any means a fair comparison. The motors of 1916 operate at higher rotative speeds following the same trend as in passenger car design. They are geared lower and the power curves of the motor extend to a higher peak than ever before and the result is that the motor has a greater reserve power for use on hills. The fact that the miles per hour speed allowed by the governors is just the same as last year shows that there is a greater factor of safety than ever before due to the fact that the trucks are not using in their regular duties anywhere near the ultimate horsepower of the motor. This is advantageous in two ways: first, it gives a greater reserve power for hills and rough roads and secondly, it increases to a notable extent the life of the vehicle.

Disk Clutch Gains 20 per Cent

In the various units which go to make up the drive of the truck there has been no change, shaft drive excepted, which is more noteworthy than the increase in the disk type of clutch. This has risen in one year from 28 per cent to 48 per cent. In other words whereas a year ago about one-quarter of the trucks had dry-disk clutches, at the present time they are fitted on nearly one-half the chassis. The cone clutch has fallen off from 42.2 to 26.3 and the disk in oil has dropped from 17.8 to 13.1. The fool-proofness of the dry-disk design and the ease with which it can be cared for are the two points that have recommended it to the designer of motor trucks, and it is probable that the use of this type of clutch will continue to grow in popularity. This is another trend which reflects that of the passenger car industry where simple clutches have come to be in great demand.

One point in which the tendency in truck design varies widely from that of passenger car practice is in the use of the four-speed gearbox. Whereas in the passenger car the four speeds have proved to be unnecessary with the lighter car loads, the higher-speed multi-cylinder motors, etc.; in the truck field, with the increasing capacity tendency there is an inclination to favor four speeds.

The development of the trailer, too, has resulted in designers looking with more favor on the multi-speed gearset, for the increased inertia imposed by the trailer requires an additional starting reduction. On hills, too, the additional load calls for a lower hill-climbing gear. The steps also need to be closer together, as they are in the four-speed design.

The result is that the percentage of trucks equipped with the four-speed gearbox is higher than it was for 1915. The respective percentages are 11.5 and 19.9 for 1915 and 1916. The difference in these percentages is made up by the drop in the three-speed gearbox which has fallen from 82 to 76.6. The use of the two-speed gearset is falling off.

Although the gear ratio average in 1916 is very slightly higher than that of 1915, a broader view must be taken than that which would be suggested by the averages of 8.66 to 1 and 8.75 to 1 which represent the practice for two years.

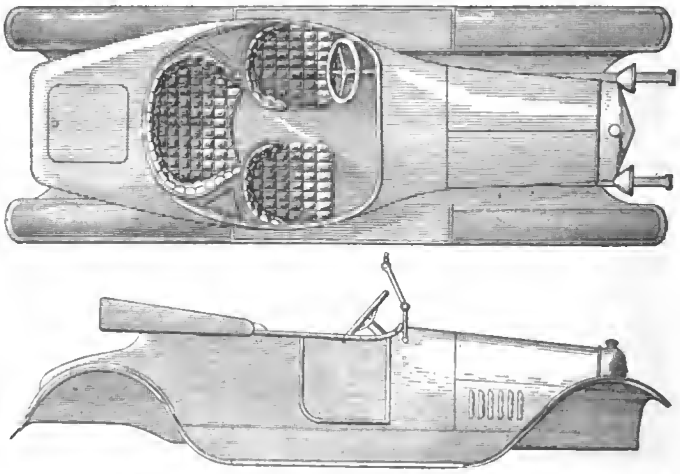
Simplification a Factor

It must not be understood that with the greater capacities the truck of 1916 is a heavier and more unwieldy vehicle than that of 1915. The contrary is the case and although the pay-load may be higher the weight of the chassis itself is, on the whole, less. This is due to the tendency toward simplification which is reflected in many ways throughout the car. The elimination of parts due to the employment of spring drive is a very good example of this. Last year the percentage of trucks which transmitted the drive through the springs was twenty-three. For 1916 this has increased to 47.3. The torsion strains are taken through the springs on 81 per cent. Practically every truck which takes the final drive through the springs takes the torque in the same manner and the percentage figure, for those using the spring drive, will hold good for Hotchkiss drive also.

Semi-elliptic springs seem to be the most favored way of carrying out the suspension. They are used on 88.4 per cent of the rear installations and 96.7 per cent of the front. Springs in general are longer and the suspension of the truck is easier on load and driver as a result.

Apperson Gets Design Patent on Clover-Leaf Body

NEW YORK CITY, Jan. 10—In view of the large number of three- and four-passenger roadsters of the clover-leaf type on the market, special interest attaches to the design patent on a body of this description granted to Elmer Apperson, Kokomo, Ind., and assigned to the Apperson Bros. Automobile Co., of that city. This design patent, which was granted Jan. 4 on an application filed Aug. 6, 1915, is No. 48,359 and its term is seven years. It specifies "a new, original and ornamental design for automobile bodies," as shown in the accompanying illustration, the construction being a streamline body for a left-steer chassis, the passenger compartment having a driver's seat and another seat with an aisle between them leading to the seat for one or two passengers in a horseshoe-shaped compartment behind the two front seats.



Plan and elevation of three or four-passenger body covered by design patent granted to Elmer Apperson on Jan. 4, 1916

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74,000 Trucks

THE production of motor trucks in America last year reached a total that is within sighting distance of the 100,000 mark. Of this large number a third were exported, but not all of that third went to do war work. Probably war purposes consumed about a quarter, and the difference represents trucks put to industrial purposes abroad.

Without question the most important phase of this export business is the part that is not government orders. Owing to the condition of the factories of Europe the American truck manufacturer has been able to get a decided footing in Great Britain, in France and in the many other parts of the world to which these two countries have been sending their trucks hitherto. These markets are not won completely, and it remains for the American makers to use their advantage to the utmost; they have their first success, and if it is to lead where it ought to lead they must push ahead just as fast as they are able.

With a home demand exceeding the supply and a foreign demand still more loudly clamoring for more trucks, 1916 can be faced with the probability that all previous production figures will be eclipsed. In a year from to-day the 74,000 that now looks so large ought, by rights, to have shrunk to very little in comparison with the 1916 output.

Settling Ignition Questions

HOW much stronger a thing is personal preference than scientific experiment; how difficult, in the face of prejudice, is it to get a scientific demonstration that is convincing to everyone! To-day nobody can say that the automobile ignition question is settled, nobody can see that the S. A. E. discussion has really brought us any nearer to determining the destiny of the magneto.

Taking the papers presented, of which each represents the conclusions of scientific research, it is obvious that the data collected is insufficient absolutely to settle the matter, yet it ought to be possible to *prove* the truth or otherwise of the conradictory contentions. Of course no laboratory experiment will settle a question complicated by commercial considerations, and that probably is the reason why it has taken so long to get a final ruling on the magneto-battery controversy. On and off, we have had it with us for twelve years now.

Tires Up 20 Per Cent

THE rise in the price of tires is one of those things which is always liable to happen in times of great disturbance. Practically everything the tiremaker needs costs more to-day that it did a short time ago. Rubber is up because of fear. Fear that the Suez Canal may be closed, fear that boats may be lost with valuable cargoes, fear on the part of both the plantation owner and the ultimate buyer. The reason for the present price of rubber is psychological, but it is also natural and not unreasonable. That the price will soon drop again is the general belief.

But rubber is not the only thing in tires which costs more. Certain compounds of zinc which are needed in the vulcanizing process are actually difficult to get, owing to the absorption of certain sources of supply by war. Zinc itself is short throughout the United States, so short that copper is getting to be cheaper than brass for some purposes. Cotton, too, of the special grades used by the tiremakers, is dearer and labor is certainly no cheaper, so if there is nothing to really account for the rubber price ruling to-day, there are plenty of things to explain the price of tires. Consumers can, however, rest with an expectation that the present prices are but temporary.

That rubber must cheapen again soon is as nearly certain as anything can be in connection with the romantic tropical product, and if rubber falls substantially the price of tires cannot but follow the fall.

Roadster Development

THE development of the roadster has suddenly taken a stride ahead in the past year. It was not long ago that the tendency of many makers was to drop the roadster from their lists. The new sociable seating giving three- and four-passenger capacity has again, and justly, put these vehicles in a position where they appeal to the popular fancy.

N. A. C. C. Cross Licensing in Force

Agreement on Exchange of Shop Rights of Members on Patents Effective Jan. 7

NEW YORK CITY, Jan. 10—Perhaps the most important event that occurred during show week in this city last week was the formal enforcement of the cross-licensing patent agreement among the members of the National Automobile Chamber of Commerce, Inc., which agreement went into force on Friday, Jan. 7. This cross-licensing patent agreement has been under organization for over a year, and by it the members hope to reduce very materially the amount of patent litigation among members.

Eighty of the ninety-seven members of the chamber have signed this voluntary agreement, by which they agree to give to the other seventeen members of the chamber shop rights on their patents. This agreement gives the other seventeen members six months in which they can enter into the agreement and share in the privileges.

Up to the present moment the N. A. C. C., through its able patent department, has examined and verified 353 patents controlled by the eighty companies that have entered into the voluntary agreement. This work of examining and verifying is still going ahead, and it is anticipated that well over 500 different patents will be represented in the cross-licensing agreement.

Two Classes of Patents

By the present scheme it does not mean that all patents owned by the eighty companies signing the agreement are pooled among the said companies and shop rights granted, but rather that patents are divided into two grand classes as follows:

Class A—Fundamental and basic patents, and particularly fundamental patents on motor trucks. These patents are not included in the cross-licensing agreement in that the purpose of the agreement is not to take away from any concern the value of basic and fundamental patents.

Class B—Patents relating to the general development of the industry are covered in the agreement. These patents have more to do with detail inventions rather than basic or fundamental patents.

New Detroiter Six for $1,098

DETROIT, MICH., Jan. 11—The Detroiter Motor Car Co., this city, has brought out a new five-passenger touring model called the Detroiter Six-45 and selling at $1,098. The Continental unit powerplant has block cylinders, which are 3¼ by 4½, and which have detachable heads.

Other features are: Auto-Lite starter with a Connecticut distributer separate from the generator with a variable spark, three-quarter floating axle, the differential being carried on ball bearings, and the wheels on roller bearings. Lubrication is force feed with pressure gage on dash. The clutch is multiple disk; the drive is Hotchkiss through vanadium-steel springs; tires 33 by 4; wheelbase 118 in. Equipment includes one-man top, windshield, Stewart speedometer, gasoline gage, electric horn, tire repair kit and tools.

Ford to Shorten Working Hours and Increase Wages

DETROIT, MICH., Jan. 12—*Special Telegram*—It is expected that important changes will be made in the working schedules of the Ford Motor Co. to take effect Jan. 15. Six hours will constitute the day's work instead of eight. There will be four shifts of six hours. Along with this shortening of hours, the minimum wage will probably be 50 cents an hour and those men now receiving $5 a day will be given $1 an hour, thus increasing their wage to $6 a day. It is likely that the system will be applied to all the Ford assembling plants and branches.

20,405 Cadillacs in 1915

DETROIT, MICH., Jan. 7—Cadillac cars having a value of between $41,000,000 and $42,000,000 were sold by the Cadillac Motor Car Co. in 1915. Exactly 20,405 eights were shipped between Jan. 1 and Dec. 31, 1915. A good many more should have been shipped before the year ended, but the shortage of freight cars was one reason why many purchasers were disappointed. There were also times during the past year when the general conditions of the material markets made it necessary to slow down production until the delayed supplies were received. At the present time there are about 7500 men working at the different plants of the company and from seventy to eighty cars are completed daily.

Knowles Is Saxon Chief Engineer

DETROIT, MICH., Jan. 11—*Special Telegram*—William H. Knowles, for the past year assistant engineer of the Saxon Motor Car Co., has been appointed chief engineer of the company to succeed R. E. Cole, resigned. Previous to his connection with Saxon, Knowles was for two years in the engineering department of the Timken company and later assistant to the chief engineer. He has been associated with the industry for about ten years, serving chiefly with the Warren and Corbin companies. He takes up his new duties at once.

Explains Proposed Gov't Tax on Cars

Sec. McAdoo States That Car Is Taxed But Once and at Factory Only

WASHINGTON, D. C., Jan. 11—Secretary of the Treasury McAdoo has issued the following statement: "The suggestion that tax on the horsepower of automobiles and other internal combustion engines might be considered by Congress, seems to be misunderstood in many parts of the country. A circular just issued by the California State Automobile Assn. and signed D. E. Watkins, secretary, illustrates this. The circular says that a Federal tax of 50 cents per horsepower on motor cars and 1 cent per gallon on gasoline 'Means to you each year nearly twice as much tax as you now pay. We now have men at Washington fighting this bill and are badly in need of financial support. Will you not join this club and help us defeat this unjust measure? If you do not feel that you can contribute $8 for a membership, then send us $1 or whatever amount you will. Now is when we need your support, so please give us an early response.'

Car Taxed at Factory Only

"The suggested tax on the horsepower of motor cars refers entirely to a tax on the automobile before it leaves the factory, to be paid by the manufacturer and paid once only, to the Federal Government; for instance, an automobile with a 20-hp. engine would be taxed $10 in the hands of the manufacturer. No yearly taxation of automobiles and motor trucks similar to the license taxes of States and municipalities is contemplated nor has it at any time been suggested that a Federal tax be imposed on automobiles already in use by private owners."

Vollbrecht Resigns as King V.-P.

DETROIT, MICH., Jan. 7—F. A. Vollbrecht, vice-president and general manager of the King Motor Car Co., Detroit, has resigned and has left the automobile field to engage in manufacturing in Detroit. Theodore E. A. Barthel has succeeded him. Mr. Barthel has been connected with the automobile field since 1902, when he joined the Olds Motor Works. Since then he has seen service with several of the large automobile concerns in the capacity of financial adviser.

Moreland Truck Prices Increased 5%

LOS ANGELES, CAL., Jan. 7—The Moreland Distillate Motor Truck Co., this city, has raised the prices on its trucks 5 per cent. This raise has been made on all models and will take effect immediately.

F. T. C. Concentrates on Gasoline

Commission Will Handle Exclusively Investigations of Reasons for Its High Price

WASHINGTON, D. C., Jan. 8—The latest development in the gasoline situation is the announcement by the Federal Trade Commission that it will handle exclusively investigations to determine the reasons for the high cost of gasoline. Several investigations now are being conducted by the commission to gather data which will enable it to tell whether the present high prices are reasonable.

In addition the commission is attempting to handle a number of complaints from all parts of the country charging discrimination in the price of gasoline. These matters are being handled directly by Commissioner Harris. The first complaints and the greater number of them came from the South and before Congress convened Commissioner Harris and a corps of assistants had gone to the southern States to make on investigation of the violations of the so-called Clayton act, which is the statute relating to price discrimination.

May Give Hearings

This side of the gasoline price probleb is considered by the commission to be a comparatively simple one compared with the investigations to determine whether the price charged is reasonable. Whether the commission will give hearings on the price discrimination phase of the problem has not yet been determined, but it seems probable that it will.

The only matter which the commission needs to help it in reaching a decision is data on refining and marketing costs. Many questions enter into the latter problem, including the determination as to whether more crude oil is being produced now than last year or in previous years; whether the oil is as productive of gasoline as oil taken in former years, etc. Labor costs, as well as depreciation of machinery used in the refining, also must be considered.

Replying to the Steenerson resolution calling upon the Department of Justice for information as to any action on the high price of gasoline, Attorney-General Gregory has sent the following communication to Congressman Webb, chairman of the house judiciary committee:

No prosecutions have been instituted by the government based on the increase of petroleum and its products, for the reason that no evidence has been developed as yet which would justify a charge that the increase is due to any action in violation of federal law. It is the duty of the United States district attorneys and investigators throughout the country to scrutinize closely all increases in the prices of stable commodities and to report promptly any evidence tending to show that such increases were brought about by agreement or combination. This duty has been particularly impressed upon them since the beginning of the European war, which has made it easier to find pretexts for increasing prices.

Opposes Steenerson Inquiry Resolution

WASHINGTON, D. C., Jan. 11—*Special Telegram*—Representative Carlin presented an adverse report from the House judiciary committee on the Steenerson resolution for an inquiry into the rising cost of gasoline on the ground that the attorney-general has answered question fully as stated above.

N. Y. Bankers Dine Willys

NEW YORK CITY, Jan. 11—A dinner was given last night at Sherry's in honor of John N. Willys, president of the Willys-Overland Co., by Elisha Walker, of William Salomon & Co., this city.

The occasion was unique, in that never before has such a gathering met to do honor to a leader of the automobile industry. It shows the importance of the place in the industrial world occupied by J. N. Willys in the opinion of prominent men of finance.

Among the sixty-three guests were: Frank A. Vanderlip, president the National City Bank and a director of the S. K. F. Ball Bearing Co.; E. H. Broadwell, vice-president of the Fisk Rubber Co.; Rathbone Fuller, L. G. Kaufman, president of the Chatham and Phenix National Bank, this city, and chairman of the finance committee of the General Motors Co.; A. P. Sloan, vice-president of the Hyatt Roller Bearing Co., Harrison, N. J.; Harry G. Fisk; H. T. Dunn, president of the Fisk Rubber Co.; Clarence A. Earl, vice-president and a director of the Willys-Overland Co.

Non-Motor-Stop Maxwell Ends Run—Covered 22,022.3 Miles

LOS ANGELES, CAL., Jan. 10—After running continuously for nearly forty-four days, and establishing a record of 22,022.3 miles, the engine of the non-motor-stop Maxwell has been officially stopped by Mayor Sebastian. It was immediately re-started and the car left for a tour through southern California and Arizona. The Maxwell's record replaces a former mark of 12,404.9 miles. The last day's run was made the longest and fastest of all, the car covering 562.5 miles in the twenty-four hours. The entire test was held under the sanction and observation of the contest board of the A. A. A.

Four Companies Raise Tire Prices

Empire, Falls, Globe and Pennsylvania Increase Rates 10 to 25 Per Cent

NEW YORK CITY, Jan. 12—Four more tire companies have raised their prices, the Empire list going up 15 per cent, the Falls 10 per cent, Globe approximately 25 per cent and Pennsylvania about 20 per cent. Kelly-Springfield announced an increase of 7½ to 26 per cent on its former list last week as reported in THE AUTOMOBILE for Jan. 6.

In every instance the reasons given for the higher prices are the scarcity and high market prices for the ingredients used in tire manufacture, crude rubber having risen from 57 cents a pound in September and October to 95 cents to-day. Similar high rates are found in Egyptian and Sea Island cotton and in zinc and sulphur. The great trouble seems to be that the manufacturers are not getting deliveries on materials, many of them being unable to procure the latter at contract prices, the shippers complaining that they are unable to get vessels to transport them.

The Globe company has not definitely decided what increase in its prices will be necessary but, like the other manufacturers, is endeavoring to keep the increase as low as possible.

Some of the new prices on Empire, Falls, and Pennsylvania tires are as follows:

Size	New	Old
EMPIRE		
30 x 3	$11.40	$9.90
34 x 4	24.05	20.90
34 x 4½	32.95	28.65
36 x 4½	34.65	30.15
FALLS		
28 x 3	15.50	14.50
34 x 4	32.75	30.50
37 x 5, non-skid	64.75	58.75
PENNSYLVANIA (All non-skid)		
28 x 3	15.65	12.65
30 x 3	16.60	13.00
30 x 3½	21.05	15.85
37 x 5	58.30	46.85

Culbertson Sails for London

WICHITA FALLS, TEX., Jan. 6—J. G. Culbertson, treasurer and general manager of the Wichita Falls Motor Co., Wichita Falls, Tex., left New York, Dec. 31, on the steamship New York for London, accompanied by Frank Kell, vice-president of the firm. They will return sometime in February.

Price with Rubber Products Co.

BARBERTON, OHIO, Jan. 10—H. A. Price, formerly with the B. F. Goodrich Co., and the Kelly-Springfield Tire Co. has been appointed sales manager of the tire division of the Rubber Products Co., this city.

Two Shows for Chicago

The Automobile Salon and National Show to Be Held Same Week

CHICAGO, ILL., Jan. 10—Chicago will have two shows during the week of Jan. 22 to 29, just as New York had two shows last week. In addition to the show of the National Automobile Chamber of Commerce at the Coliseum and First Regiment armory, there will be a salon held in the Auditorium Hotel, at which the following makes of cars will be exhibited: White, Simplex-Crane, Rolls-Royce, Lancia, Brewster and one or two others. These are practically the same makes that have been exhibited during the past week at Hotel Astor in New York under the name of the Automobile Salon, which has succeeded the Importers' Salon, the latter having been held in the same place in New York for many years. The show this year has had many more American cars than foreign makes, in fact, only five different makes of foreign cars were exhibited last week, whereas there were American cars of the following makes on exhibit: White, Packard, Locomobile, Cadillac, F. R. P., Simplex, Crane, Singer, Daniels, Owen Magnetic and Brewster. White exhibited at the salon, because it withdrew from the N. A. C. C. show because of differing with the association on the matter of drawing space. Many of the other exhibits of American cars, such as Locomobile, Cadillac, Owen Magnetic and Packard were made by the body builders and not by the companies themselves.

European War Beneficial to Italian Makers

TURIN, ITALY, Jan. 7—The effect of the European war on automobile and truck manufacture in this country has been beneficial. The industry, centered in Turin, profited by the increased demand for military trucks, both at home and abroad, and all of the plants were compelled to employ extra workmen and to introduce night shifts. This stimulation to an industry which had begun the year rather unfavorably offset to a large degree the depressing effects of the crisis in other local industries. The decree of Aug. 1 prohibited the exportation of automobiles, but exceptions were granted with a certain liberality in the case of medium weight and heavy trucks, so that the total value of the exports of motor vehicles was larger than in the preceding year, there being $7,849,695 in motor vehicles in 1914 compared with $6,596,921 in 1913.

The largest company, the Fiat, turned out 4800 automobiles in 1914, which is 1500 more than in the preceding year.

The future of this industry is promising, as the trucks lost in the war will have to be replaced and the local factories will be occupied for some time to come in supplying the demand. The exchange quotations of the shares of the Turin companies are given in dollars in the following table:

Companies	Nominal Value	Market Value, December, 1913	Market Value, December, 1914
Fiat	$10.30	$24.32	$24.32
Itala	4.82	9.84	7.72
Spa	4.82	5.21	5.50
Scat	4.82	4.15	4.82
Diatto Clement	4.82	2.30	2.70
Peugeot	4.32	.35	.....

The automobile coach-building industry, on the contrary, has been seriously injured by the war which has almost eliminated the demand for passenger cars and caused the exportation of this class of vehicle to cease. The cost of all supplies for this branch has greatly increased, particularly hides, varnishes, and cloths, as well as other accessories, which were previously supplied by England, Germany and France.

U. S. Rubber Introduces Usco Tread and Royal Cord Tires

NEW YORK CITY, Jan. 10—Rounding out the line of the United States Tire Co. so that it comprises a tire for practically every need, the Usco tread and the Royal Cord tires have been put on the market, the former selling at a very slight advance on the plain tread prices while the latter lists at practically the same price as any other first-class cord construction.

The Usco tire uses a tread pattern made up of two rows of the letter U, one on each side of a plain strip in the center of the tread, the letters in each row being staggered in relation to those of the others. Another advantage of the Usco is said to be the special strength secured by a practically perfect union between the fabric and the rubber, the plies of the fabric being unified by rubber joined to the fabric.

The Nobby tread and Chain tread are continued by the United States company, and commercial vehicles are provided for by the new Pressed-On truck tire recently announced.

Scripps-Booth Capital Stock Increased to $350,000

DETROIT, MICH., Jan. 7—The Scripps-Booth Co. has increased its capital stock from $150,000 to $350,000, for the purpose of enlarging its plant and increasing its manufacturing facilities. The company has elected Clarence H. Booth vice-president and managing director.

250,000 See New York Show

Largest Attendance of Any Exhibition Held in That City—Sales Big

NEW YORK CITY, Jan. 10—The sixteenth annual automobile show held in held in New York City closed Saturday night after a week of record-breaking attendance and sales, approximately 250,000 persons, or 33 1-3 per cent more than last year, inspecting the 326 cars and chassis as well as the 290 accessory exhibits on display in the Grand Central Palace. This is the largest attendance recorded for any automobile show, horse show or other great exhibition ever held in this city. In fact, during the entire week, hotels were over-crowded and theaters overwhelmed with demands for tickets. Never have the huge hostelries of the metropolis experienced such a rush of business with the exception of the week of the Hudson-Fulton celebration. And the tremendous crowd which came to see the show, to sign new contracts, buy cars and negotiate for replenishment of accessory stocks contained 40 per cent more dealers in cars than were in evidence at the 1915 show.

The exhibitors themselves were delighted with the sales made, new agents obtained, and general business done and, practically to a man, declared the week to have been one of unprecedented success as compared with the shows of previous years.

Business-Like Atmosphere

The atmosphere of the show this year was more business-like than has ever been the case. More people seemed to come to the show with the intention of buying a car than ever before and the questions of visitors at the various booths were in every case evidence of the greatly increased familiarity of the general public with the essentials of construction and the performance to be expected from the cars of to-day. These questions reveal marked attention to details which in former years were passed over without comment. The dealers state that the great improvement in business confidence over the corresponding period a year ago was reflected in the attitude of the show visitors, who seemed to have more ready money and to be more inclined to spend it than at that time. More retail sales are reported than ever before, practically every exhibitor having sold a number of cars while some of the more popular low-priced makes reported many sales each day.

From the dealers' standpoint the show has netted more live prospects for immediate and spring delivery of cars than any previous exhibition, in fact, some exhibitors sold more cars last week than in an entire month of the past year. In addition many new contracts were signed and much new territory covered for 1916. Practically all the dealers predict a big shortage of cars for next summer's selling season. The attendance of dealers at the show was much better than expected, men coming from as far south as Florida and as far west as Omaha, St. Louis and Kansas City with a few from the coast. As to the individual exhibitors' opinions of the show, these may be realized from the statement that the sales made vary from 40 to 600 per cent in excess of those at any previous show.

Accessory Exhibitors

In the accessory field it is the same story over again. Though here the sales made during the week were in most cases comparatively small, the general interest shown the new contracts secured and territory distributed served to make the net business gain far above that attained at last year's display.

Laurel Four for $750—Six to Come Later

RICHMOND, IND., Jan. 7—The Laurel Motor Car Co., this city, announces a new four-cylinder car to sell at $750, and soon will have ready a six that will sell somewhat under the $1,000 mark. Specifications of the four include a block motor with cylinders measuring 3 by 4¼ in., rated at 22.5 hp. Under brake test the motor is said to give 31.9 hp. at 2,000 r.p.m. The bearings are unusually large, the crankshaft front bearing being 1½ by 3⅞ in., center, 1⅝ by 2¼ and rear, 1⅝ by 4 in. The oiling system is a combination force-feed and splash, with revolving sight feed on dash, to which the oil is forced by a plunger pump. This sight feed is provided with an oil line leading the oil back to the three main bearings of the motor and then runs into the stamped steel oil tray. Cooling is by thermo-syphon.

The motor has a detachable cylinder head, and the clutch is a single disk in oil. Three speeds forward are offered, drive is left and control levers in the center.

Body design is conventional, the rear seat being 48 in. wide and the upholstering is heavy and of good material. Among the equipment is found one-person top, demountable rims, speedometer, electric starting and lighting, electric horn, etc.

Linerd Resigns from Ajax-Grieb

NEW YORK CITY, Jan. 11—J. B. Linerd, sales manager of the Ajax-Grieb Rubber Co., this city, has resigned to become president and general manager of the Bourne Chemical Corp., also of this city. No successor has been appointed.

550 Attend S. A. E. Banquet

Engineers Hear Officials of Army, Navy and Automobile Industry on Preparedness

NEW YORK CITY, Jan. 7—One of the most successful banquets ever held by the Society of Automobile Engineers was given last night at the Hotel Plaza, approximately 550 being present. The speakers included Secretary of Navy Josephus Daniels, Major General Wood, U. S. A. Commander of the Department of the East, and Alfred Reeves, General Manager of the National Automobile Chamber of Commerce. The dinner was presided over by William VanDervoort, president of the society.

Preparedness the Keynote

Preparedness was the keynote of the addresses given at the close of the banquet. President VanDervoort first addressed the members, extending a welcome and reviewing the accomplishment of the society. He pointed out the peculiar fitness of the Society of Automobile Engineers to be an efficient aid to the Government in time of war and peace and assured the Government that the society is willing to not only extend words expressing intentions, but would also be ready to take officers of the Navy and Army into the plants of the manufacturers for the purpose of instructing them in the intricacies and economics of manufacture.

General Wood delivered a brief speech, in which he brought out the necessity of the organization of industries to support the fighting arm of the service. He compared the situation to that of a heavy sword in which the keen edge is the first line of fighting proof, but in which the mass of metal which enables the edge to acquire the desired strength and stiffness is the industrial resources of the country. The better organized this industrial group is, the more efficiently can the keen cutting edge be kept in its proper condition.

Need of Truck Standards

An important point brought out by General Wood in his address is the need of standardization of the motor truck. He stated that the Army did not desire a miscellaneous mass of different sizes and varieties of vehicles to aid in transportation problems, but rather a standard form of vehicle upon which replacements would be easily made. He also said that he hoped an Army consulting board similar to that recently created for the Navy would soon be formed.

Secretary Daniels stated that the Navy department would assuredly appreciate the opportunity of sending officers to the automobile factories for the purpose of securing technical information, and it is probable that, beginning with the coming spring, squads of officers will be sent to the automobile factories. The need for a good aeroplane motor was mentioned by Secretary Daniels, who pointed out that the automobile engineers would be the logical men to develop it.

Considerable time was spent by Secretary Daniels in pointing out the necessity for an adequate Navy in this country, and the evident indorsement of the members of the S. A. E. present was shown by the enthusiastic reception of Secretary Daniels' expression of views.

The Motorists' Part

Alfred Reeves, general manager of the N. A. C. C., spoke of what the automobilist should do in time of war. He pointed out to General Wood that the 240,000 automobiles in the State of New York alone should move 1,000,000 men over the roads at an average speed of 30 m.p.h. There were about 550 at the banquet, and among the prominent guests were William McClellan, vice-president of the American Institute of Electrical Engineers; C. C. Hanch, director of the National Automobile Chamber of Commerce; William L. Saunders, president of the American Institute of Mining Engineers; Dr. J. S. Jacobus, president of the American Society of Mechanical Engineers; Howard E. Coffin and A. L. Riker, both of the Naval Consulting Board and members of the Society of Automobile Engineers; W. H. VanDervoort, president of the society, and A. J. Hemphill, president of the Automobile Club of America.

M. & A. M. Directors and Officers Re-elected for 1916

NEW YORK CITY, Jan. 6—At the twelfth annual meeting of the Motor and Accessory Manufacturers, held at the Waldorf-Astoria yesterday, the following were re-elected as members of the board of directors: F. Hallett Lovell, Jr.; C. E. Thompson, A. P. Sloan, Jr., and C. E. Whitney. W. M. Sweet continues as manager.

At the meeting of the board of directors held in the association's offices today, the officers whose terms had expired were re-elected to serve for an additional year. They are as follows: President, F. Hallett Lovell, Jr., Lovell-McConnell Mfg. Co., Newark, N. J.; first vice-president, C. W. Stiger, Stromberg Motor Devices Co., Chicago, Ill.; second vice-president, C. E. Thompson, the Steel Products Co., Cleveland, Ohio; third vice-president, T. J. Wetzel, the Dyneto Electric Co., New York City; treasurer, L. M. Wainwright, Diamond Chain & Mfg. Co., Indianapolis, and A. P. Sloan, Jr., Hyatt Roller Bearing Co., Newark, N. J.

National Acme Takes Windsor Machine

$3,500,000 Deal Practically Closed—Details to Be Decided at Jan. 20 Meeting

CLEVELAND, OHIO, Jan. 10—The negotiations by which the National Acme Manufacturing Co. of this city is to acquire the business and plant of the Windsor Machine Co., Windsor, Vt., have been practically closed. The deal involves about $3,500,000. The capital stock of the local company will be increased to take care of this addition, but any further amount will not be decided upon until the annual meeting is held on Jan. 20. The details will then be worked out for the consolidation.

Portage Rubber Profits Increase 46½ Per Cent

BARBERTON, OHIO, Jan. 6—The financial report of the Portage Rubber Co., made public at the annual stockholders' meeting, showed net profits from operation of $129,000 for the year 1915, which is 46½ per cent above those of the previous year. The sales amounted to $1,100,000, an increase of 62½ per cent over 1914. The usual quarterly dividend of 1¾ per cent on the common stock of the company was declared.

Officers elected were: James Christy, president; M. S. Long, vice-president; W. J. Anderson, secretary, and W. W. Wildman, treasurer.

Overland 1915 Earnings Estimated at $10,000,000

TOLEDO, OHIO, Jan. 10—Willys-Overland earnings last year amounted to $10,000,000, according to a circular sent to the holders of the preferred and common stock. This amount is equal to over 9½ times the preferred dividend requirements on the $15,000,000 issue and equal to 45 per cent on the common stock. The average surplus for the 3¼ years ended Sept. 30, was $6,893,622, or six and one-half times the annual dividends on the new $15,000,000 in convertible 7 per cent preferred stock issue.

The proceeds of the new issue will be applied in retiring existing $4,483,700 preferred stock, and to the general funds of the company. The new convertible preferred stock is exchangeable from Jan. 1, 1917, to Jan. 1, 1922, into common stock at 300. In the event that additional common stock is issued as a dividend or at prices less than $300 per share, the conversion price is to be proportionately reduced. The company is to set aside, on or before July 1, each year, commencing with 1917, a sum equal to 3 per cent of the par value of the preferred stock as a sinking fund.

Markets Easier

NEW YORK CITY, Jan. 12—Market prices last week were easier. Prices on those commodities which have seen violent rises during the past few weeks, either remained constant or were lower. Steel prices were unchanged, though the demand by the manufacturers was as urgent as it has been during last month. Lead and copper, however, continue to rise, the former closing yesterday at $5.90 per 100 lb. and the latter at 23½ cents a pound. Tin, on the contrary, dropped yesterday to $41.50 per 100 lb. This metal has always been subject to violent changes, however, and so the latest reduction cannot be taken as a mark of further reductions.

The rubber market was quiet last week and prices were somewhat lower. Para, which earlier in the week reached the $1 mark, declined to 96 cents, yesterday, and Ceylon pale crepe likewise saw a reduction and closed at $1.03. The demand for rubber last week was weak as was that in London.

Gasoline in this city went up another notch in its unprecedented climb toward new high marks, quoting at 22 cents a gallon. The increasing price of gasoline has brought benzol as a substitute into greater prominence. In many parts of the city last week, it was noted that garages displaying on signs the price o gasoline, had posted a roughly painted number—usually 25 cents—over th former price, as if the new price wer merely temporary, and another an higher price might be quoted the nex day. Benzol as a substitute for gasoline has been the subject of the evenin at a number of meetings held in thi city lately, especially at the Chemists Club, recently, where it was stated tha with the present immense production o benzol the cost has been reduced unti now it is believed that it can be manufactured and sold at a profit at the pro portionate price of gasoline, and that thi will be done after the war is over. Pro portionate price means that, when it i considered that benzol has a motiv power about 25 per cent greater tha gasoline, it would consequently have 2 per cent advantage at the same price.

Aluminum Shortage Grows

The scarcity of materials has hit man of the manufacturers. Especially is thi true in aluminum. Manufacturers of mo tors and parts in and around Milwauke it is said, are apprehensive of a seriou shortage of that metal and report tha already there is a necessity for returnin to the use of cast iron parts because o the soaring prices and the added difficult of getting a sufficient supply. A shor age of high speed steels is also reporte and the restricted supply of tool steel coupled with greatly increased price may prove a hardship during the co ing year.

Thomas Receivers File Report

BUFFALO, N. Y., Jan. 8—The receive of the E. R. Thomas Motor Car Co., thi city, have filed their report in which the state that the total receipts of the r ceivership have been $512,025.23; th claims filed aggregate slightly more tha $1,000,000, on which there have been pai dividends aggregating 30 per cen There is now cash in the hands of th receivers amounting to $39,938.88.

Chicago Gasoline Prices Reduced

CHICAGO, ILL., Jan. 7—Gasoline pric in this city have dropped to 16½ cent nearly 2 cents. The Standard Oil C it is said, is responsible for the lo price.

Reports from the Oklahoma and Tex oil fields state that there is an oil fami and that the oil wells in those two Stat have slumped in production from 35 to per cent. Gasoline prices, as a result, is predicted, will reach in the near f ture 40 cents a gallon and oil by-produc will be 35 to 40 per cent higher than any time in the history of the Unit States.

Advances of 1 cent a gallon in whol sale gasoline prices were put into effe in the entire eastern territory last wee

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.53	.53	.53	.53	.53	.53	...
Antimony	.40	.41	.41	.42	.42	.42	+ .02
Beams and Channels, 100 lb.	2.07	2.07	2.07	2.17	2.17	2.17	+ .10
Bessemer Steel, ton	33.00	33.00	33.00	33.00	33.00	33.00	...
Copper, Elec. lb.	.23	.23½	23½	.23½	.23½	.23½	+ .00½
Copper, Lake, lb.	.23	.23½	23½	.23½	.23½	.23½	+ .00½
Cottonseed Oil, bbl.	8.81	8.78	8.80	8.74	8.80	8.82	+ .01
Cyanide Potash, lb.	.28	.28	.28	.28	.28	.28	...
Fisb Oil, Menbaden, Brown	.48	.48	.48	.48	.48	.48	...
Gasoline, Auto, bbl.	.21	.22	.22	.22	.22	.22	+ .01
Lard Oil, prime	.92	.92	.92	.92	.92	.92	...
Lead, 100 lb.	5.75	5.75	5.75	5.90	5.90	5.90	+ .15
Linseed Oil	.66	.67	.67	.68	.69	.69	+ .03
Open-Hearth Steel, ton	34.00	34.00	34.00	34.00	34.00	34.00	...
Petroleum, bbl., Kansas, crude	1.20	1.20	1.20	1.20	1.20	1.20	...
Petroleum, bbl., Pennsylvania, crude	2.25	2.25	2.25	2.25	2.25	2.25	...
Rapeseed Oil, refined	.93	.96	.96	.96	.96	.96	+ .03
Rubber, Fine Up-River, Para	1.00	1.00	.97	.97	.97	.96	— .04
Rubher, Celyon Pale Crepe	1.05	1.05	1.04	1.04	1.04	1.03	— .02
Sulphuric Acid, 60 Baume	1.50	1.50	1.50	1.50	1.50	2.00	+ .50
Tin, 100 lb.	44.50	44.50	44.50	42.50	42.50	41.50	—3.00
Tire Scrap	.05½	.05½	.05½	.05½	.05½	.05½	...

following the advances on the Pacific Coast.

The New York City price to garages is now 22 cents a gallon, which compares with a price of 12 cents on March 31 last. The same schedule is effective for Standard Oil of New York territory in Long Island and Connecticut. In other New England States the price is 1 cent higher at 23 cents.

The schedule for New Jersey is 21 cents; for Ohio 19 to 21.

Bowen Resigns from Locomobile—To Build Automobiles

New York City, Jan. 12—Frank H. Bowen has handed in his resignation as sales manager of the local Locomobile branch. He is at present engaged in the promotion of a scheme to build automobiles.

Gier Pressed Steel Co. Now

Lansing, Mich., Jan. 7—The name of the Gier & Dail Mfg. Co., has been changed to that of Gier Pressed Steel Co. The concern started in business in July, 1909, with a capital stock of $35,000, making among other things metal stampings and steel products.

Regular Dividends Declared

United States Rubber Co.; quarterly on first preferred of 2 per cent and on second preferred of 1½ per cent, payable without closing of transfer books, Jan. 31.

Ajax Rubber Co.; quarterly of $1.25 per share; payable March 15 to stock of record Feb. 28.

Security Prices Lower

General Motors Drops 35 Points —Studebaker Drops 6— Maxwell Lower

New York City, Jan. 12—Automobile and accessory issues last week suffered a setback in prices, due to a downward movement in quotations on the Stock Exchange and an inactive market. The decline last week of those stocks which have seen new high marks was a keen disappointment to those who have money invested in those issues. General Motors common, especially, has declined during the past two weeks. On Saturday it quoted at 455, just 83 points under its high mark on Dec. 13. Notwithstanding the adoption of a 20 per cent dividend rate and the declaration of a 5 per cent dividend for the last quarter of 1915, in addition to 5 per cent for the current quarter, the stock closed 35 points under last week's quotation. The decline depressed other stocks.

Willys-Overland common dropped 6 points to 226 as did that of Studebaker, which closed at 159. Maxwell common, first preferred and second preferred, declined 3½, 2 and 1 points, respectively. Chalmers also went down to 125 with a 5-point loss. Chevrolet closed at 126, just 4 points lower than last week's quotation. Reo Motor Car dropped 2 points to 30 as did White, which closed at 49½.

Firestone common, Peerless, J. I. Case and Goodrich preferred, were the only stocks to make any appreciable gains during the week. Firestone went up 10 points to 720; Case rose to 85; and Goodrich went up 1 point to 113. Ajax dropped 1½ points. It is claimed that current earnings of the Ajax company are at the rate of more than 25 per cent per annum on the company's $3,000,000 outstanding capital stock.

Detroit issues also declined last week, General Motors, Studebaker, and Maxwell showing the largest drops. General Motors common went down to 445 with a 12½-point loss; Studebaker quoted 7 points under last week's quotation and closed at 159½; and Maxwell common was 5¼ points lower, quoting at 69½.

Hercules Is Now Dixie Motor Car Co.

Louisville, Ky., Jan. 7—Complying with the will of a majority of the stockholders of the Kentucky Wagon Works, ratified at a meeting several days ago, to conduct an automobile manufacturing plant in connection with the regular business of the concern, officers yesterday filed articles of incorporation of the Dixie Motor Car Co., the capital stock of which is fixed at $150,000, divided into 1500 shares of a par value of $100, two-thirds of which is common stock fully subscribed, and one-third preferred stock.

The articles are in the nature of an amendment to the Hercules Sales Co., in which the name is changed to the Dixie Motor Car Co., and the amount of capital stock increased from $100,000 to $150,000, the owners of the capital stock of the old concern becoming the owners of the common stock of the new. Incorporators of the new concern are P. S. Tuley, C. D. Kelso, W. E. Massey, A. H. Ross, J. R. Duffin and R. V. Board.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	70	71	—1½
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	..	85	85	88½	—2½
Chalmers Motor Co. com	..	97	125	150	—5
Chalmers Motor Co. pfd	..	93½	101	103	..
Chevrolet Motor Co	..	..	126	130	—4
Electric Storage Battery Co	..	..	64	65	..
Firestone Tire & Rubber Co. com	348	352	720	..	+10
Firestone Tire & Rubber Co. pfd	109½	111	112	..	—1½
General Motors Co. com	84	85	455	465	—35
General Motors Co. pfd	92	94	114	..	..
B. F. Goodrich Co. com	26	27	73	75	—1
B. F. Goodrich Co. pfd	92	95	113	114	+1
Goodyear Tire & Rubber Co. com	188	191	340	343	—2
Goodyear Tire & Rubber Co. pfd	100¼	101¼	114	..	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	20	25	—5
International Motor Co. pfd	..	..	40	45	—5
Kelly-Springfield Tire Co. com	75	77	*292 † 73	295 74	—3 —1
Kelly-Springfield Tire Co. 1st pfd	79	80	94½	95½	+ ½
Kelly-Springfield Tire Co. 2d pfd	95	100	† 73	74	—1
Maxwell Motor Co. com	17½	18	71	73	—3½
Maxwell Motor Co. 1st pfd	48	49	90	91	—2
Maxwell Motor Co. 2d pfd	18	20	55	57	—1
Miller Rubber Co. com	..	..	260	270	..
Miller Rubber Co. pfd	..	..	113	115	..
New Departure Mfg. Co. com	110	120	..	..	..
New Departure Mfg. Co. pfd	102	..	..	..	..
Packard Motor Car Co. com	..	100	185	195	..
‡Packard Motor Car Co. pfd	93	..	102½	104	+1
Paige-Detroit Motor Car	..	..	..	700	..
Peerless Motor & Truck Corp	..	..	30	31	+3
Portage Rubber Co. com	33	36	70	72	..
Portage Rubber Co. pfd	80	85	102	105	..
Regal Motor Co. pfd	..	..	..	20	..
§Reo Motor Truck Co	11½	12¼	23	25	..
§Reo Motor Car Co	24½	25½	30	32	—2
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	52½	53½	87	89	..
Stewart-Warner Speed. Corp. pfd	100	102	108	..	..
Studebaker Corp. com	36	37	159	161	—6
Studebaker Corp. pfd	91½	92½	110	113½	—3
Swinehart Tire & Rubber Co	69	71	89	90½	..
Texas Co.	133	134	227	229	—3
U. S. Rubber Co. com	57½	58	56	57	—1
U. S. Rubber Co. pfd	102½	103½	109	110	..
Vacuum Oil Co	198	201	230	235	..
White Motor Co. (new)	..	..	49½	50½	—2
Willys-Overland Co. com	86	90	226	229	—6
Willys-Overland Co. pfd	90	95	111	112½	— ½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Chalmers Motor Co. com	..	97	..	153	—3
Chalmers Motor Co. pfd	..	93½	..	102	— ½
Continental Motor Co. com	165	..	247	255	—3
Continental Motor Co. pfd	..	..	91	94	..
Ford Motor Co. of Canada	445	..	..	410	..
General Motors Co. com	84	86	445	480	—12½
General Motors Co. pfd	92½	94½	113	115	—1
Maxwell Motor Co. com	17	19	69½	72	—5¼
Maxwell Motor Co. 1st pfd	48	50	89½	91½	—2½
Maxwell Motor Co. 2d pfd	19¼	21¼	53½	56½	—1½
Packard Motor Car Co. com	..	100	..	190	—2
Packard Motor Car Co. pfd	93	..	103	104⅛	— ⅞
Paige-Detroit Motor Co. Co	..	..	..	700	..
§Reo Motor Car Co	24¼	25¼	32⅛	33⅛	— ⅜
§Reo Motor Truck Co	11⅛	..	22¾	23¾	— ⅛
Studebaker Corp. com	36	38	159½	162½	—7
Studebaker Corp. pfd	91¼	93½	112	115	..

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
§Atlas Drop Forge Co	..	25	28½	31	..
Kelsey Wheel Co	185	..	295	..	+10
§W. K. Prudden Co	19¼	20¼	30	34	+3¾
Regal Motor Co. pfd	..	25	..	20	—2½

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*Old. †New. ‡And accrued dividends. §Par value $10.

A. B. C. Ford System Is Effective

Two Unit Disposed in Novel Manner—Motor of High Cranking Power

NEW YORK CITY, Jan. 10—The outstanding novelty in the A. B. C. electrical starting and lighting system for Fords to be made by the A. B. C. Starter Co., Detroit, Mich., as announced last week, is the location of the cranking motor. This is usually the most troublesome part of a Ford system, as if it operates through a chain the latter needs some attention, and if it connects to the crankshaft it must stand in front of the radiator.

The A. B. C. motor lies alongside the crankcase near the right front where it is entirely out of the way. Integral with its casing is an inclosed gear reduction looking something like the timing gears of a small gasoline motor and this case is of course quite narrow. The small pinion of the gear train is on the starting motor shaft and the large gear is of such a size that it comes in line with the crankshaft, the inclosing case bolting to the front frame member so that the gears come beneath the radiator where their case is concealed by the license tag.

On the spindle of the large gear there is a Bendix pinion, but instead of being a toothed wheel the pinion part is formed just like the starting jaw of a hand crank. Thus, when current is switched into the motor, the gears begin to turn, the Bendix "pinion" jumps forward and the jaw takes hold of the Ford crankshaft just exactly as the old hand crank used to do. The reducing gear gives lots of power and the control is a switch.

For the generator drive a belt is used after the manner which has proved so successful on the Maxwell. There is a pulley on the crankshaft and the belt passes round the fan and the generator, giving an easily tensioned triangular drive. The generator locates on the front left side of the engine, fairly high.

For controlling the output of the generator a Ward-Leonard controller is employed. The system as supplied includes everything, a battery which fits on the left running board, wiring for headlights and tail lamp, dimmer switches, etc.

17,300 Paige Sixes for 1916

DETROIT, MICH., Jan. 10—At the annual meeting of the stockholders of the Paige-Detroit Motor Car Co., it was announced that during the fiscal year 1915, which ended Aug. 31, nearly 8000 Paige cars were made and sold. For the 1916 fiscal year the production schedule calls for 17,300 cars. The profits of the company during the past fiscal year were nearly 430 per cent greater than in 1914, and the earnings 130 per cent on the capital stock. The production schedule is being maintained at the rate of 150 cars a day, hut provisions have been made in all departments to enable the output to be 300 cars a day on a ten-hour working basis. Conditions throughout the country as reported by Paige dealers and distributors are the best the company ever had. The demand is steady and on an increase in every section of the country.

Goode Leaves Paris Branch of Packard Motor Car Co.

PARIS, Dec. 24—R. N. Goode, manager of the Paris branch of the Packard Motor Car Co., severs his connection with that firm on Jan. 1. No arrangements have been made for a successor, and it is understood that the Paris office will be closed, at any rate temporarily. This will not interfere with the Packard truck business in France, which is handled direct between the factory and the French army. Mr. Goode, who has had charge of Packard interests in Paris for the last five years, and is well known to American visitors to Europe, has linked up with Gaston, Williams and Wigmore, Ltd., and in conjunction with his brother, Keith Goode, will have charge of the French and Italian markets for that company.

Take American Truck Agencies

F. Charron, one of the founders of the Charron and the C. G. V. automobile companies, now president of the Alda Automobile Co., has taken up the agency in France for the Federal truck. Charron's factory at Courbevoie, near Paris, is almost completely occupied on shells, only a few touring cars being built; thus the truck agency is a side line.

Another French automobile manufacturer is about to take up the agency for the U. S. truck. The Jeffery company has opened a spare parts depot at Neuilly, in the suburbs of Paris, to give service in connection with its Quads.

At the present time there is a demand in France for trucks for civilian uses which local manufacturers are unable to meet, owing to the demands of the war department. Practically all private trucks were requisitioned by the army months ago, and users, after being content with temporary measures for a time, are now looking around for permanent relief.

Fire in Chevrolet's Tarrytown Plant

TARRYTOWN, N. Y., Jan. 7—Fire due to spontaneous combustion in a testing shed of the Chevrolet Motor Co., at Kingston Point, to-day did damage estimated at $50,000. The building, a one-story brick structure, 100 by 65 ft., was gutted.

Omaha Sales Show 100% Gain

Car and Accessory Dealers Optimistic—Many Enlarge Distributing Quarters

OMAHA, NEB., Jan. 7—An increase of 100 per cent in the automobile business for the past year in Omaha—acknowledged third largest automobile distributing point in the United States, by the way—is taken by local dealers and distributors as a reasonable ground upon which to base an estimate of the progress of the industry in the entire country.

The steady enlargement of quarters, the removal in many instances of dealers and distributors to new locations with immensely increased stocks and facilities, with the building of several new houses during the year, are all taken as measures of prosperity.

Bour-Davis Co. Formed

DETROIT, MICH., Jan. 10—The Bour-Davis Motor Car Co. is a new Michigan corporation with a capital stock of $500,000, organized by Chicago men to manufacture a low-priced car here. The incorporators are prominent business men of the Windy City, but this seems to be their first venture in the automobile industry. They are Robert C. Davis, engineer for the Chicago, Duluth, Lake Superior Steamship Co.; Charles J. Bour, well-known in advertising circles in Chicago; and E. C. Noe, general manager of the Chicago Elevated railway system.

To Fight Bill for Yearly Registration in D. C.

WASHINGTON, D. C., Jan. 8—A bill introduced in the House by Congressman Cary, of Wisconsin, provides that on and after July 1, 1916, it will be unlawful for any person to operate any motor vehicle within the District of Columbia without having first obtained from the automobile board a certificate of registration and number plates. The color of the plates is to be changed each year and the horsepower of all engines or motors is to be computed.

The license numbers will expire at midnight on June 30 of each year. The fees provided by the bill are as follows: For each motor vehicle with a rating of 10 hp., $5 per year; more than 10 and less than 20 hp., $10; more than 20 and less than 30 hp., $15; more than 30 and less than 40 hp., $20; 40 hp. or more, $25. It is provided that the automobile board may issue to a dealer or manufacturer of motor cars a certificate of registration and number plates not to exceed four sets, upon payment of $6 for each set.

All cars used by the United States Government and the District of Columbia are to be provided with license plates free of charge. All members of Congress are to be exempt from the provisions of the proposed law, providing they have complied with the laws in their respective States. All privileges shall be accorded to the residents of other States as are accorded by law to residents of the District of Columbia.

It is expected that motorists will put up a strong fight against the Cary bill.

Dodge Bros. Get Injunction on Use of Name

DETROIT, MICH., Jan. 7—To-day the Wayne County Circuit Court issued a restraining order in favor of Dodge Bros. against the Dodge Motor Car Co., whereby the latter cannot use the name Dodge in connection with the manufacturing of its cars.

Dodge Bros. filed suit against the Dodge Motor Car Co. in August, 1914, because this concern which had started in business in July of that year, was using the name Dodge on its cars. The company was promoted by Alvan M. Dodge, who was formerly with the Wahl Motor Car Co. Dodge Bros. claimed that the new company was trying to profit by the name Dodge, which had then been well known for a period of twelve years.

While the Dodge Motor Car Co. made a few cars, it ceased to manufacture a few months after it had started in business.

Marvin Batavia Rubber Treasurer

NEW YORK CITY, Jan. 10—New York capital will aid the Batavia Rubber Co., with factories at Batavia, N. Y., and sales and financial offices recently established in this city, in extending and developing its business, Charles F. Marvin, formerly of Blake Bros. & Co., having become treasurer and a member of the board of directors, and George W. Hodges, of Remick, Hodges & Co., having also been added to the board of directors. Both will henceforth take an active interest in the company. They succeed O. C. Carpenter and Horace F. DeCamp of this city. There is no other change in the personnel of the company.

H. A. L. Leases Royal Plant

CLEVELAND, OHIO, Jan. 7—The Harry A. Lozier Co., this city, has leased for a short term the Royal Motor Car Co. plant along the Lake Shore tracks west of Gordon park. Within two weeks the manufacture of the H. A. L. twelve will have begun. The first car manufactured was on exhibition last week at the New York City automobile show. It is stated that a permanent site for the plant is now being negotiated for.

15,000 Overlands for Kansas City

Big Allotment To Be Handled in Enlarged Territory by New Branch

KANSAS CITY, MO., Jan. 7—The Willys-Overland Co., Toledo, Ohio, has taken over the local agency as a factory branch and installed S. W. Ramsey, who for the past two years has had charge of the sales department here, as branch manager. The territory to be served from Kansas City has been enlarged by the addition of the States of Arkansas, Oklahoma, New Mexico and parts of Nebraska and Oklahoma to Kansas and the portion of Missouri that formerly was handled from here.

The establishment of the factory branch here will mean an actual investment by the Willys-Overland Company of approximately $1,000,000 in real estate and buildings. Recently the building now occupied by the agency at 2110 Grand Avenue and 95 ft. of vacant property north of it was purchased for $250,000. As soon as possible work will start on the construction of a six-story building to occupy the entire 135-ft. frontage on Grand Avenue.

In addition, it has been given out that a 5-acre tract on the Belt Line will be acquired and a building with approximately 500,000 sq. ft. of floorspace will be erected as storage quarters. The present structure on Grand Avenue and the new building to be erected there will be used only as a show room and shop and not for storage purposes. The Belt Line property will be necessary for the storage uses.

The year just ended found the Kansas City agency distributing approximately 5000 cars in Kansas and western Missouri. With the addition of three whole States and parts of two others it is believed at least three times that number will be handled from here and the factory has allotted 15,000 cars to Kansas City as its 1916 quota.

80 Per cent of Packard Output Sold—Factory Works Day and Night

DETROIT, MICH., Jan. 10—"Our manufacturing schedule calls for 7750 twin-sixes for this fiscal year," said Sales Manager H. H. Hills, of the Packard Motor Car Co., and of this number 80 per cent have been contracted for. At the rate orders are coming in from our dealers, distributors and branches, we could dispose of an additional 5000 cars. In addition to those 7750 cars we will build a very large number of trucks, but here again conditions, which we cannot overcome now, will not make it possible to produce the number that could be sold. We are doing everything possible to increase our production. We are adding to our working force, we are making extentions to the plant, more equipment and other necessities to increase production are being added, and yet we cannot keep pace with the demand. Many departments are being worked with day and night shifts and the truck department especially has orders now which will keep it busy day and night for several months."

Austin-Cadillac Suit Ends

DETROIT, MICH., Jan. 4—Judge C. W. Sessions of the United States district court in Grand Rapids, Mich., to-day signed the final decree in the Austin-Cadillac two-speed axle case.

It was on Jan. 8, 1915, that the judge rendered a decision in favor of Walter S. Austin, of the Austin Automobile Co., Grand Rapids, granting the latter's demand for an injunction and damages against the Cadillac Motor Car Co., ordering an accounting so that the amount of damages could be fixed.

The parties since then had agreed upon a form of decree, and it is this decree which now has been confirmed by the judge and signed by him and thus brings the case to an end.

Suit was started by Mr. Austin in July, 1914. He claimed that the Cadillac company infringed his two-speed axle patent, No. 1,091,618, which had been issued to him in March, 1914.

Hyatt Employees Form Class in Iron and Steel Metallography

HARRISON, N. J., Jan. 11—Employees in the physical testing laboratory of the Hyatt Roller Bearing Co. factories have organized a class in the metallography of iron and steel. The course consists of correspondence lessons prepared by Professor Sanveur of Harvard and is supplemented by letters and practical examples taken from the regular shop work. The course consists of two lessons a week and will continue over a period of six months.

Tuition is charged for the course but any employee remaining with the company two years will have his tuition refunded to him. The Hyatt company has permitted the use of its metallographic apparatus for the carrying on of the work and prizes will be offered for the greatest progress.

Missouri Dealers Want Lower Fees

ST. LOUIS, MO., Jan. 8—A strong movement for the reduction in the price of State automobile licenses has appeared among automobile dealers in St. Louis. The present system, they say, has had a deterrent effect on automobile sales during the closing months of the closing year.

Every automobile owner in Missouri must take out a license each year, the cost of which varies from $2 to $12, according to the horsepower of his car. The cost of a license is the same no matter when taken out, so that short-lived license is just as expensive as one which has a full year to run.

Plans are being made by automobile dealers to influence the next General Assembly to establish a license graded according to the time it covers.

"I know five automobile prospects who have put off the purchase of a car because they were unwilling to pay a full year's license for a few months' use of their car," said Frank R. Tate, president of the Tate-Gillham Motor Car Co.

Form Wolverine Tractor Co.

DETROIT, MICH., Jan. 10—The Wolverine Detroit Tractor Co., is being formed here to manufacture a motor tractor which is to sell at from $800 to $900. The promoters of the company are W. G. Wagenhals, formerly vice-president of the Wagenhals Motor Co., who is the designer of the tractor, and W. J. McNamara, former mayor of Edmonton, Alberta, Canada, and reputed to be the owner of more than 20,000 acres of farm land in that section of Canada. Temporary offices have been opened at 664 Grand Avenue. The tractor is to appear at the Detroit show, Jan. 15 to 22.

Banner Buggy Co. Reduces Its Capital to $400,000

ST. LOUIS, MO., Jan. 5—Simultaneous with the beginning of operations at the new St. Louis Chevrolet assembling plant the Banner Buggy Co., part of whose plant was converted into an automobile factory, has announced a decrease of its capital stock from $700,000 to $400,000. Russell F. Gardner, president of the buggy company, is also president of the recently incorporated St. Louis Chevrolet Co.

Mr. Gardner has converted a large portion of his buggy factory into an assembling plant and turned out the first St. Louis-made Chevrolet "Four-Ninety" on Jan. 1. The local plant, Mr. Gardner says, is to supply the entire Southwest and Middle West with Chevrolet cars.

King Resigns from Jones

WICHITA, KAN., Jan. 6—W. A. King, general factory manager and consulting engineer of the Jones Motor Car Co., this city, has resigned, his resignation to take effect Feb. 15. He has accepted a position with a new organization now being formed to build cars. He will hold the same position that he is holding at present with the Jones company.

A. A. A. To Pick Master Driver

Contest Board Will Also Select Master Car for 1916 Racing Season

NEW YORK CITY, Jan. 10—The contest board of the American Automobile Association has tentatively decided to select the master driver and master car in the 1916 speedway and road-racing circuit, thus following the example set by *Motor Age* during the past several seasons of selecting the master or winning driver for road racing and also for speedway racing. Plans are yet chaotic, but the suggestion has been made to award the driver so distinguished with a gold medal, carrying his profile on the front and a suitable inscription on the rear, and to further give him $500 in gold. The complete details of the scheme will be worked out in the near future by the contest board.

During the past year *Motor Age* awarded the speedway supremacy to Gilbert Anderson, piloting a Stutz car, and road-racing supremacy to Earl Cooper, also driving a Stutz. The minor speedway circuit was awarded to Edward Rickenbacker in a Maxwell. In making these awards the two invitation 100-mile speedway races won by Resta were not considered because of their invitation nature. It was necessary to establish a major speedway circuit made up of Indianapolis, Chicago, New York and Minneapolis, and a minor circuit of smaller tracks where shorter races for smaller purses were offered.

Miller Is Vice-President of Miller, Hicks & Hewitt

NEW YORK CITY, Jan. 11—Roland Van G. Miller, formerly sales manager of the Hune Carriage Co., Boston, Mass., has been elected vice-president of Miller, Hicks & Hewitt, manufacturers of automobile bodies in this city.

Austin Heads Dry Climate Tire

DENVER, COL., Jan. 7—The Dry Climate Tire Mfg. Co., Denver and Arvada, has elected E. A. Austin, of Boulder, president to succeed C. W. Clark; A. L. Davis, Arvada, director and vice-president, and W. H. Davis, Fort Lupton, secretary. The recently organized firm has a factory at Arvada and sales office in Denver.

Auto Wheel to Add 100 Men

LANSING, MICH., Jan. 5—Within the next two or three weeks additions to the plant of the Auto Wheel Co. will be completed and about 100 more men will be added to the working force, bringing the force up to about 300 men. Business in 1915 was the best the company ever had, and orders now on the books from regular customers will keep the plant busy until August. Recently new housings were erected, and it is said that the company now has about 1,000,000 ft. of lumber stored.

Reo Starts Night Work

LANSING, MICH., Jan. 10—Night work was started at the plant of the Reo Motor Truck Co. a few days ago. A force was put to work in the automatic screw machine department and from now on night shifts will be added in other departments. These night workers work 14 hr. a day during five days. The day workers, who work six days a week, work only 10 hr. a day.

Velie Sales Gain 400 Per cent

MOLINE, ILL., Jan. 10—In spite of having been somewhat held back by the materials situation, the Velie Motor Vehicle Co., this city, states that its car sales for November were 400 per cent greater than a year ago. Further plans for manufacturing expansion are now under way.

South Dakota Fees Now Only $3

PIERRE, S. D., Jan. 7—Several changes are noted in the new automobile tag license law. The fee is $3. Formerly it was $6 per year payable in two bi-yearly installments. A discount of 50 per cent on the license fee for cars operated five years or more has been done away with.

Allen Motor Co. Expands

FOSTORIA, OHIO, Jan. 6—The Allen Motor Co., this city, has increased its capital stock from $100,000 to $1,500,000. Of the new capitalization $500,000 is preferred stock all of which has been taken by Cleveland capitalists. The additional capital will be used in making improvements on the plant.

Limberg Buys Delage Racer

PARIS, Dec. 31—Carl Limberg, who is now in Paris, has closed a deal with the Delage company for the purchase of one of their 1914 Grand Prix racing cars. The car has been purchased conditional to the government permit to export being obtained. It is not believed that there will be any difficulty in getting this permit. The car is one of the sixteen-valve type with positively closed and opened valves. It is Limberg's intention to run it in the Indianapolis and other American races next season.

10,000 Kings for 1916

NEW YORK CITY, Jan. 7—The King Motor Car Co., Detroit, will build 10,000 cars this year, according to plans announced this week.

Corona Wants Grand Prix

International or Corona Grand Prix May Be Held March 17

LOS ANGELES, CAL., Jan. 5—Corona may hold a race in 1916. There remains but 2 miles of the highway from Los Angeles to Corona to be completed and permission has already been granted by the city trustees for a race on the course.

There is but one condition under which the race is to be run. There must be no appearance money paid for drivers. This is a case of civic pride and the trustees require the directors of the Corona Racing Association to sign a guarantee not to offer any appearance money before the race is allowed to be advertised.

The $15,000 subscribed last Fall when the Corona race was first suggested, is still in the hands of the officers of the association.

According to Chairman Kennerdell, the Corona race will not be a road race this year but a boulevard race. This is a new classification insisted upon by the Chairman of the Contest Board on the grounds that the Corona course was originally designed for speed although it is a public highway.

The next race on the Los Angeles speedway is to be held Feb. 22 and the Corona date, according to supporters, will be March 17. There is some hope of making it a high grade match by getting the International Grand Prix for the course, the Vanderbilt going to the New York Speedway. In case the Corona boosters are unsuccessful in getting the International Grand Prix, the event will be known as the Corona Grand Prix.

2-Mile Speedway for Cincinnati

CINCINNATI, OHIO, Jan. 7—Cincinnati is to have a 2-mile speedway within six months, according to plans of the Cincinnati Speedway Co., organized here with a capital of $500,000 of which $400,000 has already been subscribed. At a meeting of the board of directors last Saturday authority was given to purchase a tract of land 1 mile long and 1½ miles wide near Sharon, Ohio, and lying close to the Big Four, Pennsylvania and Cincinnati, Hamilton and Dayton Railroad lines. There are four improved pikes surrounding the track on which it is planned to erect the new speed saucer. At the Saturday meeting it was understood that the architect, Henry Hake, accompanied by his engineer, Captain Charles Kuck, was to leave within a week to make an inspection of the New York and Chicago speedways.

The plan of construction of the Cincinnati track is to use 2 by 4-in. planks laid lengthwise. There is to be a clubhouse on the field and it is planned to hold military tournaments and general athletic contests on the course as well as automobile races. Through the transportation facilities at the disposal of the company it expects to be able to handle 100,000 persons in half an hour. It is pointed out that 1,500,000 persons live within 100 miles of Cincinnati, which should insure good attendance. The plans for the course are to be ready by February, much of the preliminary work having already been done.

The officers of the speedway are E. W. Edwards, president; Harry Lehman, vice-president, and T. J. Davis, treasurer. The directors, in addition to the officers, are M. J. Freiberg, R. K. Le Blond, J. P. Orr, I. J. Cooper, A. E. Burkhardt, W. T. Foley, T. J. Corcoran.

Elgin May Lose Road Races

ELGIN, ILL., Jan. 7—Elgin may lose the national road races. Negotiations are pending between the Chicago Speedway Assn. and the Elgin Road Race Assn. over a proposition to hold the 1916 races on the Maywood Speedway. F. W. Jencks, general manager of the Elgin events, has arranged for a conference with D. F. Reed, president of the speedway association, to go over the details of the proposition and will present them to the Elgin directors for their consideration. The Elgin association has the option of renting the speedway and taking entire charge, or taking a guarantee from the speedway association and the latter assume the management. Elgin directors hesitate about taking the races away from this city, but they will consider the subject. If assured of financial support from Elgin business men, they will turn down the Chicago proposition. Rains last year proved disastrous to the financial success of the meet.

E. A. Introduces New Rear Signal

BROOKLYN, N. Y., Jan. 7—The E. A. Laboratories, this city, have just perfected a new electrically operated rear lamp signaling device and are making a bid for equipment business. It substitutes for the usual rear lamp with no additional cost.

The E. A. Laboratories, having outgrown their quarters at 627 Kent Avenue, Brooklyn, have just moved into their new building at Broadway and Wythe Avenue, where they expect to produce half a million automobile horns during 1916.

Three More Maxwell Branches

DETROIT, MICH., Jan. 10—The Maxwell Motor Sales Corp. has opened branches in Philadelphia, Atlanta and Providence, in charge respectively of L. G. Peed, C. H. Batchelor and O. C. Reed.

Indianapolis Race Changes

Drivers to Get 25% of Gate Receipts During Practice —33 Starters

INDIANAPOLIS, IND., Jan. 10—Entry blanks for the 300-mile sixth annual race on the 2½-mile brick speedway in this city have been issued, as reported in THE AUTOMOBILE for Jan. 6, and in addition to showing the race of 300 miles for $30,000 in prizes, several other changes as compared with previous Indianapolis races are noted. For the first time the speedway agrees to pay entrants 25 per cent of the gross gate receipts during practice, the distribution of this practice money to be based on the number of laps driven between the hours of 2 and 5 p. m. on practice days. The number of starters has been limited to thirty-three cars and the previous order of eliminating will be carried out so that only the fastest thirty-three cars of all entrants will start. The management insists on the use of steel or bronze spiders on the steering wheels, requires chain-driven cars to have chain guards, and leaves the safety of all other parts of the car, such as steering parts, front axle, etc., to the judgment of the speedway technical committee.

80 M.P.H. Required

The American Automobile Assn. rules will apply in all details including the entry of five cars of the same make. Instead of cars having to qualify at a speed of 75 m.p.h., the figure has been raised to 80.

Tacoma Speedway Race Aug. 5

TACOMA, WASH., Jan. 7—The Tacoma Speedway Assn. announces that the principal racing event of 1916 will be held on Aug. 5, and that the prize for the one race will be $10,000, with a distance of approximately 300 miles, with intermediate prizes for the 100 miles, and the 200 miles.

The big race of the year will be a combination of the Montamarathon and the Potlatch trophy races, and will be broadened into a race for the whole Northwest, and has not yet been named.

Lien Against Sheepshead Speedway—Will Not Affect Operation

NEW YORK CITY, Jan. 10—A lien has been brought against the Sheepshead Bay Speedway Corp., owner of the 2-mile motor speedway for $203,437. The speedway has for many months refused to pay this construction item on the ground that there has been an overcharge of approximately $100,000. The speedway had previously agreed to settle on this basis, but as the contractor has refused, the matter has gone into the courts. The case will not come up for hearing inside of a year and will in no wise affect the speedway, the finances of which are in ample condition to take care of all indebtedness. To date the speedway has a total investment of $3,550,000 made up of property, real estate, $2,050,000, and track, grandstands, and other improvements $1,500,000. The real estate embraces 430 acres of land. Part of this land lies outside of the grounds and is being sold for building purposes.

45 Car and Truck Exhibits at Cleveland Show

CLEVELAND, OHIO, Jan. 8—Although the doors of the Wigmore Coliseum were opened for visitors to the fifteenth annual Cleveland automobile show at 1 o'clock, the formal opening did not take place until 7.30 in the evening. Through the afternoon, however, there was a constant throng of people looking over the forty-five exhibits of automobiles and trucks. Three manufacturers are exhibiting electric cars. One of them showed two models; another, three, and the third showed four.

The number of chassis shown seems rather small, considering the fact that they are always given great attention.

Two local companies, the Peerless Motor Car Co., and the White company, made special displays of the trucks turned out at their plants. Peerless showed its 2-, 4- and 5-ton trucks, all 32.4 hp. White displayed a complete 45 hp. truck and chassis of a 45-hp. and three 30 hp. trucks. Several other light trucks and delivery wagons were shown, including the Baker electric 1- and 2-ton trucks.

Among other exhibits of the Gabriel Auto Co. was a bus built for the Green Line Bus Co. which operates a line between Cleveland and Strongsville and, when this new car is added, will extend the line to Medina. The bus is built to resemble a street car and is equipped with rattan seats with a capacity for seating twenty-one people. It is equipped with a 40 hp. engine and the tires are 36 by 6.

The White company has on exhibition a car with seating capacity for twenty persons. It is equipped with the usual White engine and the body is built something on the order of a sight-seeing car. However, the seats are placed crosswise, with an aisle down the center.

Cars Reduce Kansas R. R. Earnings

TOPEKA, KAN., Jan. 7—Railroad officials state that a disastrous slump in local passenger business has been occasioned by the large number of automobiles in Kansas and as a consequence have asked for an increase from 2 cents a mile to 3 cents on passenger rates.

Milwaukee Show Opens

56 Makers Represented—Show Caters to 4,000,000 People —Trucks Exhibited

MILWAUKEE, WIS., Jan. 8—The eighth annual show of the Milwaukee Automobile Dealers', Inc., opened last night, in the Milwaukee Auditorium and attracted the largest first-night crowd ever known here, or 4790. A total of fifty-six manufacturers are represented by exhibits.

As in past years, the entire basement of the Auditorium is devoted to exhibits of trucks, commercial cars, bodies, and heavy parts and supplies.

The Milwaukee show, like its predecessors, is principally a retail selling proposition, although it ranks high as a booster for the sales by State or district agents to sub-dealers from all parts of the State.

It is estimated that more than 1500 garage-keepers, repairshop owners and agents from every section of Wisconsin attend the January show. With this in view, various organizations select the January show week for the important conventions of the year, notably that of the Wisconsin Retail Automobile Dealers' Association. The M. A. D. annually entertains the visiting tradesmen at a monster banquet, which this year will be held Wednesday evening, Jan. 12, after show-closing time, 10:30 p. m. More than 700 acceptances have been booked.

The Milwaukee show is the principal one between Chicago and Minneapolis and caters to a total population estimated at 4,000,000 people.

Cincinnati to Stop Reckless Driving

CINCINNATI, OHIO, Jan. 10—The city authorities and the judiciary of Cincinnati have both taken up the question of obediance to traffic rules and ordinances and the result is a more stringent observance of the laws which are now in force. Steps are also being taken to have enacted more rigorous laws for the control of traffic on the streets of the city.

Safety Director W. J. Friedlander. acting under instructions from Mayor Puchta, has issued orders to the police to place reckless drivers of automobiles and motor trucks under arrest and to force them to furnish bonds, instead of being cited to appear in court.

Hercules Motor Completes Organization

CANTON, OHIO, Jan. 6—The Hercules Motor Mfg. Co., this city, recently organized to build automobile motors, has completed its organization by the election of Charles Balough, president; Gordon M. Mather, vice-president, and O. J. Strayer, secretary and treasurer. Mr. Strayer is at present secretary and treasurer of the Canton Stamping & Enameling Co. Others on the board of directors are H. H. Timken of the Timken Roller Bearing Co., J. G. Obermier and L. Pulcher.

Reo Employees Get Christmas Present

LANSING, MICH., Jan 3—A $5 gold coin was given as a Christmas present to every employee, either in the shops or in the offices, of the Reo Motor Car Co., and of the Reo Motor Truck Co. All told, 4500 employees were in line, which means that the companies distributed $22,500 in gold.

Star Rubber to Start Work

AKRON, OHIO, Jan. 7—The Star Rubber Co., which has been making automobile sundries, is to begin the manufacture of automobile tires. For this purpose a three-story building 70 by 100 ft. will be put up at a cost expected to be about $30,000.

Dunham Body Factory Burns

NEWARK, N. J., Jan. 10—The plant and show rooms of the D. B. Dunham & Sons, Inc., manufacturer of automobile bodies, were destroyed yesterday by fire, entailing a loss of $100,000.

Larrabee-Deyo Truck Makes Lease

BINGHAMTON, N. Y., Jan. 7—At a meeting of the directors of the Larrabee-Deyo Motor Truck Co., arrangements were perfected to lease part of the main building of the Sturtevant-Larrabee Co. for the manufacture of trucks.

Goodyear Opens Station in Dakotas

ABERDEEN, S. D., Jan. 7—The Goodyear Tire & Rubber Co. has opened a service and sales station here to cover northern South Dakota and southern North Dakota. H. F. Brownell Co., Sioux Falls, state agent, will manage the new station here.

Van Sicklen Speedometer on 1916 Stutz

NEW YORK CITY, Jan. 7—Announcement was made at the automobile show in this city that the Van Sicklen Co., Chicago, Ill., will equip all cars made by the Stutz Motor Car Co., Indianapolis, Ind., with its speedometers.

Mitchell Eight $1,450

NEW YORK CITY, Jan. 7—In the Dec. 30 issue of THE AUTOMOBILE the price of the Mitchell eight was given at $1,250. The Mitchell company would like it announced that the price of this car is $1,450 f.o.b. Racine, for either three-passenger roadster or seven-passenger touring car.

Factory Miscellany

Cleveland-Ford Tire to Build—The Cleveland-Ford Tire Co., Ashtabula, Ohio, will soon start the erection of its plant.

Heinze to Add New Equipment—The John O. Heinze Co., Springfield, Ohio, contemplates installing additional equipment to its plant.

Ford Addition in Denver—The Ford Motor Co., Denver, Colo., will build a four-story addition to its assembling plant. The estimated cost is $150,000.

Harvey Top Starts Manufacturing—The Harvey Auto Top Co., 4050 Easton Avenue, St. Louis, Mo., has begun the manufacture of winter or convertible tops.

Link-Belt to Add—The Link-Belt Co., Indianapolis, Ind., will build an addition to its plant at Addison Street and the Vandalia Railroad, the estimated cost being $12,000.

Crow to Add—The Crow Motor Car Co., Elkhart, Ind., has awarded contracts for an addition to its plant which will be 60 by 240 ft., and will cost approximately $10,000.

To Make Tires in El Paso—J. Thomas Ward is organizing a company to build an automobile tire and tube manufacturing plant at El Paso, Tex., the estimated cost being $200,000.

Fuelton-Greuter to Move Plant—The Fuelton-Greuter Mfg. Co., Saugas, Mass., manufacturer of carbureters, will remove its plant to Cincinnati at an early date. A building at the corner of Sixth and Baymiller Streets has been leased.

Overland's Toledo Building Plans Changed—Plans for the Willys-Overland service building to be erected at Adams and Fourteenth Streets, Toledo, Ohio, have been changed in order to secure a larger structure. The new plans call for a fireproof structure, four stories high and 100 by 280 ft. The cost of the building will exceed $100,000.

Baldwin Locomotive Truck Plant—The Baldwin Locomotive Works, Philadelphia, is erecting a one-story factory building at its Eddystone property in which it will manufacture motor trucks exclusively. These trucks are for foreign service.

Mitchell-Lewis Improvements — The Mitchell-Lewis Motor Co., Racine, Wis., is installing an additional 300-hp. boiler and making other improvements to its power and generating facilities to accommodate the increased demand of its big plant. Immediately after Jan. 1 the force was increased and overtime schedules made effective in numerous departments to bring the production of cars up to the requirements of agents.

The Automobile Calendar

Jan. 7-13	Milwaukee, Wis., Show, Auditorium.
Jan. 8-15	Cleveland, Ohio, Show, Wigmore Coliseum, Cleveland Automobile Show Co.
Jan. 8-15	Philadelphia, Pa., Show, Philadelphia Auto Trade Assn.
Jan. 13-18	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Club and Columbus Auto Trades Assn.
Jan. 14-22	Dayton, Ohio, Show, Delco Bldg., Dayton Automobile Dealers' Assn., and Dayton Accessory Dealers' Assn.
Jan. 10-15	Fort Wayne, Ind., Show, Auto Trade Assn.
Jan. 10-15	New Bedford, Mass., Show, State Armory.
Jan. 15-22	Detroit, Mich., Show, Detroit Automobile Dealers' Assn.
Jan. 17-19	Erie, Pa., Show, Erie Automobile Dealers' Assn.
Jan. 17-22	Rochester, N. Y., Show, Exposition Park, C. A. Simmons, Mgr.
Jan. 17-22	Wilmington, Del., Show, Wilmington Automobile Show Assn.
Jan. 18-21	Fargo, N. D., Show, North Dakota and Minnesota Automobile Dealers' Assn.
Jan. 18-22	Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-29	Lancaster, Pa., Show, Conestoga Park Pavilion.
Jan. 22-29	Montreal, Que., Show, Almy's Bldg., Automobile Trade Assn., Ltd.
Jan. 22-29	Chicago, Ill., Show, National Automobile Chamber of Commerce; Coliseum and First Regiment Armory.
Jan. 24-29	Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.
Jan. 24-29	Scranton, Pa., Passenger Car Show, Town Hall.
Jan. 24-30	Portland, Ore., Show, Armory, Portland Automobile Dealers' Trade Assn.
Jan. 25, 26, 27	Montgomery, Ala., Show, Klein Bldg., Montgomery Automobile and Accessories Dealers.
Jan. 29-Feb. 5	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Show Co.
Jan. 29-Feb. 5	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.
Jan. 31	Scranton, Pa., Show, Commercial Car Show, Town Hall. H. B. Andrews, Mgr.
Jan. 31-Feb. 5	Fall River, Mass., Show, State Armory. R. C. Borden, Mgr.
Feb. 1-3	Frederick, Md., Show, Armory.
Feb. 1-5	York, Pa., Show, York Auto Dealers' Assn.
Feb. 2-5	Buffalo, N. Y., Show, Auditorium, Buffalo Automobile Mfrs. and Dealers' Assn.
Feb. 2-5	Poughkeepsie, N. Y., Show, State Armory.
Feb. 7-12	Kansas City, Mo., Show, J. I. Case, T. M. Bldg., Kansas City Motor Dealers' Assn.
Feb. 7-12	Duluth, Minn., Show, Armory, Duluth Automobile Dealers' Assn.
Feb. 8-11	Grand Forks, N. D., Show, Auditorium.
Feb. 9-12	Peoria, Ill., Show, Coliseum, Peoria Automobile and Accessory Assn.
Feb. 12-19	Albany, N. Y., Show.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Des Moines, Ia., Show, Des Moines Auto. Dealers' Assn.
Feb. 14-19	Winnipeg, Man., Show, Ford Plant, Winnipeg Motor Trades Assn.
Feb. 19	Newark, N. J., Show, First Regiment Armory, C. G. Fitzgerald, Mgr.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory. B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 28-Mar. 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Paterson, N. J. , Fifth Annual Show, Auditorium.
Feb. 29-Mar. 4	Ft. Dodge, Ia., Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Ia., Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
Mar. 8-11	Mason City, Ia., Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
Mar. 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
Mar. 28-Apr. 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 20	Chicago, Ill., Amateur Drivers' Race, Chicago Motor Speedway.
May 30	Indianapolis Track Race.
June 17	Chicago Track Race.
June 28	Des Moines, Ia., Track Race.
July 4	Minneapolis Track Race.
July 4	Sioux City Track Race.
July 15	Omaha, Neb., Track Race.
Aug. 5	Tacoma Track Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Track Meet.
Sept. 15	Indianapolis Track Race.
Sept. 16	Providence Track Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Track Race.
Oct. 14	Chicago Track Race.

The Week in the Industry

Pardee Is Diamond-T Sales Manager—Fred Pardee has been made sales manager of the Diamond-T Motor Car Co., Chicago, Ill.

Stanford Is Westcott Purchasing Manager—E. E. Stanford of Indianapolis has been made purchasing manager of the Westcott Motor Car Co., in Richmond, Ind.

Rittenhouse Joins Norwalk Tire—L. K. Rittenhouse, former manager of the St. Louis branch of the B. F. Goodrich Co., has become associated with the Norwalk Tire & Rubber Co., Norwalk, Conn. O. E. Hoerger, former assistant branch manager of the St. Louis Goodrich office, is now acting manager.

Dealer

Overland Factory Office in Seattle—The Willys-Overland Co. will establish a factory office in Seattle, Wash., controlling the territory of Washington, Oregon, Idaho, Montana and British Columbia. Offices will be opened at the plant of J. W. Leavitt & Co., which remains the distributer of the Overland. This company will augment its office staff by moving there W. J. Pedlar, at one time its San Francisco manager, who will be supervisor in the Northwest at Seattle.

Philadelphia Trade News—J. R. McClellan, manufacturer and sales agent of the McClellan tire, will retail that tire, together with the Chester tire and Efficiency gas oil, at 817 North Broad Street.

The George W. Reinbold Co. is erecting showrooms and service station at 2506 North Broad Street, the home of the Scripps-Booth car.

The Metz Co. has opened new showrooms at the southwest corner of Broad and Wood Streets.

Overland Makes N. Y. Lease—The Willys-Overland Co. has leased the Conrad Stein Brewery property, running through the block from Fifty-seventh to Fifty-eight Streets, near Eleventh Avenue, New York City. A new concrete, eight-story building, which is to be 150 ft. wide by 200 ft. deep, will be fitted out as zone offices and general headquarters for the New York zone. The entire upper part of the building will be occupied by the wholesale establishment while the lower part will be sublet to the C. T. Silver Motor Co., the New York City distributor, as a service station for its customers.

Motor Men in New Roles

Drawe Resigns from Pathfinder—G. E. Drawe has resigned from the Pathfinder Co., Indianapolis, Ind., and is now assistant general manager of the Allen Motor Co., Fostoria, Ohio.

Kimball Makes Change—Wade Kimball, formerly sales manager of the Moreland Motor Truck Co., has assumed the duties of manager of the Pacific Metal Products Co.'s truck and tractor department, Los Angeles, Cal.

Montgomery Joins Standard Truck—G. M. Montgomery, formerly traveling representative for the Bessemer Motor Truck Co., has been appointed eastern traveling representative for the Standard Motor Truck Co., Detroit, Mich.

Flint Heads Los Angeles White—G. M. Flint has been placed at the head of the pleasure car department of the Pioneer Commercial Auto Co., Los Angeles, Cal., which controls the southern California and Arizona agency for the White products. Mr. Flint for the past two years has been manager of the local Moline branch.

Spencer Moline Mgr.—L. R. Spencer has been appointed sales manager of the Los Angeles Moline Automobile Co., factory branch. For the past two years Mr. Spencer has been in charge of the service for the company in this territory and previous to his coming to Los Angeles was connected with the sales department at the factory.

Gallmeyer Transferred to Fort Wayne—E. G. Gallmeyer, district manager for the S. F. Bowser Oil Tank & Pump Co., Fort Wayne, Ind., has been transferred from Louisville, Ky., where he was manager of the Louisville branch, to Fort Wayne, where he will act as editor of the Bowser Boomer, the monthly publication of the company. A. D. Carriger will succeed him at the Louisville branch. G. A. Townsend, Jr., advertising and publicity manager for the Bowser company has acted as editor of the Boomer but on account of the increase in business he would be unable to look after getting out the publication. The fourth annual convention of the Bowser Pacemakers has been in session at the home office during the past week. One hundred and seventeen salesmen this year are members of the club.

Chouteau Made V.-P.—August Chouteau has been made vice-president of the Bittel-Leftwich Tire Service Co., St. Louis, Mo., and will take an active interest in the business.

Wilkinson Blair Mgr.—R. L. Wilkinson has been appointed general manager of the factory of the Blair Motor Co., Newark, Ohio. R. C. Hammond has been elected secretary-treasurer of the company.

Metcalf Joins Philadelphia Houk—W. H. Metcalf, heretofore associated with the management of the Bartlett garages, and secretary of the Philadelphia Motor Truck Assn. since its organization, will in future have charge of the Houk wire wheel interests in Philadelphia, with headquarters at 328 North Broad Street.

Dealer

New Detroit Body Co.—The Beach-Cross Body Co., Detroit, Mich., has opened for business at 863 Woodward Avenue, handling the product of the Highland Body Mfg. Co., Cincinnati.

New Detroit Firestone Home—The new home for the Detroit branch of the Firestone Tire & Rubber Co., will be a four-story structure, 181 by 300 ft. at Woodward and Canfield Avenues. It will be started at once and is expected to cost between $30,000 and $50,000.

L. I. Site for Pierce-Arrow—The Arrow Motor Realty Co., representing the interests connected with the Harrolds Motor Car Co., agent for the Pierce-Arrow automobile, New York City, has purchased an entire block in Lond Island City, directly at the rear of its service building erected last year, involving the property bounded by Freeman and Webster Avenues, Fifth and Sixth Streets.

Omaha Goodyear Again Adds—For the third time since occupying its new quarters last spring, the Omaha, Neb., branch of the Goodyear Tire & Rubber Co., has been forced by the development of trade to add to its floor space in very material degree. The last move will increase the space by about 3500 ft.

When the branch first moved in, it had about 5000 ft. of floorspace. It now has 14,000, and the latest move, besides including extensive remodeling within the building already occupied, involves also the occupying of the basement of an adjoining building. After the first of the year, the branch will have a district credit office and a district mechanical office, with special men to handle these new goods. The sales force will have been increased to twelve men.

Vol. XXXIV New York—Thursday, January 20, 1916—Chicago No. 3

The Automobile

1916 Body Design Is Uniform

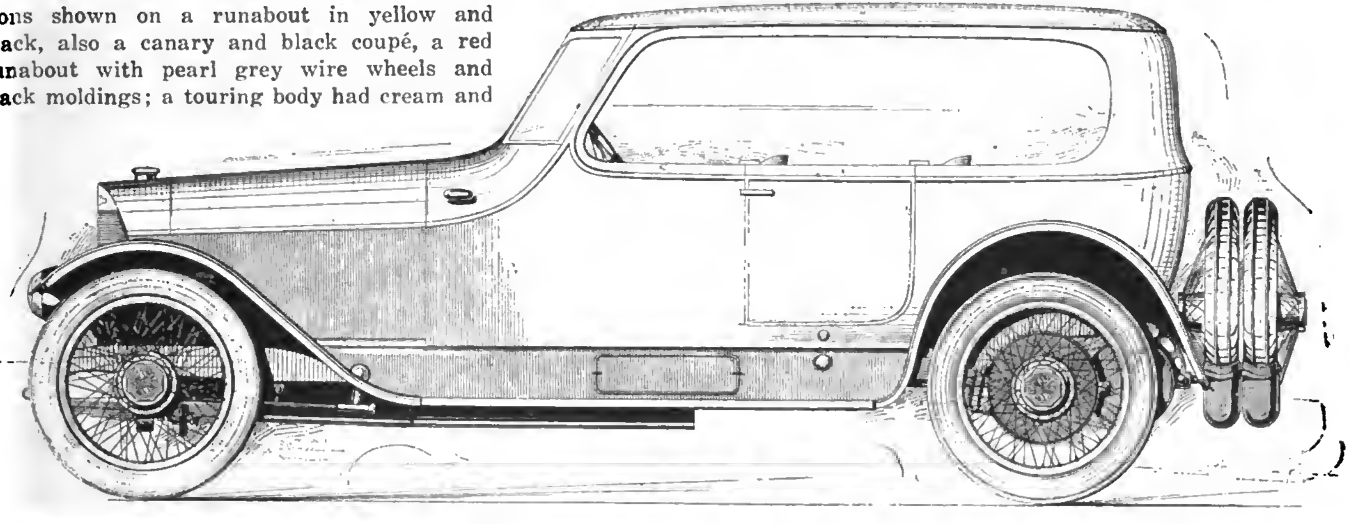
Best of Last Year Is Now Average. Form, Color and Comfort All Improved at Both Palace and Astor Shows

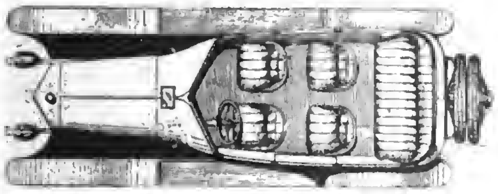
By G. J. Mercer

THE Palace and Astor Hotel shows just concluded, present in the body designs displayed, a more uniformly worked out plan to develop the streamline effect, than in previous years. This is particularly noticeable in the fore part of the car, and in both shows, with the exception of a negligible number, the line from the radiator to the body both on the sides and the top, presents a graduated surface, so that viewed from a distance, in many cases it is difficult to determine just where the engine hood ends and the body proper commences.

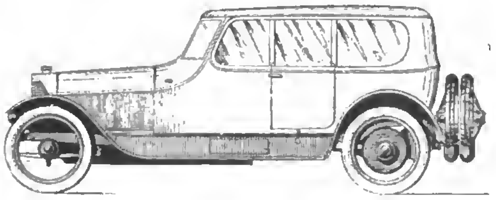
The Palace exhibition outshone all previous years in color combinations, there were very good combinations shown on a runabout in yellow and black, also a canary and black coupé, a red runabout with pearl grey wire wheels and black moldings; a touring body had cream and brown with Spanish leather. There was a dark grey sedan and a very pleasing grey and black sedan; a dark grey limousine, a coffee and black touring body, a wine colored coupé, a green and black touring body, a wistaria sedan, a white and grey limousine and a white and black limousine. These are a few of the best combinations, most were in good taste, only a few violated the rules and had combinations that made a glare in place of a pleasant sensation.

In the Astor show the color combinations were less conspicuous than at the Palace, grey or white and black, and yellow and black were used, but not extensively, and the trim-



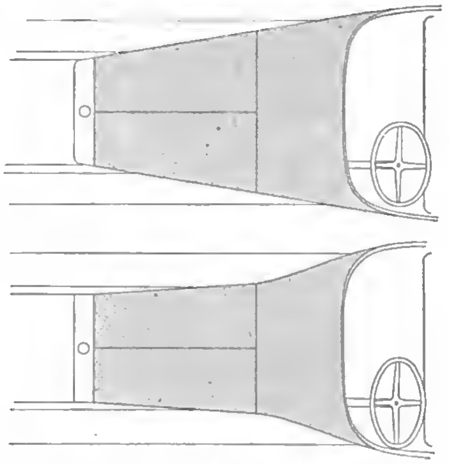


A new style body by Bender and Robinson on a Singer chassis at the Astor show



mings were suitable to match the car colors; in one Armstrong closed body, and in one Holbrook open body, a soft undressed leather trimming was used; the majority had the regulation cloth goods with dark leather for the front seats.

In the following not all the good things at the shows have been enumerated, nor have all the commendable designs been illustrated, but to the best of the writer's ability, those things that are of interest to the greatest number have been given prominence. Both shows serve their separate purpose and as long as one is not a duplicate of the other there will be room for both, one the manufacturers' exhibit of standard make, and the other special designs particularly in bodies, for those that are desirous to have automobiles custom made.



Figs. 1 and 2, showing plan views of two bodies with contrasting cowl taper

Smoother Bodies at Palace

Returning to the consideration of body shapes as noticed at the Palace show the first point is that the sides of the bodies have a smoother surface, due to the absence of moldings. This is true even of the doors, where the customary tee molding has been replaced by allowing the panel sheet to extend and cover the door openings. The top line of most of the touring bodies and runabouts and the driving compartment of closed bodies show rounded edges and on these closed bodies the overlap panel in which moldings are not used to join the upper and lower panels, was the rule and not the exception, also the seat trimming roll does not show above the body line, or if it does, it is very much reduced in size over former years.

There are fewer slanting windshields than was to be expected, considering the general desire to eliminate wind resisting surfaces, but there are more shields placed on top of the cowl panel and forward of the rear edge of the cowl and there are fewer cowls having the extreme upward tilt to the top line, near the shield seating.

Touring Body Holds Position

The touring body still holds its own as the most representative member of the automobile family, and the type with a second cowl, not only shows a large increase in numbers, but the effect of its popularity is proved by the desire to imitate it, by minimizing the height of the driving seat back, and in some cases, rounding it to give the appearance of half a cowl. This tends to give the bodies a lower appearance and the elimination of the trimming rolls helps to accomplish this end. In reality the bodies are lower, measured at the seat back, but the sides are slightly higher; 24 to 25 in. is the average side panel height. The aisle between the driving seat also shows gain in numbers and in some cases the second cowl itself is divided.

The disappearing seat, despite the fact it is not so roomy as the older form of side seat, has proved to be the only style that is acceptable on both open and closed bodies, and the most popular is the one that folds into the back of the driving seat.

The four-passenger clover leaf runabout is the new idea this year. Last year there was one three-passenger body, and while, now, the majority on exhibition were only comfortable seating for three, there were two, the rear seat of which could accommodate two adults and one of these bodies was 42 in. wide on the cushion by 24½ in. from trimming or rear seat to panel of front seat.

One expected to see quite a number of good looking designs of demountable tops fitted to touring and runabout bodies, the demountable top has been featured so much in automobile advertising of late, that naturally we looked for a better showing than there is. The Kissel, which is one of a very select few that look like jobs, showed one car with the inside stripped of its trimming, showing the method of attaching and detaching the upper section so it could be readily understood. The other tops exhibited have the effect of marring the general clean look of the body by the excessive width of the framing pillars, which only proves that to make a successful demountable top, it must be made with the body as part of the original design and not added as an afterthought.

The permanent-roof body shows increased numbers over last year. The regular Springfield body is on a number of cars and there is an adaptation of the Springfield idea on two others. Pierce had a body of this type in which the pillars fold down inside and are fitted with an automatic hinged arm for holding them in their respective positions. The only full collapsible all-weather body was exhibited by the Springfield Metal Body Co.

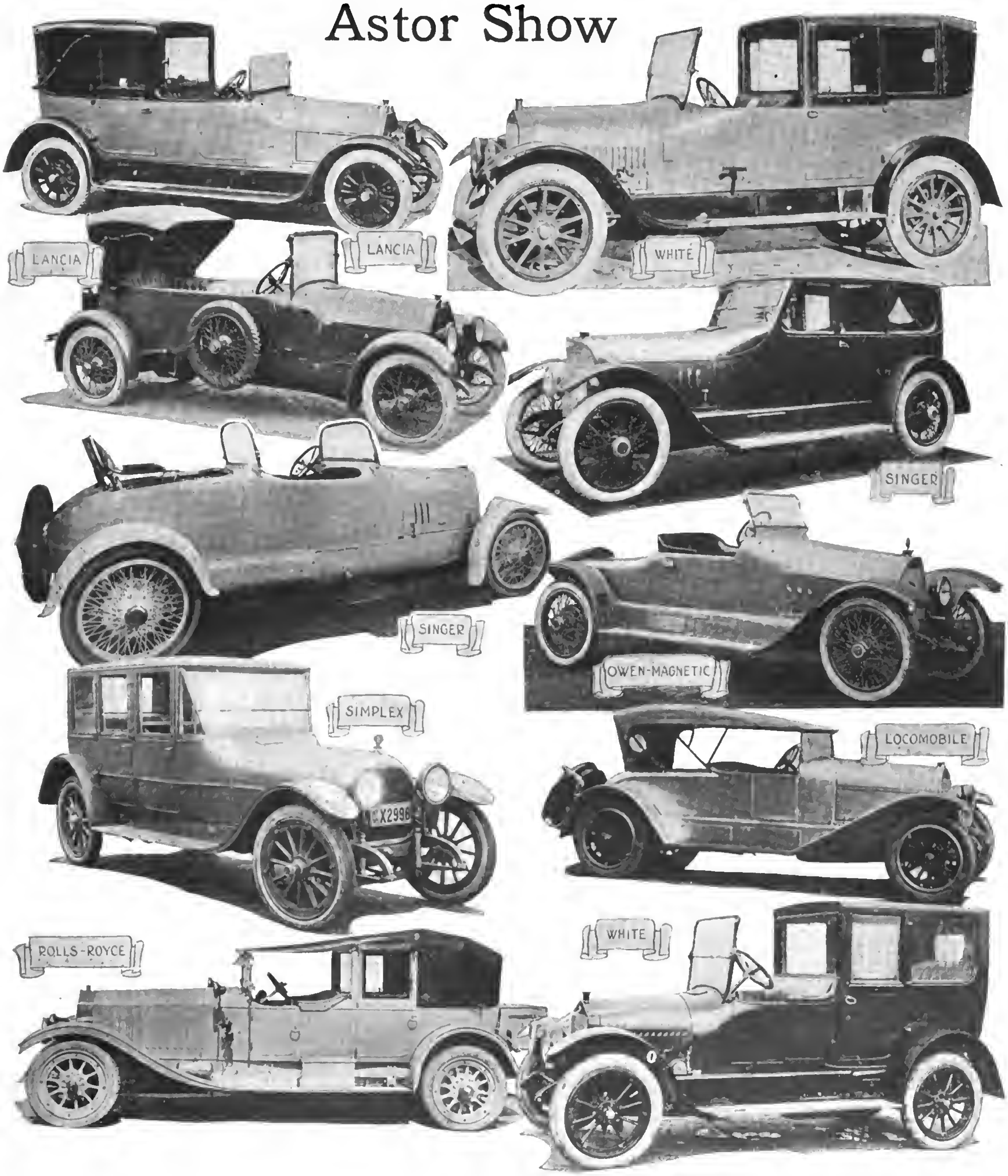
Few Innovations

The Palace show from a body point of view, had practically no features that were innovations, the *average* this year was virtually the duplicate of the *best* in the show last year and many of those that excelled last year, had the same exhibit this time. The Palace average was very good in finish, design and workmanship and novelties were conspicuous by their absence. There were fewer closed bodies in proportion to the total exhibit than formerly, but town cars, which have never been very numerous at this exhibit, were about the same in number and are of better design than formerly, but there is one feature in which this show outdid all its former records, and that is in colors. Hardly an exhibit but had its white or white and black, or yellow and black, or grey, or some other light color, and the striping of the hood and wheels was louder and more prominent than ever.

The word streamline has become the synonym for the latest in body design and is used indiscriminately for every body that shows a tapered line from the radiator to the cowl. Truthfully speaking the only bodies that approach the true streamline effect are the runabouts. To understand this, imagine a shape exactly like an egg placed on wheels, the large end toward the front, as the egg moves forward separating the air, the pressure of the atmosphere is increased by the displacement, and as the air currents pass along the sides, due to the egg moving forward, they meet easily and without clashing at the tapered rear end, and no revolving eddies or air currents are set up to disturb the road dust as the body passes forward. No body design in the near future is going to be built along these ideal lines, except the beforementioned runabouts, no real necessity exists to disproportion the rear end of a limousine or a touring body to make it egg-shaped and there is also the item of additional cost of construction. The fore part of the body that breasts the wind, is the part that has a commercial value, and eliminating the flat surfaces at the front and on the sides is the real money saver. Summing up the above logic, the writer suggests that "fore-streamline" would be a more applicable term to use, as it would cover all that we are trying to accomplish in body designing at the present time, that is, giving the front of the car the minimum of resistance.

Figs. 1 and 2 show the plan view of the hood and cowl of two touring bodies at the Palace, Fig. 1 is the newest de-

Some Examples of Typical Bodies at the Astor Show



THE Astor exhibition is always productive of many different styles of body construction. Both old models and the most advanced examples of modern tendencies may be seen side by side. The ten bodies shown here are representative of most of the new ideas and it will be noticed that the Astor show, like that at the Palace, contained many examples of the clover leaf. The number of comparatively small capacity bodies is also noteworthy, though many were very large.

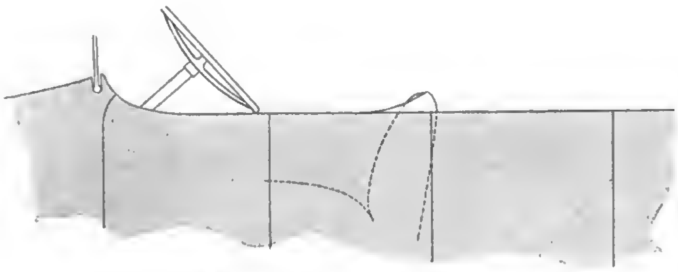


Fig. 3—Example of lowered back driving seat

sign and there is a taper of approximately 6 in., each side in the length of the hood. The body line continues from this without a ripple, to the widest part, this being a fine example of a fore-streamline. Of stock cars the Mercer is one of the best of this class. Fig. 2 is an example of one of the more conservative makes of cars, it marks a slower growth and lacks the bold straight appearance that characterizes Fig. 1. The top line of the hood has the same appearance on most cars as the side line of Fig. 1, from radiator to dash, the average raise is 2 to 3 in., the radiators are similar to last year, those with the slightly rounded edges predominating.

Figs. 3 to 8 are sketches of Palace show bodies.

Fig. 3 is an example of the lowered driving seat back rounded over like half a cowl, on this particular body the back below the cowl had two compartments that are used to stow away the top curtains.

Fig. 4 shows a runabout deck cover supported in the open position by arms that travel in slides at the bottom and drop into pockets at the slide end when raised.

Fig. 5 shows the rear seat of a runabout and the method of locking the lid in position to form the back, it shows a cheap way to make a seat in a small rear compartment and still be able to raise the lid when the top of the car is down.

Kissel All Year Is Sound Job

Fig. 6 is a diagram of the interior of the Kissel demountable top body, *A* shows the lock that fastens the upper part of the door to keep it from rattling, it engages in a plate in the body pillar and is operated by *B*, this lock is operated by the inside or outside handle and the push rod moves up and raises *A* and when the handle is released *A* drops into its place in the pillar, the push rod rests in the lock *A* and disengages itself when the top section of the body is lifted off; *C* shows the attaching lugs; the bolts used to fasten these are always accessible, being covered by flaps in the trimming.

Fig. 7 is a four-passenger runabout adapted from the clover-leaf idea the plan view shows the seating arrangement and the second cowl is divided by a passage way.

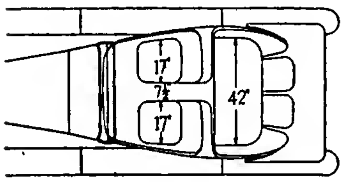
Fig. 8 is the outline of a town car body on the Owen Magnetic, there is only one door for the driver on the right side, the glass space at the front is unusually large and has rounded top corners, the driving compartment is joined to the body by a second cowl; this body was one of the best designs exhibited.

Low Appearance Favored

The coefficient of streamline in body nomenclature is *low looking* and the effort to produce this effect has replaced 36-in. tires with 34 and 32 sizes, the running board has come nearer the ground and a little additional kick up to the chassis frame sends it down forward of the rear wheel. The double drop to the frame has not had many converts. Pierce did this in place of reducing the tire size. The optical effect of raising the hood and cowl helps to make the touring and runabout look lower, but the greatest gain has been in lowering the seats, since the gasoline tank has been placed at the rear. The driving seat has been lowered 3 in. on touring and about 6 in. on runabouts and the slant of the cushions is about 2½ in., so that on touring bodies the driver actually is about 5½ in. lower when seated than formerly. The seats have been moved farther back to allow the extra leg room required when seated low and the steering wheel has been lowered and the column lengthened to accommodate the seat, in many bodies the driving seat is now made adjustable, because the driver sitting more straight out than formerly, it is not practical to expect men of different heights to accommodate themselves in the same sitting space. At present this is only done on touring and sedan bodies where the aisle between the seats makes the driving seat a free agent. On closed bodies, such as limousines, etc., the driving seat is much the same as formerly, on account of the necessity of having the door to the body as large as possible, and the driver is placed as far forward as freedom of movement and the proper room to sit will permit.

Cushion Height Decreasing

The average height of the front and back seat cushions from the floor at the front of the cushion is 15 in. on touring bodies with an average slant of 2½ to 3 in. This applies to the rear seat in closed bodies also. There are a few touring bodies in which the rear seat cushion is only 12 in. up, but this is a height that no woman can either sit down on or



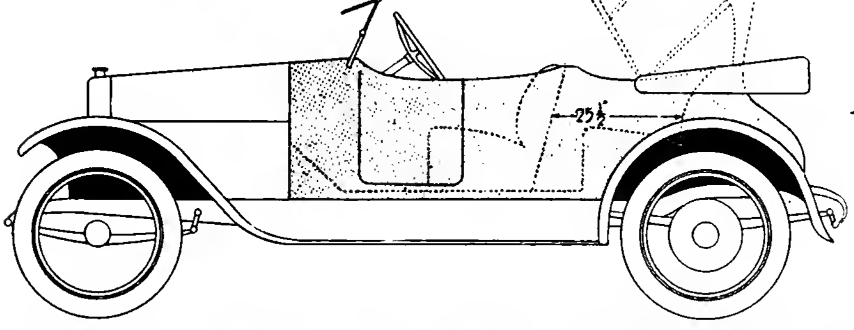
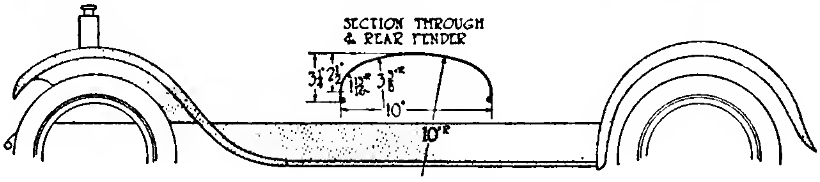


Fig. 7—Side and plan views of a good four-passenger roadster.



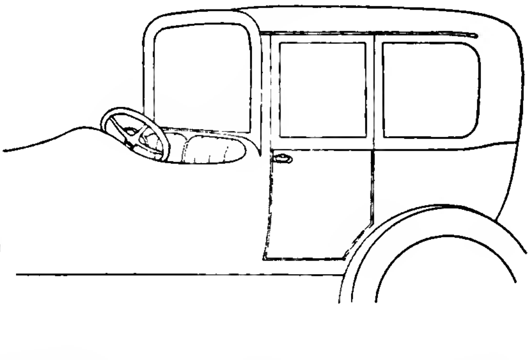
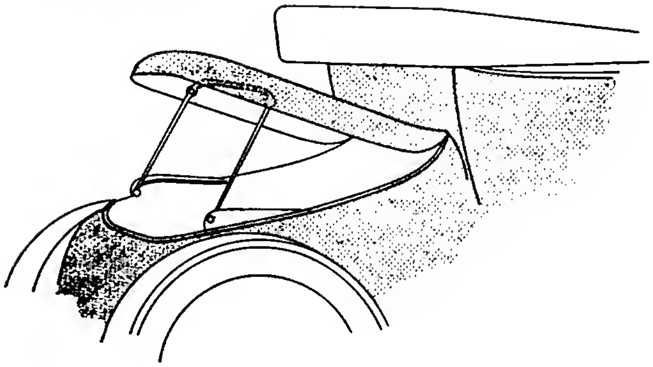


Fig. 8—A well-proportioned town car. Fig. 9—Proportions of Chalmers front and rear fenders



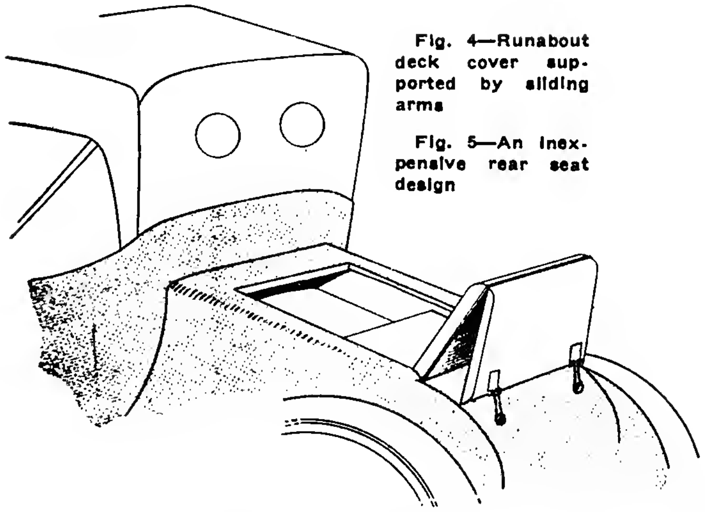
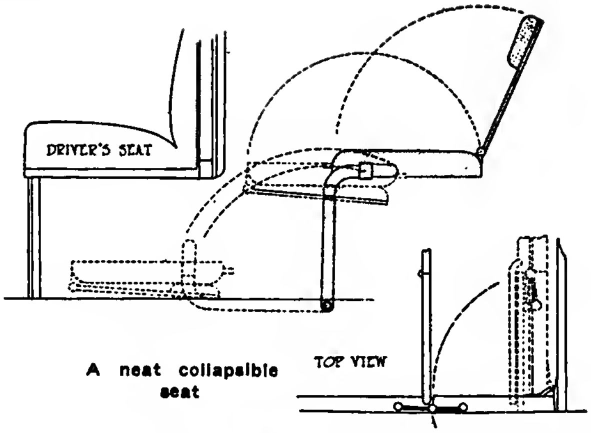


Fig. 4—Runabout deck cover supported by sliding arms

Fig. 5—An inexpensive rear seat design



A neat collapsible seat

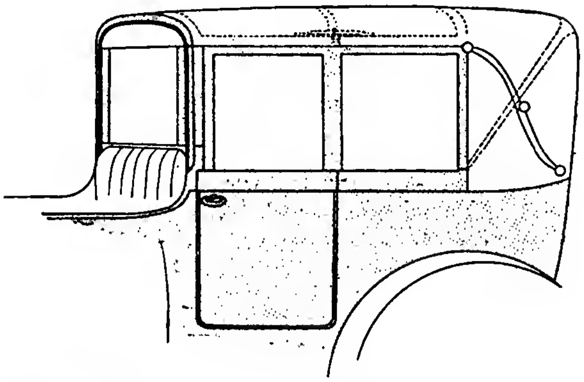


Fig. 10—Healey Holbrook folding top semi-touring car

get up from comfortably. The average height inside from floor to under roof in closed bodies is 55 in. One body at the Salon had only 50 in. height and there are several that are only 53 in. Years ago 58 in. was considered the proper height and from present indications 54 in. will be the average height for all stock bodies. The average height of the seat back on touring bodies is 15 in. for the front and 18 in. for the rear.

The instrument boards on nearly all the cars seen at the Palace are similar designs to last year, and though arranging the indicators in this manner gives the car a machine-like look, there is a disadvantage and expense when the bodies are changed, and there was more than one comment that this is a thing that is being overdone and should be made less prominent. One body at the Astor Hotel had the clock and speedometer at the rear of the driving seat and the balance of the indicators on the dash just above the toe boards, this left the cowl free and clean-looking and one felt that it would be easy to enter this body and not bump the shins, although the seat was very low. It is safe to predict that a year hence will see a change in the location and appearance of this feature.

One Person Tops Universal

At the Palace one-person tops were used exclusively, a few touring bodies had victoria top, there were more wire wheels used than last year and the dash lamp was only noticed on two makes of cars, the extra shoes or tires were carried in nearly every case at the rear and there were more guards of the crown type than ever. Fig. 9 shows the Chalmers front and rear guards and the cross-section shows the shape of the top line. The trimming material of the touring and runabout bodies is mostly leather, a few have the imitation and a few Spanish leather with fancy colors. Only one body in the show had the Turkish style of trimming, all the rest had either the straight pipe with few buttons or the older form of pipe and point.

The electrics from a casual glance appeared like the display of last year, except that there was less conspicuous trimming used inside and more color used in the outside painting.

The closed bodies were modest in design, no job had the full rounded or extreme dip to the roof line, there was a tendency to flatter roof shapes, two bodies had chauffeur lights, nearly all had the double vision windshield and regulators were used on the windows almost exclusively. Several had fancy trimming combinations and some had the broad black and white striped trimming, this was nearly always accompanied by white and black painting on the body and chassis. The coupelet designs were identical with last year and the coupés were all large and had the extension window forward of the door, and room for four inside.

At the Salon there was enough new in body construction to satisfy the exacting and the curious as well as those who are really interested in watching progress. The new bodies were practically all closed ones this year as against previous years when open bodies represented the bulk of the innovations.

The exhibits of Brewster, Healey, Lock, Bender & Robinson and the foreign bodies of Barker & Co., as well as the bodies of the Fleetwood Metal Body Co. and Hayes & Miller Co. all came in for their share of notice. Fig. 10 is a semi-touring body, Healey and Holbrook showing some of this type. The top is fully collapsible and the ease with which

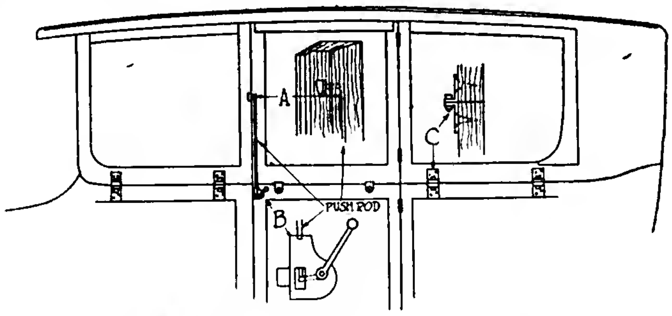


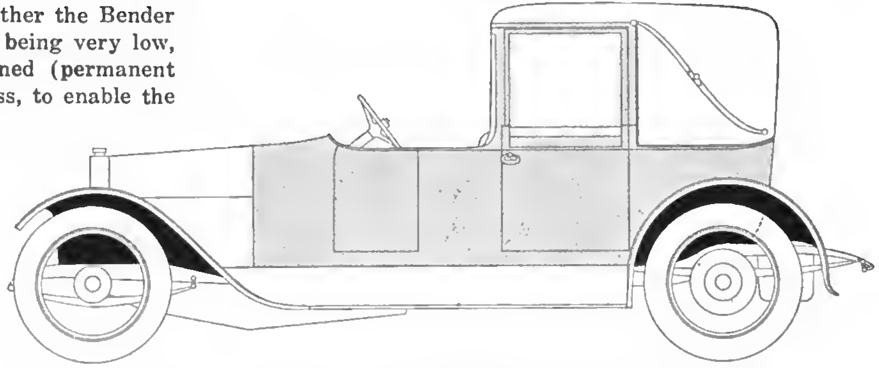
Fig. 6—Diagram of Kissel "All Year" body

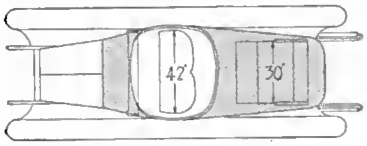
one man can operate it was demonstrated at stated intervals on the Healey body at the Locomobile exhibit. At the rear pillar are landau springs to assist in carrying the weight while lowering and raising. The front pillars fold down, and the manner in which the top part collapses is indicated in the diagram plan view; the top is of leather and is lined inside in light grey cloth. The body makes an attractive design, having the advantage of being easily converted into a closed, and open car, or the sides can be entirely opened after the manner of the well understood permanent roof bodies. Fig. 11 is also a Healey production, and has one of the two new folding seats at the shows; the method of operation is clearly depicted in the drawing. Its advantage is that it is folded away horizontally, and the pocket to receive it will not be high enough to prevent the glass in the front division from dropping its full length, as is the case when the ordinary type is let into the partition.

V Windshield Types

Fig. 12 is a V-type windshield Sedan exhibited on the White, it is painted in white and black, and the trimming corresponds; the roof is leather covered and it makes a very neat, compact body that is not too extreme to suit the taste of refined people. There was another V windshield body shown by Holbrook that was larger, and another the Bender & Robinson exhibit on the Singer, this body being very low, as indicated in the drawing. It can be opened (permanent roof fashion) and the roof is entirely of glass, to enable the occupants to get light from above. This job was the most extreme design at the show, it was finished in good taste, both outside and in, and the right balance altogether gave the body a racy, but not an overdone appearance; for its class it hit the mark and did not shoot beyond.

Figs. 14 and 15 are two drawings of the Fleetwood Metal Body Co. cabriolet on the Lancia. Fig. 14 is the complete design and Fig. 15 shows the operation of folding the top down. The cabriolet is coming into its own as a town car, and while it will never be generally used, it has a class that appeals to the discriminating. This body is painted in yellow, red and black, the top is leather and the trimming light cloth, while the driving seat is black leather. The Barker cabriolet is operated in practically the same way as the diagram for the Fleetwood, but the leather quarter is cut semi-circular to allow the leather to part at the front when the top is thrown back, while the Fleetwood uses a loose flap that is fastened, when up, by glove fasteners. Barker had two cabriolets, one large and one small and both on Rolls Royce chassis. Fleetwood had a touring body on the Lancia that attracted attention on account of painting, this being a green color in which the brush marks are plainly left just as the paint had been spread. The makers use a special





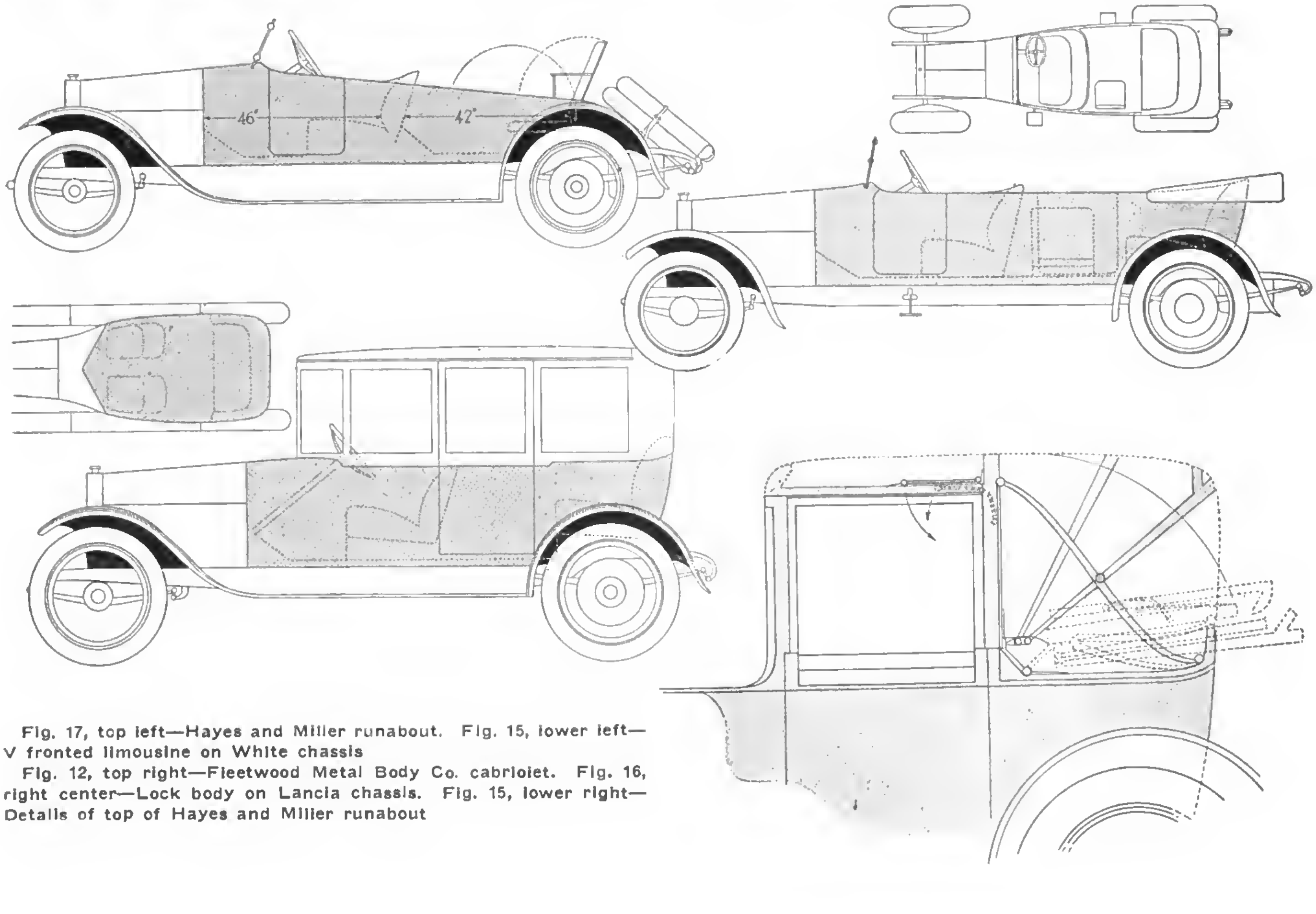


Fig. 17, top left—Hayes and Miller runabout. Fig. 15, lower left—V fronted limousine on White chassis
Fig. 12, top right—Fleetwood Metal Body Co. cabriolet. Fig. 16, right center—Lock body on Lancia chassis. Fig. 15, lower right—Details of top of Hayes and Miller runabout

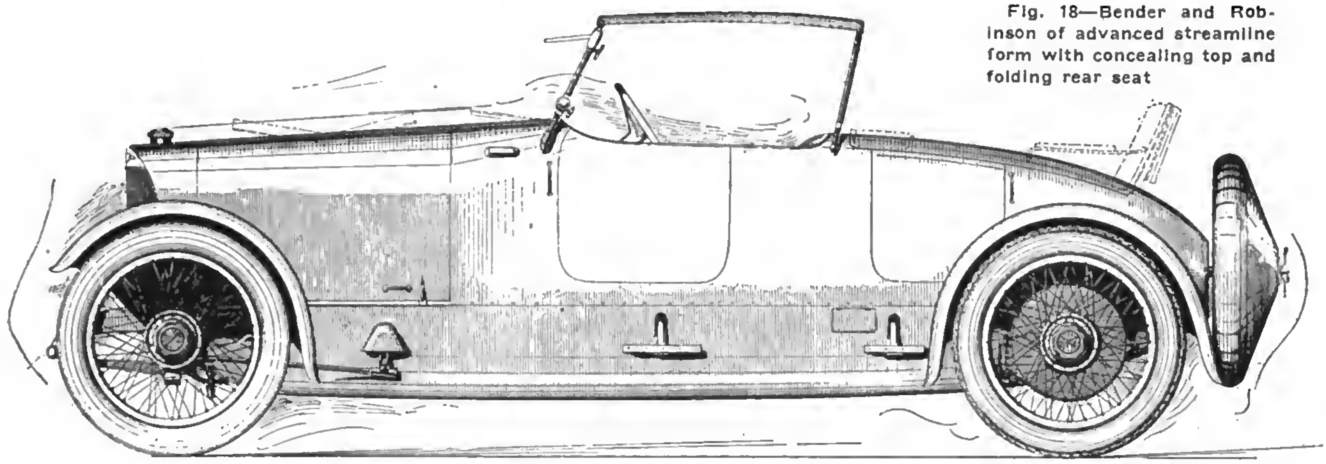


Fig. 18—Bender and Robinson of advanced streamline form with concealing top and folding rear seat

paint that does not need either dryers or varnish; it is applied with the brush and not rubbed smooth; in use, however, it wears smooth and gives the dull finish that has the most durable wearing qualities.

Fig. 16 is the outline of a Lock body on the Lancia. For five passengers, four on the seats facing forward and the fifth on the side seat placed practically on the floor, the occupant sitting across the car. This body came in for much favorable comment, on account of its light appearance and general air of tastefulness in finish and design. The doors are offset as indicated in the drawing, and there is no instrument board used; the clock and speedometer are placed at the rear of the driving seat and the other indicators on the dash board, this giving the cowl a very light and airy look compared with the majority of the bodies at the Palace show with their ponderous boards under the cowl. The paint was green and inside finish grey cloth, the top of the driving seat was especially good where it joined the side body line. Dome bicycle guards were used and steps in place of the running board.

Fig. 17 is the Hayes & Miller runabout on the Lancia, this job, while not absolutely new in design, being well received by the observing public and it merits all the favorable comment that was passed upon it.

Fig. 18 is another Bender & Robinson creation. It was tastefully painted and trimmed and was one of the few that approached a true streamline in its entire contour. It strongly resembles their larger body.

Good Patents Often Unworkable

By Walter Tibbetts

THERE is an erroneous impression held by a great many people, even among those who are otherwise well informed, that once a patent is issued to an inventor there is nothing whatever to prevent him from proceeding at once to manufacture the entire device or machine shown in the drawings of the patent. This probably comes by reason of the layman considering a patent as standing by itself, isolated, independent of all previous and future patents, a thing having no relation to anything that has gone before, a new creation made out of whole cloth.

On the contrary, it seldom happens that a patent is issued in these days but that the line between it and what is prior to it is so hazy as to require an expert in many cases to define it at all. And frequently a great deal of technical argument before the Patent Office is necessary to convince it that there is a line of demarkation in the case.

Every patent is so closely interwoven with the patents that have gone before it in the same art, that in most instances the device or machine of a newly issued patent cannot be made without infringing the claims of one or a dozen previous patents. In other words, practically all patents issuing from the Patent Office are "improvement patents;" that is, the devices and machines shown and claimed in them are simply improvements upon or changes in the devices or machines shown in previous patents.

Thus a man may invent a valve mechanism for a motor and, while his attorney will probably get an allowance of several claims that will not conflict with the various similar earlier patents to which his attention will be called by the Patent Office, yet it does not follow that his motor is not an infringement upon any of those earlier patents.

This valve mechanism may be arranged in the head of the motor and co-operate peculiarly therewith, which fact may give it novelty and make it patentable, but he will probably find several earlier patents on similar valves arranged at the side of the motor or elsewhere and containing claims that are broad enough to cover that particular valve construction regardless of its location or co-operation with other parts of the motor.

And even should his valve mechanism be of such nature that it is absolutely new in toto, yet he could hardly build and operate his motor without infringing a number of patents on several of the other essential elements of the motor, such as the carbureter, the magneto, spark plugs, etc.

Of course it does not follow that suit would be brought under all of the patents which such a motor might infringe, or if brought, that they would all be upheld against him, but the fact remains that the new device or machine in nearly every case is simply a step in advance in the art, and is usually anticipated in part at least by some one or more of the clever inventors that have gone before, so that the earlier claims will be seen to cover and perhaps control the later structure.

Obviously each inventor has the like privilege of making his claims as broad as the prior art will permit so that he may also cover the next inventor who comes along with a slight improvement upon his device. He is then in a position to stop the later inventor from making the improved device, and the later man, if he obtains a patent upon his particular improvement, may exercise a like privilege as regards the making of that particular form of the device. Neither of these inventors can make the improved form of the device without the consent of the other.

Of course the earlier patent will expire first and the later inventor may then use everything shown in it, while the first

(*Concluded on page* 167)

Condition and Development of the Automobile Industry in Russia

By Professor Nicolas Kouznetzoff,
of Petrograd

THE development of automobilism in Russia dates from the first automobile exhibition which took place in Petrograd in 1907. This was followed the next year by another exhibition in Moscow and the last show took place in Petrograd in 1913. This was of a specially great importance to the development of the automobile industry, and the number of cars imported into Russia during 1913 was doubled, being 2000 as compared with 400 the year previous. Every year the Imperial Russian Automobile Society organizes contests which are partly races and partly reliability trials, and these are of great benefit to the business, more particularly because they introduce automobiles to towns and cities where motor vehicles have never before been seen.

In 1909 an automobile regiment was organized in Petrograd, and this was the beginning of military motoring in Russia.

Prof. Nicolas Kouznetzoff

Five Cities Led Before War

Before the war commenced the automobile business was more or less concentrated in Petrograd, Moscow, Kiev, Riga, and Charkow, and the following table shows the approximate sales:

Petrogad	2,600	Riga	600
Moscow	2,200	Poland	1,500
Kiev	1,000	In other States	3,000
Charkov	800		
		Total	12,000

In this enumeration the military automobiles are not included and these probably numbered about 1500 at the outbreak of war.

German Cars Were Popular

Concerning the cars tabulated above the majority came from Germany. France ranked next and England had a fair proportion. A good many also came from Italy and a few from America, mainly Ford, Case and Hupmobile.

In the city of Petrograd the most popular car was the Benz, with the Opel ranking second, and then followed Renault, Delaunay-Belleville, Mercedes, Fiat, Metallurgique, Vauxhall, Itala, Rolls-Royce, Peugeot, Lancia, Panhard and a few less known French makes. A certain number of cars are also turned out at the Russian factory in Riga.

No Real Automobile Dealers

Trade conditions in the automobile business in Russia have been very unsatisfactory, owing to the absence of agents or dealers as understood in America. Many good firms were represented by people who regarded automobiles as a side line and the general poor state of affairs led to the establishment of manufacturers' depots in Russia during the two years previous to the war. Much of this activity was the result of German farsightedness, as may be shown by the example of the Benz company who opened a branch in the best part of Petrograd, adding repair shops. The rent for the building amounted to $12,000 a year and at the outbreak of war an excellent business was being done. The first year more than 400 cars were sold and large inducements were offered to the clients. Another branch was situated in Moscow and was also doing a very good business indeed.

Almost as good a trade was being done by the Renault branch in Petrograd although the sales were slightly smaller than those of the Benz. In 1914 Renault actually commenced to build a factory in Petrograd, intending to manufacture cars on the spot, but of course this is at present operating on the manufacture of munitions.

Among other well known manufacturers having depots in Petrograd may be mentioned Mercedes, Delahaye, Fiat, Metallurgique and Vauxhall.

American Car Prices Exorbitant

Concerning American cars in many instances the Petrograd agent represents several different manufacturers. For example, the Ford and White are handled by M. Fride, while Pluim & Oxs sell Cadillac, Hupmobile, National and Saxon. M. D. Mikailovsky & Co. have the Chandler and Metz. Case, Chevrolet, Detroiter, Franklin, and Mitchell have individual representation.

The sale of American cars in Russia has been restricted by the extravagant prices asked and by lack of proper advertising. A Ford car in Petrograd costs $1,187.50. Of this amount the freight and import duty amounts to about $300 in normal times, so it is easy to see that an extravagant profit is obtained somewhere. Another trouble is that many of the agents carry an entirely insufficient stock of spare parts and a man hesitates to buy a car knowing that a replacement may take from two to three months to obtain from America.

7500 Cars and Trucks Needed

Notwithstanding the unsatisfactory condition the Ford has sold extensively, the agent being credited with a turnover of more than 1000 cars per year. It can be stated positively that during the first year after the war Russia will need more than 6000 passenger cars and not less than 1500 trucks. After this it is expected that the annual demand will increase at the rate of 100 per cent each year.

Many people are unaware of the existence of the Russian-Baltic factory of Riga, which has been producing railroad cars and commenced the manufacture of automobiles in 1899. The factory has been favored by many large government orders and at the start of the war was building complete cars without the need for importing any parts. Its estimated output for the past few years is between 300 to 500 cars annually and its most recent program consisted of two models of passenger cars. Only experimental trucks have been built and the work of the factory must have been somewhat interfered with by its transference from Riga to the interior. At present, the entire output is taken by the government for war purposes.

No Large Car Builders in Russia

It is perhaps surprising that the number of cars used in Russia should be so small, but the situation is explained by the paucity of state roads and the unsatisfactory conditions of sale which have been described. It may also be due in part to the absence of any large automobile manufacturing plants in Russia. At present there are only 22,000 miles of state roads in all Russia. They are situated mostly in places where they have a military value such as the western part of Russia, in Poland, in the Caucasus and in the state of Moscow. In addition to these principal state roads there are country roads aggregating about 135,000 miles, and these are quite satisfactory in summer. In the spring and fall the majority of the roads are impassable, although all-year traffic is possible on a few. The reason for the roads being so bad is that the money available for their improvement has been insufficient. It has absorbed the attention of the government to develop the railroads, but the Duma has been devoting attention to roads recently and it is expected that the state road system will be extended very greatly soon after the war.

Less Than $5,000,000 Yearly for Roads

At present, for building new state roads and repairing old roads there is an annual appropriation of less than $5,000,000 and two-thirds of this is given to the roads having military importance. This, of course, leaves but a small sum when one regards the vastness of the road system really required by Russia. As a comparison, it is interesting to observe that the State of New York last year voted nearly three times as much money to roads as does the whole of Russia in a normal year.

The use of automobiles in the war will undoubtedly result in their value being appreciated much more widely and there is, therefore, every reason to anticipate that the building of new state roads will proceed very rapidly when the war is over. The ministry of ways of communications has already worked out a scheme for a complete system of state roads interconnecting with new railroad lines.

Cars Taken for Army

Harking back to the start of the war, one of the first problems of mobilization was the necessity of equipping the army with a proper quantity of automobiles. The first step taken was to issue an order appropriating all private cars and almost every one of these in addition to every truck was taken for the use of the army. In this manner about 3000 passenger cars were collected. The majority of firms which used trucks for handling their product were left entirely without means of transportation.

America Has Contracts

In addition to this appropriation of all trucks in the country the Russian war department sent a special commission to London and there purchased all the trucks it could get at that time, also ordering some American cars and motorcycles through the London agents. The European supply was soon exhausted and at present America is the only country holding war contracts for motor vehicles for Russia. The largest American orders have been given to White, Packard, Pierce-Arrow, Peerless, Locomobile, Jeffery, Garford and Federal.

Large Market Expected After War

At the end of the war there will be a very large market for motor trucks in Russia. In the last two years trucks have been used to an increasing extent in the principal cities. The types mostly desired for Russian use are 5- or 6-ton trucks which are required for city service and light trucks of from 1½- to 3-ton capacity for the country. It seems reasonable to assume that Russia will look to America as the principal supply of automobiles and there is no doubt that America can grasp this great market if it will only act quickly. After the war German competition will be renewed and will be extremely keen so it is necessary that the American manufacturers should make a concerted effort properly to establish themselves in Russia.

American Cars Popular in Russia

The matter to which the American industry needs to give the closest attention is that of securing proper sales representation and it is the opinion of the writer that success can only be hoped for by means of establishing American-owned and managed sales and repair establishments throughout Russia. At present American cars are popular in Russia because they are better able to withstand bad roads. Plans should be proceeded with immediately, since now is the time to establish the American industry in Russia. There is much to be lost and nothing to be gained by waiting until the war is over.

A Truck-Factory Opportunity

Another great opportunity for American industry is to erect a truck factory in Russia itself. Shortly before the war French, German, and some British automobile manufacturers were planning to build factories near Petrograd or Moscow, and there is no doubt these intentions will be carried out. An American concern intending to manufacture in Russia would be able to commence operations immediately. Of course it is a truck factory which is most urgently needed. A law is expected to be passed which will subsidize automobile trucks modeled on the German system which will encourage the purchase and the use of trucks. It is obvious that those who are first in solving the problem of giving Russia an adequate supply of commercial vehicles will obtain the largest orders at the earliest moment after the war is over.

Let it again be said that the opportunity is at its best just now, to wait for another year in order to see how things are going is to lose a substantial amount of advantage when the big orders come along.

A graphic illustration of the area of Russia in Europe as compared with the United States and giving an idea of the possible automobile and motor truck market which it is expected will be opened to American manufacturers at the close of the European war. In addition, it must be remembered that Russia in Asia represents a much larger territory than that illustrated, although there is a comparatively small population

Electric Efficiency Improved

Better Engineering Keynote of 1916 Electric Passenger Cars—Lower Weight and Improved Electrical Parts Give More Miles per Charge

THE keynote of progress in the electric passenger vehicle field during 1915 has undoubtedly been better engineering as indicated in the many refining touches, greater standardization and factory economies in production, all of these making possible considerable price reduction in nearly every case.

It has not been easy for the manufacturers of a product, heretofore regarded as a thing to be marketed only in comparatively small quantities to a leisure class and to the feminine element, to cut production cost without in any way curtailing quality. In most manufacturing activities it is the rule that unless quantity of output is greatly increased it is impossible to lower price without sacrificing the qualitiese for which the electric must always stand. But it has been done, and by the strictest attention to design the new models are in every case better. It has meant much for one of the leading makers to bring down prices averaging $700 on all models, and for another to lower them $150 to $200 per car, but they are signs of the times. They have materially increased their outputs, in one or two cases actually doubling their manufacturing schedules.

Weight Cut in Many Cases

Weights have been lowered in many instances, models almost alike but heretofore differing in only a few details have been standardized so as to use the same chassis wherever possible, batteries have been lessened in weight at the same time that they have been increased in capacity, motors have been improved so as to draw less current, and these latter influences have had their effect upon the greater mileage of the cars per charge. The need of absolute silence has been still further recognized, and all have come to some form of silent axle gearing—in most cases either spiral-bevel or a worm gear type. Speed has been increased so that many cars will now attain a maximum of 30 m.p.h., which is more than ever needed within the city limits, although a feature of advantage for suburban going. The need of lubrication attention has been minimized as well as care of batteries, these being factors which cannot help but appeal. In short, much has been accomplished in a few months, and the electric industry to-day is on a better basis for success than ever before.

Few Startling Changes

Thus while no sweeping changes have been made by anyone, a better all-around vehicle has been evolved as a result of the general refining process that has manifested itself, not in any one part of the chassis only, but here and there throughout the whole car. In a few instances a large part such as an axle or a type of motor has given way to a different construction, but this is rather the exception than the rule. Most of the changes have been of a refining nature.

A more general use of aluminum for the body panels and fenders has been the rule, and this has had its effect upon lightening the cars. Another factor for lightness has been quite a wide adoption of stampings and forgings to take the place of castings, one of the leading makers effecting a considerable saving in this way, while at the same time strength is increased. In making such a change as this, however, much depends upon the facilities of the factory and the volume of the output, for it would obviously be impossible to go to the great expense of making dies for forgings and stampings unless the quantity of the output would warrant it. Here again is an instance of the advantage of larger output, for once the preliminaries are over, it costs less to use forgings and stamped parts than castings and they are more desirable.

Batteries Are Lighter

Another point of attack has been the battery, and in a number of cases weight has been lessened by redesigning the cells. One prominent maker has succeeded in cutting 50 lb. from the weight of the battery and at the same time the capacity has been increased. On the whole there has been little change in the mileage possibilities of the cars, many of them having been for a year or more capable of close to 100 miles on a charge, and this seems to be all that could be desired.

Of all types of vehicles on the market, the electric must be the acme of silence, and one of the points at which much attention must be focussed in order to bring this about is the rear axle. Since the spiral-bevel type of gearing has become so extensively used with such great success the worm-driven axle which has enjoyed high esteem among the electric designers, has encountered a serious competitor, and the list of designs of electric cars now on the market are now about evenly divided between the two types of final drive. One of the largest producers has come to the spiral-bevel within the past year, although still offering the overhead worm optionally. There are many designers who do not take kindly to the worm drive where they can get something else that equals it in the matter of silence. There is one big advantage of the worm however, that must not be overlooked, this being the fact that it gives a bigger reduction between motor and driving wheels than is possible with a single-reduction spiral-bevel axle. This means that the motor may run faster for a given speed of the car, and it can as a rule be smaller. However, so far as this point is concerned, and considering the current consumption, the advantages of one drive about offset those of the other.

As between the underneath and overhead worm types, there are about as many adherents of one as the other. Better oiling of worm and wheel is claimed where the worm is below, but such construction obviously reduces the road clearance and puts the drive shaft at a greater angle to the horizontal. Either of these may or may not be objections. In most of the designs using the underneath worm there seems ample clearance for average city work, and in fact any reasonable road surface, and there is no difficulty in attaining a straight line drive between motor armature and worm, it being simply a matter of supporting the motor at an angle to correspond. Adherents to the overhead worm have obviously overcome any oiling difficulties that may have been present in the earlier types, so that the position of the worm simply resolves itself into a consideration of which lends itself best to any particular chassis installation. Generally speaking, it would seem that the overhead worm type would lend itself to simplest installation, although this remark will not apply to every case.

Lubrication Improved

One refinement that is of special advantage to the car owner is the method of lubrication. There is a more general use of self-lubricating bushings, these doing away with a multiplicity of oil or grease cups. In thus reducing the number of parts demanding lubrication attention the cars have taken a decided step forward, for with the electric perhaps more than with the gasoline car the owner is less in touch with the mechanism, relying more on the garageman, and a reduction of the points for lubrication has an obvious advantage from this standpoint alone. This attention to grease cup reduction is more especially to be found in the steering mechanism, and this is a factor for greater safety since it allows of less attention to these parts without detrimental result. At points where grease cups have been applied, there is a tendency to make them more accessible, and in more than one design there is not a single grease cup beneath the car.

Turning to less mechanical aspects of the electric of to-day, it is at once noticeable that designs are being brought out which are more masculine in their appeal. Heretofore the electric makers have almost overlooked the fact that while their product is especially desirable to meet the transportation needs of the lady, it also can be made to fill a very important place with the business or professional man. Being dependable at all times, and usually equipped with solid tires, it can be relied upon to get the business man to his destination without delay, and can wend its way in and out of traffic with the least trouble in starting and stopping. Now that speeds as high as 30 m.p.h. and over are attainable, the manufacturers have awakened to the possibilities of selling mannish roadsters to the city man. Hence a large number of these have appeared and are meeting a popular demand that might well be increased with aggressive attack upon this hitherto neglected class of possible buyers.

Cars Have Better Bodies

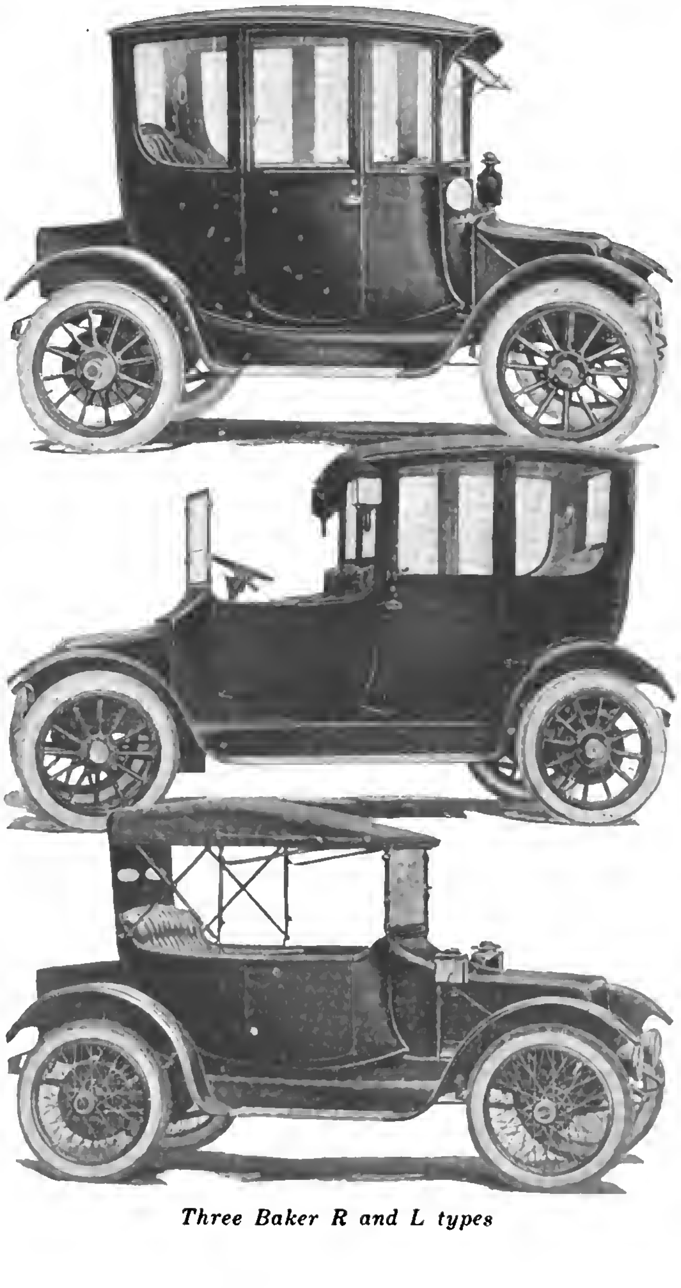
Externally the cars are even better to look upon. The impression is given by the new designs that the fenders, running boards, battery hoods and bodies are more of a unit, this being gained by the better and more substantial mounting of all parts. The domed fenders which seem to be consistent with the general curved lines of the bodies are attached much more rigidly than they used to be, and they have larger skirts to help in this direction. With the extensive use of aluminum panels, it has been possible to make the battery hood sides of the same sheets that form the body also, since it is possible to handle the large sheets of this material satisfactorily when hammering them to the proper shape, and for other reasons of unity, substantialness and appearance. In most cases, the corners have been very pleasingly rounded and the hoods blend into the bodies to prevent any suggestion of a break between them.

There is little to be said regarding the interior appointments. It is difficult to imagine more elegance in upholstering, interior finish or fittings than the average electric possesses and aside from some rearrangement of the seats, better upholstery and more comfortable angle to seat backs in certain instances, there is little alteration over the designs of the previous year. If there are any discrepancies in the modern electric vehicle, they are most certainly not to be found in the interior finishing or fitments.

To give more capacity to batteries, there are several instances where this has been done by adding plates to the cells rather than by increasing the number of cells. At the same time motor efficiency has been improved so that in general the cars operate to a greater distance on a charge, if there has been any change in this respect, due to a combination of greater battery power and less current draw by the motors.

Realizing the need of better maintenance facilities in order to increase the use of electrics and breed satisfaction among present users, there has been a widespread movement among the electric men during the past year to afford better service along with cheaper rates for charging. This tendency was boosted by the opening during last summer of the new co-operative electric garage of the New York Electric Vehicle Association. This is now housing its full quota of 100 cars, and the equipment of this station, which is the largest in the Metropolis, is unusually complete, having facilities for charging from 100 to 200 cars per day and to care for the various sizes and types of batteries. With this as a germ, finely equipped electric garages are springing up in greater numbers all over the country, and in some instances going even farther and give a free parking service during the daytime. In Chicago this feature is of greatest value for in the congested Loop district it would be almost impossible to use the cars intermittently without some place to put them temporarily when at the theater, shopping, etc.

In the matter of battery rental much has been done within the year with the Walker Vehicle Co., the pioneer. Now



Three Baker R and L types

operative only in Chicago, this scheme has proven successful, and it consists mainly of selling the car without battery if desired, the car owner renting a charged battery for a certain amount monthly. Other private garages have taken it up, and the industry as a whole is very much interested in the plan. We may expect to see it materially increased in its scope and adoption within another year.

Detroits Refined and Cheaper

Although many minor mechanical changes and little improvements in the bodies of the Detroit Electrics make them better cars than those they succeed, the feature of the Anderson Electric Car Co.'s activity at this time is the large price reduction of all models which is made possible by a practically doubled production as compared with one year ago. The Detroits now sell at prices ranging from $1,975 to $2,275, which means reductions running from $600 to $725, depending upon the model.

The 1916 Detroit list includes six body types:

Model 61, four-passenger brougham, price reduced from $2,600 to $1,975.

Model 60, five-passenger double-drive brougham, lowered from $3,000 to $2,275.

Model 59, rear drive, five-passenger brougham, price lowered from $2,950 to $2,225.

Model 58, front drive, five-passenger brougham, lowered from $2,950 to $2,250.

Model 57, four-passenger inclosed type, cut from $2,850 to $2,175.

Model 56, three-passenger cabriolet, $2,650 formerly and now $2,075.

There is nothing changed in the basic construction of any of these models, as they continue to use a 4-hp. series-wound motor with shaft drive to the rear axle, and a forty-two-cell lead battery equipment. For the rear axle there is an option of either the standard type of worm drive used in 1915, or a floating spiral-bevel rear unit with a reduction of 6 to 1. There are, however, a number of refinements that tend toward great interchangeability of parts throughout the line of bodies, and to even better body work, performance and convenience.

Among the mechanical details that have been improved is the redesigning of the current cut out in order to adopt the more efficient knife-blade type of switch. The box containing the cutout has a removable cover for inspection purposes. Besides this, the taking out of two screws allows the removal of the bottom of the box, to which the contacts are fastened. Thus the container of this important unit has increased accessibility, is simplified and greater proof against wear.

As a factor for reducing the weight of the cars in many points throughout the chassis, castings have been replaced by stamping and forgings, these also increasing the strength. Weight has also been cut from the battery to the extent of about 50 lb., this despite the increase in capacity. Another point of weight reduction is in the rear axle, and the sum total of all this better designing is a chassis which is 150 lb. lighter than its predecessor. Refinement has also been brought about in the brakes which now have one-piece shoes lined with a better braking material, this resulting in not only more positive action but also in increased life of the lining. The new chassis also shows a more general use of self-lubricating bushings and a reduction of the number of parts requiring lubrication attention. Looking to greater conservation of power the wiring has been rearranged to give a shorter distance for the current to travel, hence less voltage loss.

Wherever it has seemed possible to do so the seats have been made more comfortable, this particularly applying to the Model 57 whose rear seat is deeper and which has a new and more comfortable arm-rest. Doors in this model have also been widened.

Woods

Waverley

Ohio

Baker, Rauch & Lang Prices Lowered

Nine models are listed by the Baker, R. & L. Co., and although none of these is totally new, each is an amplification or improvement upon its predecessor. They chiefly differ in that they have a higher-speed motor, a larger motor brake and a number of minor improvements that help to produce greater ease of operation and greater comfort. Price reductions have been made on some models. The roadster and the club roadster remain at $2,600 and $2,800 respectively, but the brougham is $150 lower at $2,800. The coach and Baker brougham both now sell at $3,000 instead of $3,200. For this season the Baker car will be confined to this brougham known as BBD 6 which is a double drive model and to the DA 6 coupé which sells at $2,475. The other models will carry the Rauch and Lang name.

Mechanically there has been few changes except those which another year's experience dictate. The battery equipment in all models remains the same and is eleven MV Hy-Cap Exide, forty-two cells in the larger cars and forty-one cells in the lighter types with the exception of the Baker coupé with thirty-six cells. Mileage per charge has not been

Hupp-Yeats worm drive type

Chicago 5 Passenger

Ward Coupé

altered and Baker calculated this to be from 50 to 85 miles according to conditions and the driver. Mainly the aim has been to still further promote ease of control, freedom from adjustments and safety. These cars use a worm drive rear axle which is said to have proved exceedingly satisfactory after long service. Silence is especially the result of this axle combined with the light-weight, high-speed motor.

A shorter turning radius has been secured by narrowing the chassis at the front end. There are four different wheel bases to conform to the different body types. The two town car models have 109-in. wheelbase, the roadster types and two of the broughams are 92 in., the coach and the Baker brougham 102, and the Baker coupé 90 in.

On the Rauch & Lang models an ampere hour meter has been added as the central feature around which is grouped the ammeter, voltmeter and the speedometer. These accessories have been well located in a unit with sufficient illumination to make them readable under all circumstances.

Altogether the changes make for convenience, and for the comfort of the driver.

Waverley Concentrates on One Model

A policy of concentration upon one model has been decided upon by the Waverley company. This is designated as Model 110 and takes the place of all previous Waverley types. This car is entirely new throughout, both in body construction and body features. Briefly the specifications of the new chassis include forty-two cells of eleven-plate lead battery of either Exide or other standard make, series-wound motor which drives through an open shaft to a spiral-bevel type of rear axle, with Hotchkiss drive principle employed. The wheel base is 95 in., with tire equipment 32 by 4 in. pneumatics or 34 by 2½ in. cushions.

It is a point of special note that the weight of this car is fully 1000 lb. less than that of any of the 1915 Waverley models, thus indicating the engineering refinement which the new chassis has undergone. To make maintenance as simple as possible spring lubrication is through self-oiling bushings without grease cups underneath the car.

The speed and mileage are practically the same as last year, the improvements in the engineering features being chiefly in the production of a light-weight model, while still preserving the roominess of a four-passenger car. The reduction in weight and the greater simplicity of the construction have made it possible to reduce the price to $2,150 when the body has an offset rear seat, and $2,200 where it is fitted with four separate chairs. The former seating arrangement accommodates three people on the rear seat and one on the forward seat. The body has metal panels and rounded corners with sashless windows and automatic window lifts.

A mechanical change is the mounting of the body on a pressed steel frame, this differing from the previous construction in which the mechanical parts were attached direct to the body. Long three-quarter elliptic rear springs are used. To make for safety of operation of the car, the new drum type of controller has an interlocking shift at the top of the controller core.

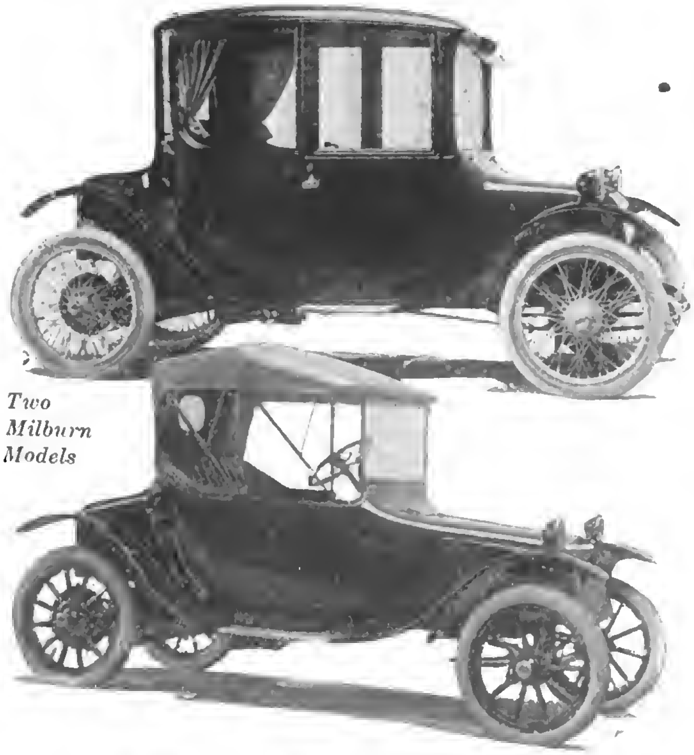
Ohio Continues Practically Same Models

There is nothing radically new in the 1916 Ohio cars, product of the Ohio Electric Car Co. The concern is continuing practically the same models as it was building last year with only those refinements which another year's experience in manufacturing makes possible. The Ohio special magnetic control is retained just as it was, having been a feature of cars of this make for several seasons.

For those who desire a large five-passenger car Ohio still builds its double-drive brougham Model 62 at $3,250. The other prominent models are a single-drive brougham, Model 42 which accommodates five and sells for $2,900; and a four passenger coupé, Model 12, $2,400.

The Ohio company was a pioneer in the double-drive type of car and brought out its first models with this feature in 1912. In its construction there are two separate sets of controller mechanism, one in front and another at the rear seat, either operating the car independently of the other. The controller itself is of distinctive design with the different speeds attained by turning a compact hard rubber disk at the side of the small controller head. Steering is by the conventional lever. Four forward speeds and three reverse, the magnetic brake and the warning signal are all operated from this controller head.

Standard battery equipment in all models is the same as it was with the Model 42 brougham having forty-two cells and the double-drive car forty-four. The speed of all the models has been increased so as to give any desired speed up to 28 m.p.h. at a maximum. A very ingenious feature of the transmission unit is the supporting of the torsion tube between the motor and the rear axle at a point very near to the center of inertia, with the idea of putting all the weight of



Two Milburn Models

Broc

these members on the frame and above the springs so that they are sprung weight, thus effecting a saving in tires and reducing the required power while at the same time a greater factor of safety results.

Ohio coach work is exceedingly well carried out and the various parts such as battery compartments and fenders seem to have a pleasing unity with the body itself. The bodies are all of aluminum as well as the fenders which are hand hammered. As an example of body refinement, the hinges are concealed and there is an absence of moldings which is made possible by shaping the entire body as a single panel instead of joining the various sections together as in the past; thus following gasoline practice.

Argo, Borland and Broc Unchanged

The American Electric Car Co., continues its three types of electrics known as the Argo, Borland and Broc. Under each of the three names, three models are listed. The Argos are a forward-drive brougham at $2,800, a rear-drive brougham at $2,650, and a rear-drive roadster at $2,350. All three chassis are the same excepting that the forward-drive brougham has a slightly longer wheelbase than the other two. Forty cells of eleven-plate Exide battery are furnished with either car, this supplying a Westinghouse series-wound motor located on the rear axle and driving through a combination of double reduction herring bone and bevel gears.

The Borland models are not the same as the Argo types, the most important difference being in the use of a double-reduction by a silent chain to the propeller shaft and bevel gears in the rear axle. All three Borland chassis are the same except the wheelbase on the forward-drive limousine, seating seven and selling for $5,500, is 123 in. in length, whereas the other two models are 96 in. There is a rear- or forward-drive coupé for five at $2,550, and a two-passenger roadster at $2,250. Steering is by wheel except on the coupé which has a lever.

The limousine forward drive model is equipped with forty-two cells of eleven-plate Exide battery with a complete installation at the front. The roadster has forty-two cells of eleven-plate type equally divided between front and rear, and in the coupé there are forty cells. In these models a G. E. series-wound motor is used and both sets of brakes are operated by pedals and act upon the rear wheel drums.

It is in the Broc models that the greatest standardization appears as all three are broughams on a standard 96-in. chassis. These models are a rear-drive at $3,100, which seats five, a double-drive also for five at $3,200, and a four-passenger, front-drive type at $3,150. The drive system is somewhat similar to the Argo, with the motor a series-wound Westinghouse hung centrally in the chassis, whence it drives by a shaft to a double-reduction combination bevel and spur gear floating axle. In all three the battery equipment consists of forty cells eleven-plate Exide. Braking is quite different from the Argo and Borland cars, in that one set is on the drive shaft and operated by lever, and the pedal set acts upon the rear wheel drums.

Milburn Adds a Brougham

Besides continuing its Model 15 chassis with roadster and coupé bodies the Milburn Wagon Co., which though long in the vehicle manufacturing business entered the electric vehicle industry a little over a year ago, is offering a brougham at $1,585 on a new Model 22 chassis. The continued models have been unchanged in construction and sell for $1,285 as a roadster and $1,485 as a coupé. Comparing the new chassis with the earlier design, the chief differences are in the wheelbase, which for Model 22 is 105 in., and for Model 15, 100 in., in the battery equipment which for the new chassis has two more cells than the older type, and the tire equipment which is 32 by 3½ in. as compared with 30 by 3½ in. on the Model 15. The new car has twenty-two cells of seventeen-plate W.T.X.I. type, whereas the other model has twenty cells, fifteen-plate W.T.X.

In these cars which have as their chief features comparatively light weight and low cost simplicity is especially apparent throughout. New to electric construction previous to being taken up by Milburn, is the cantilever spring suspension used both front and rear on the Model 15, and in the rear only on the newer car. G. E. motors are used, and the drive shaft is inclosed within a torsion tube and is very short due to the location of the motor considerably back of the center of the car.

An excellent straight-line drive is had by mounting the motor at the same angle as the shaft, which terminates in an underneath worm-drive axle with a direct gear ratio of 9.75 to 1.

Body work is excellent and reflects the long experience of the Milburn concern in the vehicle business. The battery compartments front and rear are made with the same panels that form the sides of the body proper, and there is an unbroken curve between them. Sashless windows are employed, and fenders are crowned and well fitted. Wheel steer is used on the roadster, but the inclosed cars have the usual handles.

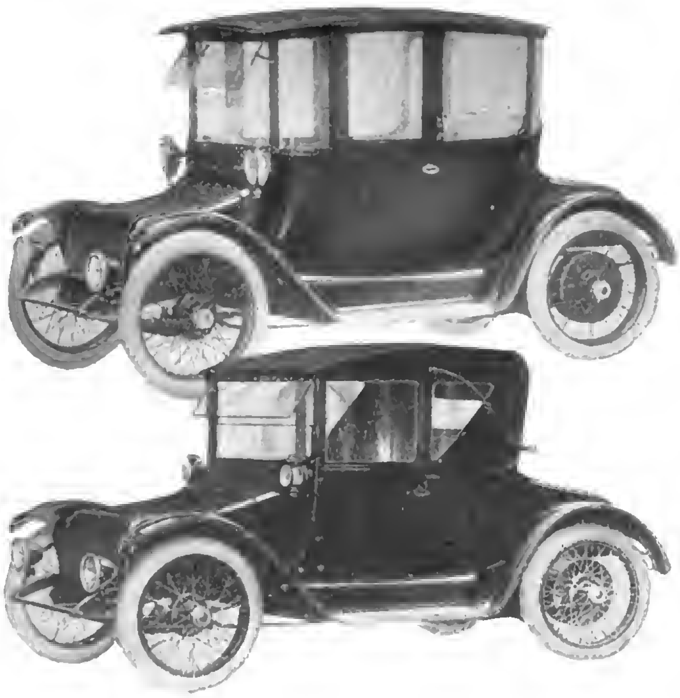
The new model is capable of slightly higher speed than Model 15, due to its larger battery and motor. On the third notch, Model 22 attains 18 m.p.h., whereas Model 15 gives 16¼ m.p.h. Treads are 50 in. for Model 15 and 52 for Model 22.

Ward Coupé a New Design

Quantity output has made it possible for the Ward Motor Vehicle Co., to market an entirely new coupé at $1,295, which is the lowest priced car of the kind on the market. The one model constitutes the line, and it supersedes the coupé which last year sold at $2,100. An unusual feature is that the entire forty-two cell, nine-plate lead battery is placed under the front hood, giving the car somewhat the appearance of a gasoline type. With this novel body arrangement, four to five passengers can be accommodated on the wheelbase of 88 in. The body length, glass to glass, is 74 in.

The car has a conservative mileage rating of from 35 to 45 miles, attaining a speed ranging from 12 to 15 m.p.h. From the motor, the power is transferred through a single propeller shaft to a spiral-bevel rear axle. A pressed steel frame is used, and spring suspension is by semi-elliptics front and rear. Tires are 33 by 4 pneumatic on demountable rims.

The body construction is attractively worked out so that the same panels of hammered metal that form the sides also integrally include the battery compartment. Interior finish, includes plate glass windows, grey silk curtains to match the grey upholstery. At the price, the equipment includes such items as odometer, locks for the doors, chargometer, thermometer, electric horn, and tools.



Two Detroit Models

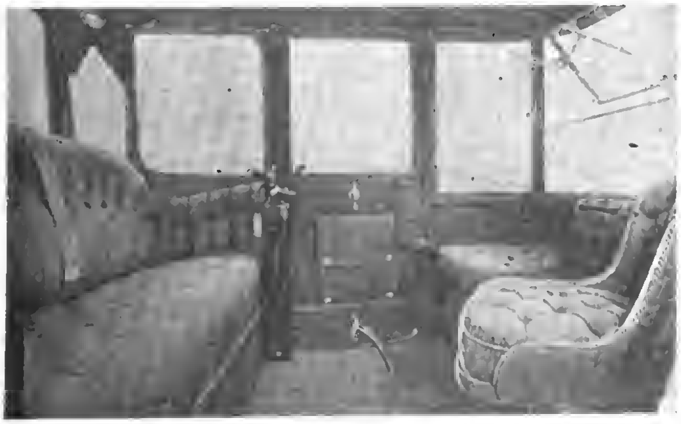
Two New Chicago Models

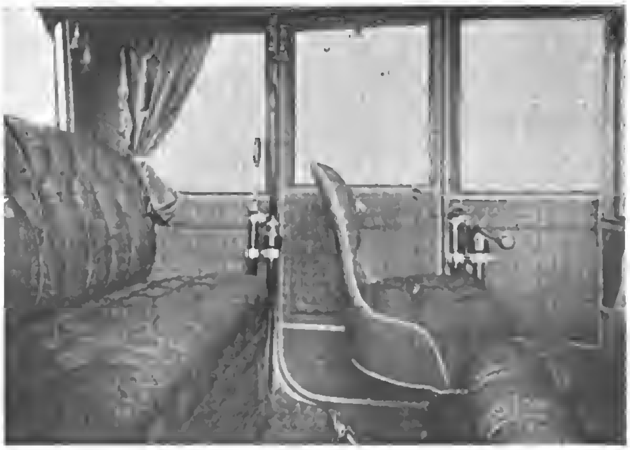
Two new models, termed the Edison models, are now on the market as Chicago electrics, made by the Walker Vehicle Co. These are designated as Models 162 and 163, and they are equipped with Edison battery as standard. They also carry the new Chicago body design which is representative of the latest ideas in electric car construction, and although built along conventional lines, it is low hung and has a long effect. All angles and sharp corners have given way to graceful curves. The arched doors have been modified, as compared with previous Chicago types, to give a straight line roof with only a slight arch perceptible over the door.

Many structural improvements have been added, these particularly with a view to the use of solid tires, for it has been found that more strength than ordinary carriage building affords is necessary in the electric car when solids are used. Aluminum also plays an important part, as it is employed for all parts exposed to the weather.

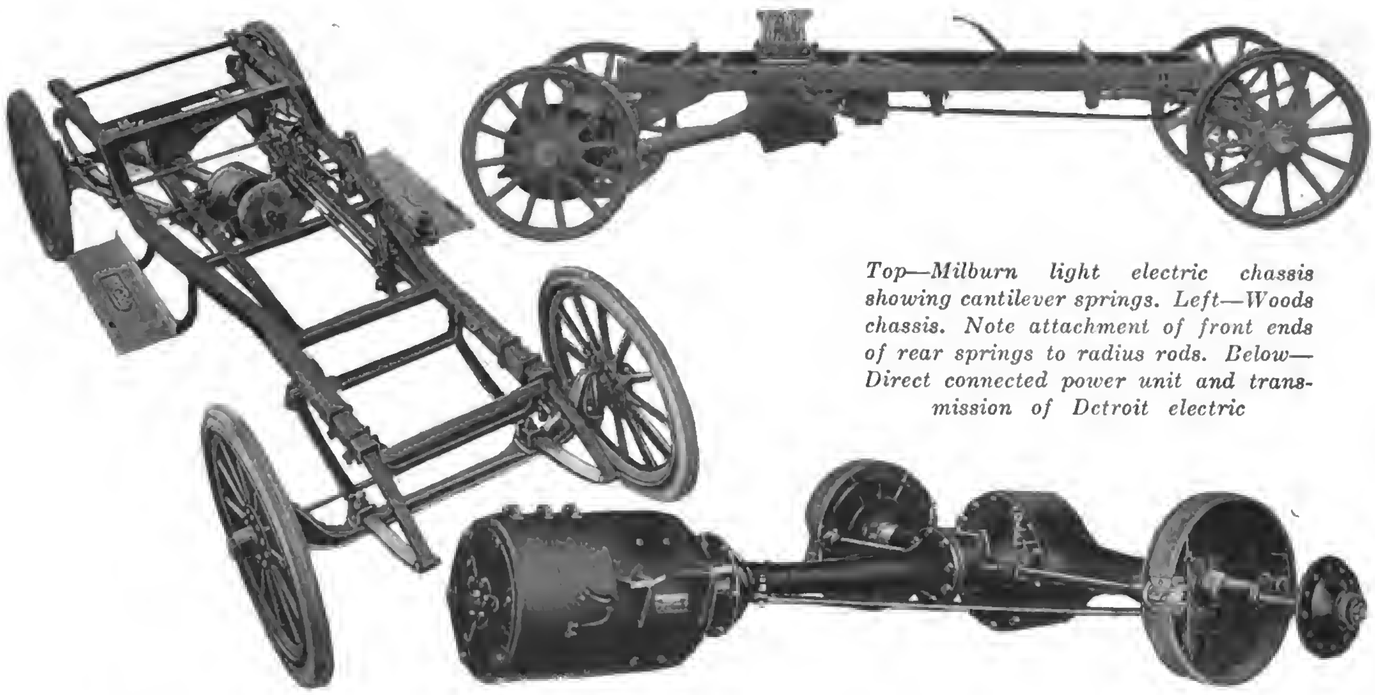
To long running boards are attached the new crowned fenders which are fully skirted to the bodies. Improvement has been made in the window lifting mechanism for operating the sashless glass, and by different positioning of the revolving seats they are made more comfortable and accessible.

Model 163 is a four-passenger rear seat drive car which has an emergency seat for a fifth, and it sells for $2,835 with a sixty-cell, G 7 Edison battery and $2,185 with lead battery. On this chassis, which has a wheelbase of 96 in., there is also built a cabriolet roadster body, and with the Edison battery equipment above mentioned it costs $2,535, as against $1,885 with lead battery. On the Model 162 chassis,





The great luxury of the interior of electric cars is well shown by these three views. The upper is of a Detroit electric, the center view a Waverley and that on the extreme right a Baker R. and L.



Top—Milburn light electric chassis showing cantilever springs. Left—Woods chassis. Note attachment of front ends of rear springs to radius rods. Below—Direct connected power unit and transmission of Detroit electric

with its wheelbase of 104 in., is fitted the new front seat drive, five-passenger limousine. As compared with the other bodies of the line, this averages 8 in. greater length and the seats are a trifle wider. The cost of this car with the Edison battery is $2,925, and with lead cells, $2,275.

The same general construction is followed in both chassis, and while building the frame into an extremely rigid unit to take care of the solid tires has been featured, careful study has also been centered upon proper distribution of the weight. Particular improvement is noted in the reduction of the necessary points of lubrication, especially the steering mechanism. Bronze bushings of long wear possibilities have been still more extensively employed than in previous models.

The motors are larger than previously and designed for heavier duty. They are the slow-speed, series-wound type and are coupled up with spiral-bevel rear axles, which were also used last year. The controller system consists of five forward and reverse speeds with brake operated by a horizontal control lever, this being a 10-in. contracting band acting on the propeller shaft.

The Walker concern is one of the pioneers in the adoption of a battery rental system for passenger electrics, and offers all purchasers in the city of Chicago, which is the only center in which it as yet has the scheme in operation, a reduction of $270 from the list prices when they elect to adopt this method of battery maintenance.

Woods Power Battery Increased

The 1916 series of Woods electrics, which are made by the Woods Motor Vehicle Co., are improved continuations of the models carried through last year with the exception of the Model 1524 which is a new car with a seating capacity for five and selling at $2,900. The leading model of the line, however, is Model 1522, which is practically the same as it was, and in general the body designs are similar to the 1916 types, but brought up to date in the matter of shape and appearance. Prices of these improved cars are the same as previously, Model 1522 being a four-passenger vehicle at $2,850, and having a wheelbase of 100 in., and in addition there are three other designs designated as 1501, 1503 and 1504. These latter all have a wheelbase of 110 in. and differ from one another mainly in the arrangement of the controlling levers, the first being a dual control at $3,100, the second a front control at $3,000, and the third a rear drive also selling for $3,000.

The Woods cars carry a battery which is specially made under the concern's own original design, and in increasing the battery power for 1916, the main change has been in the use of a greater number of plates per cell. Either chassis carries forty-two cells, and as a result of the plate change the mileage per charge is higher, the company giving the average as between 70 and 80 miles.

Much the same design is followed in both chassis, the frame being a special Woods feature in that it is narrowed at the front to allow a short turning radius. Like the battery, the motor is a special Woods design that is suspended in a subframe by means of a support on either side that has a ball and socket construction to allow free movement with the drive shaft. Located well back, the motor connects to the worm-driven rear axle with a short shaft that is inclosed within a torsion tube. Axle alignment is maintained by radius rods on either side. A special feature of the construction is the mounting of the rear springs upon the radius rods instead of on the rear axle. The radius rods extend from the subframe opposite the motor supports back to both ends of the rear axle at points just inside the brake drums and close to the center of wheel treads, and thus they act as a lever in relieving the rear springs of about one-third of the force of road vibrations, according to the designer. In the type of worm drive used, the worm is mounted under the wheel.

Hupp-Yeates Adopts Worm Drive

The only change in the chassis of the new Hupp-Yeates models as compared with those they supersede is the replacement of a bevel-drive axle for a worm drive. The Hupp-Yeates Electric Car Co., is now making three models, these being No. 3 Regent A which is reduced from $1,750 to $1,500, and the new models No. 4 Regent B at $1,750 and No. 5 Patrician which sells at $2,000. The first two are carried by the 86-inch wheelbase chassis and the last has a 100-inch wheelbase. But though the new cars round out the line, they follow the same general mechanical construction as the continued model with the exception that all three have the new worm axle that is furnished by the Cleveland Worm & Gear Co. It has a ratio of 8.6 to 1.

Model No. 5 is a four-passenger coupé with a thirty-six cell, eleven-plate Exide battery that supplies a 60-volt high-speed Westinghouse motor directly connected to the axle, the worm of which is under the wheel. Model No. 3 carries thirty-seven cells in its battery and also uses a Westinghouse motor, though it is smaller—48-volt. Thirty cells are employed by model No. 4, which has the same size of motor as the No. 5. On all models Goodrich Silvertown Cord tires are fitted, these being 33 by 4 in all cases except the front of Model No. 3 which is equipped with the 32 by 3½ size.

The interior of No. 3 is the same as the old model it replaces, it being upholstered in cloth instead of leather, however. No. 4 is finished in Bedford cord cloth with folding front seats and a split front window, and the arrangement and fittings of No. 5 are very much the same. This latter car is built with a very low appearance, due principally to the underslinging of the springs from the axles. It has a mileage capacity of 90 to 100 on a charge, it is claimed.

A feature of the Hupp-Yeates proposition is the furnishing as a part of the standard equipment of an electric battery charger, this being a Lincoln motor-generator type. Thus there is very little added expense attendant upon the charging of the car at the home garage, since it should not cost a great deal to have the charger installed. Hence any uncertainty as to the subsequent investment for car maintenance and charging is eliminated.

Hudson Crankshaft Eliminates Friction

Bending Couple Removed by Scientific Balancing—A New Idea in Balanced Engines

AUTOMOBILE engineers have been more or less curious to know how the Hudson company has been able, in its new six-cylinder motor, to obtain fully 80 per cent more horsepower than was delivered by the previous Hudson engine, which had exactly the same cylinder dimensions of 3½ by 5 in. Considerable mystery has shrouded the new design, and this curiosity was fostered by the fact that a patent on a principle involved in the engine was granted the Hudson company on Dec. 28, although the details upon which it was based were not divulged at the time the car was announced at the New York Automobile Show.

Aside from a careful and refined design along purely conventional lines, the patented feature and the secret lies in the counterbalanced crankshaft, the method of balancing being the really new thing. Careful attention to the working out of all details of valve passages, valve openings and carburetion, besides such other engineering considerations as design of the cams, timing and so on, have played their part in the increase of power which the Super-Six shows over its predecessor, and thus the ability of the new engine cannot rightfully be charged entirely to this new method of crankshaft balancing, although this is the one big factor.

Vibration Spells Power Loss

The reasoning on which the Hudson engineers have worked is that a great percentage of the power developed by a motor is absorbed internally in overcoming the forces which manifest themselves, these resulting in vibration and crankshaft distortion causing friction and loss of power. They realized that if they could reduce these wasteful forces to the minimum, the delivered power would be greater. This is really the germ of the present engine.

The new crankshaft is really not counterbalanced in the sense in which it is generally understood by the layman. The thing that has been done is to balance in a new way the forces present within the engine, this principle being what was patented. In order to understand the principle back of the design, it is necessary to follow through the reasoning which the designers used in determining the forces that had to be balanced at each point of the shaft.

First of all it should be said that the Hudson crankshaft is not balanced by having weights of equal size, shape and mass at each point of balancing, as would at first be expected. Reference to Fig. 1 will indicate the form of the weights used. There are in all three different forms of weights for different positions, and these are not forged integrally with the shaft, but are held in place by nickel steel bolts. The crankshaft is a four-bearing type, and at either side of each main and crank bearing there is a weight of some form. These weights are of a size and shape calculated to balance the inertia forces at the particular point at which each is located, and at any rotative speed of the shaft.

Weights Differ in Size

In proportion to the inertia forces present in a revolving shaft such as this, the unbalanced forces of the reciprocating parts are very small, hence these latter have been disregarded in the balancing of the more important and much greater forces due to inertia. Since these are of different magnitudes at each position along the shaft, the reason for the three different kinds of counterweights is apparent.

Referring to the diagrams in Fig. 2, the method of reasoning may be understood if we consider one one-half the length of the shaft, since the same conditions arise in the other half. In fact, the weights exactly correspond in their relative positions at either side of the center of the shaft. That is, the inertia forces with which we have to contend at a point three-quarters back from the front of the shaft are identical with those one-quarter back.

Suppose we consider then the forces acting on the first half of the shaft, which includes the first three throws. Each throw is in a plane at 120 deg. to the others, as indicated at *A*. The forces are considered all along the shaft from the first main bearing to the second, and in order to determine just what the inertia effect is at any point, it is necessary to determine the resultant inertia force that arises from the

Fig. 1—Hudson Super-Six crankshaft which is balanced on an entirely new principle

separate forces acting in each of the three planes. For instance, at Position 1, which is close to the front main bearing, the force acting in plane *X* is of a magnitude shown by the arrow in plane *X*, the amount of this force being calculated previously. Similarly, in plane *Y*, the magnitude of the inertia force acting in that direction is shown, and in plane *Z* it is shown in dotted lines. Now, referring to the vector diagram above at 1, these three forces are shown in their correct proportions and directions. From this, the resultant force *F* is determined by drawing the parallelograms of forces. At each position along the shaft the vector diagram is determined, and from it the resultant. In the chart the curve *M* is that of the forces acting at the different points in plane *X*, and *N* is the same for plane *Y*, as is *O* for plane *Z*. Referring to diagram *B*, we have plotted a curve of the resultant inertia forces acting at each point along the shaft between the two bearings, these being obtained in amount and direction from the individual vector diagrams already mentioned. This latter curve *E* indicates exactly the forces with which we have to contend at each position, and shows that the largest unbalanced force is at about the middle of the length between supports.

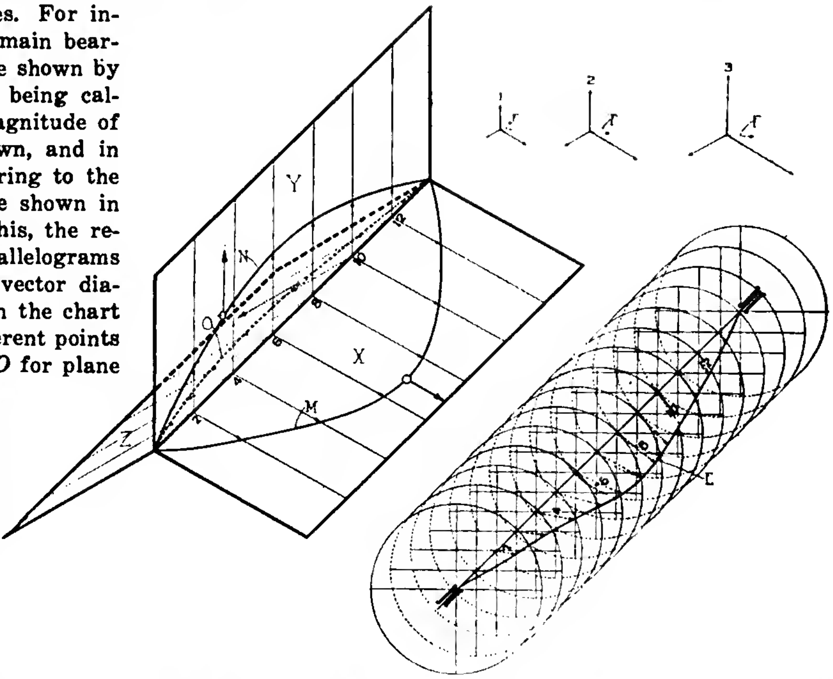


Fig. 2—Diagram of the forces acting on a six-cylinder crankshaft, for the purpose of explaining the action of the Hudson shaft which is balanced to eliminate inertia bearing pressures

Hence, knowing the values of these resultant forces at each point, the Hudson engineers set about to balance these by weights of proper size at each position. Obviously, to bring the shaft into exact theoretical balance, there should be a balancing weight at each point along the shaft, but this being physically impossible, the practical compromise is to put the weights of correct size and form where they would logically go, this at the webs of the crank throws. The principle involved makes it possible to get a correct running balance, within practical limitations, at any speed of the shaft, since the counterbalancing weights have increased inertia forces set up as the speed increases just as the natural inertia forces increase with the speed, and the two sets increase or diminish alike, thus maintaining running balance all the time.

Shaft Floats in Bearings

From this it will be apparent that the only function of the shaft itself is to form a practical mounting for the weights and rods, for, with the inertia forces balanced in this way, the shaft theoretically floats in its bearings when running, and thus in theory even a rubber shaft would be horizontal at all points when running, were it strong enough to take the power load.

It is interesting to note that the new Hudson shaft is very little larger than the previous plain shaft was, which shows that the matter of vibration has been attacked from the standpoint of inertia force balancing rather than stiffening to overcome vibration. Whether you stiffen a shaft or not, these inertia forces are still acting upon it and tend to increase friction and internal power absorption, so the logical thing to do is to compensate for them.

Of course, with these weighted throws, the crankshaft unit is heavier than that of the previous engine, although the better balancing makes possible a lighter flywheel. The new weighted shaft with flywheel weighs 164½ lb. whereas the old shaft weighs 120¼ lb.

In Fig. 3 is shown the power curve of the Super-Six engine, showing a maximum horsepower of 77 at about 2500 r.p.m., although the motor actually operates at close to 3000 r.p.m. as a maximum speed. When it is realized that at these high speeds the inertia forces amount up to several tons, the importance of this balancing becomes more apparent. Undoubtedly the Hudson engineers have attacked the problem of the eliminating of power-wasting factors at their source, and the results attained with the engine would seem to thoroughly justify the line of reasoning.

Automobile and Accessory Plants Help French Loan

PARIS, Dec. 23—Automobile factories have given considerable help in the raising of the $3,400,000,000 comprising the national loan just closed. Before the loan was announced, all the automobile factories made systematic collections of gold from their staffs, it being very difficult for men working eleven or twelve-hour shifts for six and one-half days a week to make a personal visit to the bank, in order to exchange gold for paper money. When the loan was announced the factories undertook to receive subscriptions toward it, and in very many cases to advance money to their workmen toward the purchase of stock. There was no limit to the amount men could subscribe for, and facilities were given for repayment by weekly instalments. Allowance was made for inability to make payments owing to illness, and if a workman left his employment before his stock had been redeemed, he was given the option of completing his payments or having all the deposits he had made refunded to him.

This scheme has proved very popular among automobile mechanics, most of whom are now earning good money and have been glad of the opportunity to invest profitably and safely.

The French staff of the Michelin Tire Co. has invested in this way a total of $1,010,060. As early as September, 1914, Michelin offered to loan money free of interest to any of his staff wishing to subscribe to the short-term treasury notes. In June, 1915, further loans were made to the staff toward the purchase of national defense bonds, and finally the total of more than $1,000,000 has been subscribed by the staffs in France toward the recently closed war loan. This year the shareholders in the Michelin company were paid in the national war loan stock, an innovation which was accepted with general approval. All Michelin employees totally disabled in the war are given an annual life pension of $190, this of course being in addition to the pension given by the State.

Italian Trade Profits By War

Factories Produce More Cars and Trucks Than Army Requires—Passenger Car Development Continuing

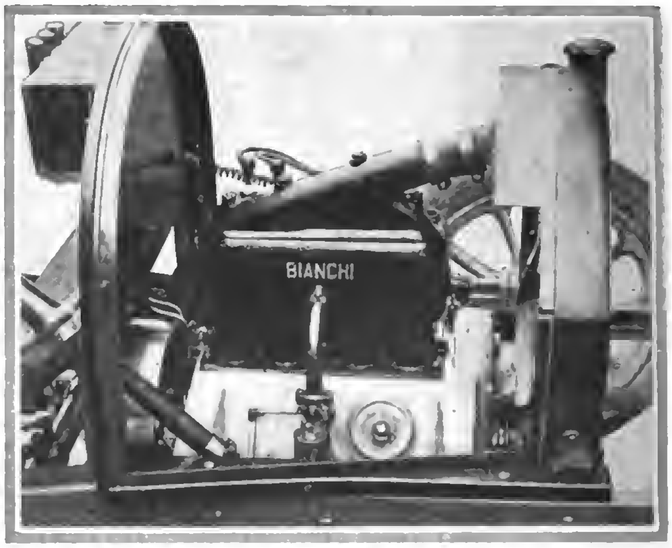
By W. F. Bradley

Paris correspondent of THE AUTOMOBILE, *recently returned from examining the busy and prosperous automobile and motor truck industry in Italy. The following is the second of a series of articles on the subject and reviews the passenger car field*

COMPARED with other European countries it has been possible to visit, Italy bears few external indications of a state of war. When the rigorous frontier formalities have been attended to, the visitor finds himself among a people, who have suffered neither the depression of an invasion nor the exhaustion of a long and undecided campaign. Alone among continental countries, Italy has imposed no restrictions on motoring, and with the exception of the frontier strip, puts no obstacle in the way of free movement of and a badge on the arm of many of the workmen and foremen indicates that they are under military restrictions. Such men, whether they be day laborers or skilled engineers, cannot leave their employment, cannot strike, cannot run short time, or absent themselves without leave. The organization throughout is remarkably efficient, and although the Italian automobile industry is not as important as that of some other European countries, the quality of the factories is certainly the best. Extensions are the order everywhere. There are very few factories in which building operations are not being carried out; this work is being done in a very systematic manner, and as the extensions are made with a view to increased output of the ordinary product, there is no confusion and no disorganization.

Labor Is Plentiful

There appears to be no scarcity of labor here. Women have not replaced men in any of the factories, and there has been no confusion by reason of the enlistment or the calling up of men necessary for the most efficient working of the shops. In all countries possessing compulsory military service precautions have to be taken against the shirker, who would prefer to do military duty in a factory, or some other safe post, rather than in the trenches. The Italians have got over this difficulty by making it a crime, punishable by a long term of imprisonment, without the option of a fine, for any employer to retain in the factories any man, who was not actually employed on that class of work before the war. It is not suggested that any Italian automobile manufacturer has ever been in danger of prison, or that this law was necessary to prevent abuse. But it is very convenient for the manufacturer to be able to point to the law when some wealthy and untechnical friend asks to be given factory employment in order to escape active military obligations. There appear to be sufficient men to supply not only army requirements but to make possible the production of cars for export. Obviously the value of exports has decreased, but it is not by any means a negligible quantity, some factories making quite important shipments overseas.



Top—Bianchi light car four-cylinder motor 2.3 by 4.3 in. developing 18 h.p. at 2000 r.p.m. Center—Bianchi light car and car construction showing gearbox front end of torque tube and internal side by side brakes on rear wheels. Left—Italian mountain troops aboard a Bianchi light car

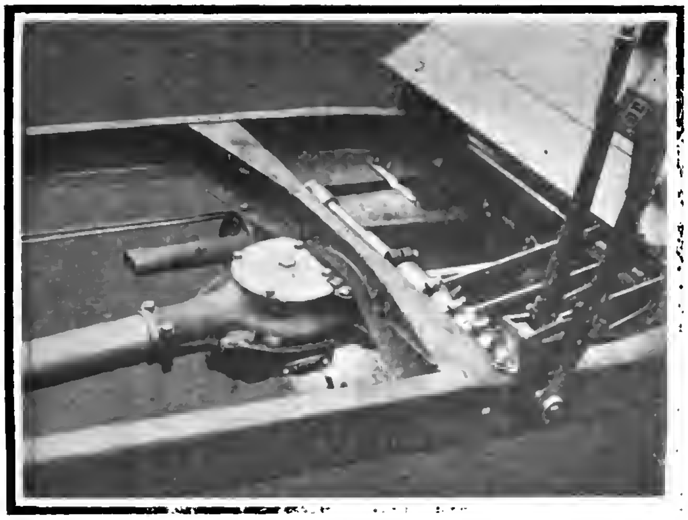
The greatest difference between Italy and her Allies is that she is able to produce within her own territory all the automobiles and trucks required for civil and military purposes. After very close inquiry I have been unable to discover a single foreign automobile in Italian army service. Trace was found of a sample White and a Denby truck at Rome, but it does not appear that any orders have been obtained for these. After England, France and Belgium, where American trucks are now as well known as the native article, it is a decided contrast to come into a country where all automobiles are made on the spot. Even Ford has failed to make any impression in King Emmanuel's territory. Italian automobile buyers belong to the wealthier classes of society and cannot be interested in the cheaper grades of cars. Thus the low-priced American cars failed to get any important hold before the war and have not been adopted since.

The first effect of the war was to make the Italian factories realize their dependence on Germany and Belgium for magnetos, forgings and stampings and certain steels. But the stoppage of supplies only came gradually and for several months after Germany was at war with France, England and Russia, she was sending supplies into Italy. Facilities were even given Belgian firms to send their stampings into Italy between August, 1914, and May, 1915.

Obviously Germany expected a return in the form of finished trucks, and it is possible that some went over the border. Indications appear to be, however, that the raw material came in readily and the finished material went out slowly or not at all. When war is threatening, it is an easy matter for government officials to delay cars on the frontier stations. Although there is a shortage of certain materials, the Italian factories began the war with immense stocks and still appear to be unusually well supplied with material.

Seventy-five per cent U. S. Magnetos

The magneto problem has been the most serious, for Germany had a monopoly of this branch of the automobile industry. Supplies are now being obtained from America, about 75 per cent of the automobiles produced in Italy being equipped with magnetos made in U. S. A. The remaining 25 per cent are German magnetos which are still being drawn from stock.



Gearbox on front end of torque tube, Bianchi light car

One important Italian electrical firm has taken up the manufacture of magnetos, but does not appear to have reached an important output at present. English magnetos were first used when the shortage made itself felt, but they were found unsatisfactory and have been abandoned. American magnetos are better, but the average is not high as that of Germany. In one of the most important test shops batteries now have to be used to help start the motors. No Italian car is equipped with battery ignition in any form. A few French magnetos have come through, but the objection to them is that they cost nearly twice as much as those of American origin.

Italy Makes Own Castings

Italy is entirely independent of outside supplies for iron, steel, and aluminium castings. Her cylinder castings are undoubtedly the finest in the world, and are all made at home. Fiat, Lancia and Scat are three of the leading firms making their own castings. Italian cars carry a greater proportion of aluminium castings than any others, and all these castings are made in and around Turin. The problem has been to get a steady supply of forgings and tool steels, for in these Italy was largely dependent on Germany and Belgium. Supplies are now coming from England, America, Switzerland, and a small amount from France, while important forges have been established in Italy and increasing supplies are coming from them.

Considerable trade can be captured here, for the feeling is strong against renewing business relations with German firms after the war. In going through one of the leading factory store rooms I was shown article after article which formerly came from Germany, but is now supplied by the Allies or by America. One example, of little importance in itself, is nevertheless significant. The set of wrenches and tools supplied with a high-grade car was obtained from a German house and was supposed to be of German construction. Quite accidentally it was found that they were made by a well-known American firm. Immediately the order went direct to America. American firms should not overlook the fact that a German distributor will not be in a position to do business outside his own country when peace conditions have been re-established.

There is no shortage of ball bearings; some of the best are made in Italy and supplies are available from Sweden. All raw material has increased in price from 10 to 50 per cent. Tool steels are rather difficult to procure, but on the whole the Italian automobile industry is exceedingly well placed for material, due partly to the fact that enormous stocks were put in before the war, and partly to the fact that Italy is in a great measure self-supporting.

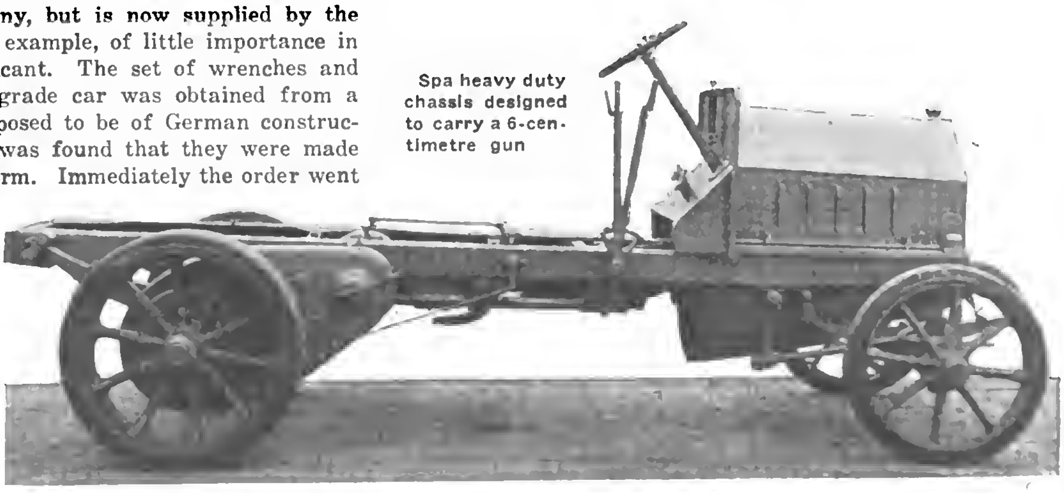
The greatest shortage is in coal and coke. Nearly the whole supply now comes from England, and although there is no danger of this supply failing so long as England retains control of the seas, the Italians would be well pleased if bigger supplies were allowed to come through. Coal has never been a very cheap commodity in Italy, but $35 a ton may be considered a fancy price. Gas coke is sold at $17 a ton. In the picturesque Italian idiom one automobile manufacturer said, "Let England supply the coal and Italy will furnish the blood."

Plenty of Tires Available

It is to be imagined that a German would be afflicted with apoplexy could he see the free use of pneumatic and solid tires in Italy and note the apparently unlimited supply. The leading native manufacturer is Pirelli, who produces pneumatics only, and is able to supply Italy and other allied countries. Michelin has an important factory in Turin, where pneumatics only are made. Since the war Goodrich has established an Italian branch near the Fiat factory, at Turin, and appears to be furnishing an immense number of solid tires to the Italian government. The American establishment is next door to what was recently the headquarters of the Continental Tire Co. The German name has been removed, but the trade mark still remains as a souvenir of a firm which, everybody declares, will *not* be re-established after the war.

A few English tire manufacturers are represented on the Italian market, but there never was much outside demand for pneumatics, and Goodrich doubtless does more business with solid tires than all foreign firms combined. Another American firm which attempted to fill Italian war orders had an unfortunate experience. An order for 5000 solid tires was obtained through a French house, and a first batch of 500 was delivered. These were the first band tires the firm had made and they proved so unsatisfactory that the president of the company had to make a special trip to Italy. It was agreed to replace the first batch free of cost, but the second shipment did not prove very much better.

The authorities appear to have realized that they were being experimented on and have considered cancelling the contract. This firm has never sold solid tires on the American market. Demountable solid tires are unknown in Italy; all trucks, without exception, have pressed on tires. Straight side pneumatic tires are not used.



Spa heavy duty chassis designed to carry a 6-centimetre gun

One of the effects of the war has been to stimulate the demand for automobile trucks among business firms. Up to a year ago the number of business trucks in Italy was not very great, but as the numbers of horses decreased and as the war furnished examples of the utility of trucks, a demand developed among business houses and the home factories have been able to meet it. Prior to the war Italy's specialty was touring car chassis, a comparatively small amount of truck business being done, and most of this was for abroad. The war has made it necessary for everybody to study trucks, with results that are not always quite satisfactory. There is too much adherence to touring car design and too much adaptation of touring car models to truck work.

Turin Is Italy's Detroit

Turin is the headquarters of the Italian automobile industry. Out of a total population of 430,000, about 25,000 or 30,000 persons are directly engaged in the automobile industry. The most important factory is Fiat, which with 10,000 workers on the pay-roll claims to be one of the largest, if not the largest automobile factory in Europe. Other Turin factories without attempting to put them in order of importance, are Lancia, Aquila-Italiana, Scat, Diatto, Itala, Rapid, Spa, Nazzaro, Chiribirri, and the Italian branch of the Gnome Co.

There is a local pride in the Fiat factory so great that every manufacturer, no matter how good his own establishment, will recommend the visitor not to fail to visit the Fiat works.

It is doubtful if any town in Europe possesses five more modern, better equipped, or better managed factories than those of the Fiat, Lancia, Nazzaro, Spa, and the Scat companies. In every case the buildings are well planned, laid out on a big scale, fitted with the most modern equipment, spotlessly clean, and really well managed. With the exception of Fiat the general layout is a big one-story main building divided in the center by the stores. At one side of the stores is the machine section and at the other the assembly department. Thus raw material goes in at one end, is machined, passed into the stores, and passed out at the opposite end to the assemblers. Around the main building are drawing and business offices, test shops, sand blasting, case hardening, nickeling, etc. Land is comparatively cheap, and some of the factories have their own test tracks banked for speed.

Fiat Plant American Type

The Fiat establishment is too big to be laid out on these lines, and the American system of five- or six-story buildings, with electric elevators, is adopted. During the present year the factory has produced 1000 cars per month, the majority of these being trucks varying from 1 to 4 tons. The capital of the company has recently been increased from $3,400,000 to $5,000,000, and stock which was quoted around 90 before the war is now negotiated at 170. Recent extensions will give the Fiat factory an output of 12,000 cars per annum under normal working conditions. It is doubtful if any other factory in Europe produces so many units of a car as the Fiat establishment. All iron and aluminum castings are made by the firm; they also make their own carbureters, radiators, springs, tanks, sheet metal parts, and all standard bodies.

Of late years the factory has designed and built a very large number of its own machine tools.

Although labor is cheap, the average price paid to workmen at the present time being 20 cents an hour (this is rather higher than under peace conditions) modern labor saving appliances are extensively used. There is too much diversity of output to justify all the labor saving machinery found in American factories producing one model only, but the average compares favorably with the best equipped American shops.

One of the finest of the many departments is the motor test room. The motor beds are in two rows on each side of the building and have the exhaust, and inlet and outlet water pipes cast in them; the gasoline lead is also permanently attached to the bed. Electric dynamometers run on rails in front of each row of motor stands. When the motor is put on its stand it is not moved until all tests are completed. It is first run light, then the dynamometer is brought in front of it, connected up, and the motor tested under load. The shop is remarkably neat and tidy and permits of the best work in the shortest possible time. Adjoining are test shops for gearboxes and axles, an examination department in which all motors are taken down and examined after undergoing the bench test, and a sound-proof room for motors.

Gearbox forming unit construction internal foot brake and aluminum dash of Newton light car

Full floating axle of Newton light car. Note neat brake control

The racing and experimental departments and test shops are in the same neighborhood, but these are entirely independent of the ordinary work and are in charge of special staffs. Throughout the war these departments have been working as in normal times, new models being developed, and during my visit I was shown a 300-hp. racing motor on the test bench with which it is intended to better the Fiat straightaway record put up by Arthur Duray at Ostend, Belgium.

In this connection it is worth mentioning that Duray's 300-hp. Fiat is in the finished car department at Turin by the side of the King of Serbia's recently repaired limousine. This racing machine, which is the biggest ever put on the road, with a height of about 5 ft. 8 in., is owned by a Russian prince. After Duray had set up the world's record, the French authorities refused to grant a license for this huge machine to be run on French roads. As Russia does not possess any highways suitable for speeds of 140 miles an hour, the car is in cold storage.

(To be continued)

The Romance of Accessories

Accessories Have Done Much to Make Motoring What It Is To-day and from Adjuncts Many of Them Have Developed Into Necessities

THE automobile of 1916 would be a very different sort of a machine had it not been for the activities of the accessory manufacturer during the past fifteen years. Taking just the high spots, imagine a car without a speedometer, without starting and lighting, without curtains to the top; even one may add, without good spark plugs and without an automatic carbureter.

All these things and many others, too, were developed as accessories, as things upon which the owner of a motor car might be persuaded to spend his money. The history of the accessory industry repeats itself rapidly. Some bright inventor sees an opportunity to make an automobile a more convenient machine to own or to use, something which makes for efficiency, for comfort or for luxury. To develop it capital is found, after experiment has proved its value, and it then appears in a form or forms which are readily adaptable to existing cars. Ingenuity is turned to devising means for applying it to cars never designed to take it, and in the Ford starter business we see the highest possible phase of this.

Stock Equipment Is Goal

Then the next stage may be quick or slow in coming, it depends upon how popular the accessory becomes. If it reaches a degree of favor which causes it to be seen on a large proportion of cars the automobile manufacturer becomes interested and adoption by one may lead to general use, as has happened with the speedometer, as has happened with the starter, and as is happening with the engine driven tire pump.

When the manufacturer takes up an accessory and begins to order in his tens of thousands that accessory becomes a component just as a motor or an axle so becomes. A true accessory is something which is not part of the original makeup, something which the user can buy and add as it pleases him so to do. Perhaps the day will come when there are no more accessories, when every automobile is complete to a point where nothing more can be added, but it is unlikely that any who read these words will live to see that day. Meanwhile there is scarcely a car that cannot be made more comfortable, more efficient, or more luxurious by the expenditure of a few dollars now and then. Also it must be remembered that there are things which wear out. It is necessary to replace spark plugs at regular intervals, warning signals of the various sorts grow old faster than the car that carries them and new things may come along worthy of attachment, just as a motor operated tire pump is well worth adding to a sound chassis not so provided by its maker.

Non-Stock New Parts

Then, too, there are the repair shop accessory opportunities. When an old car with many years' service ahead of it is being limbered up there offers a chance to put in new piston rings of a better pattern, to substitute aluminum pistons, perhaps to change the carbureter for a more efficient and economical instrument. This is a condition which will be with us always, at least as long as the automobile goes on improving from year to year, as it seems likely to do for a very long time indeed.

Of course there are a few accessories offered for sale that have little worth, that are just novelties with no useful purpose, but they are a very small minority indeed. Practically everything to be found in a well stocked store of automobile accessories is worth the price asked for it and many motorists lose a great deal by not paying sufficient attention to their dealer's display. By a proper and judicious purchase of new fittings and new attachments an old car can be kept in efficient and convenient condition for several years longer than if run in its original state all the time. No man hesitates to refit his home with metallic filament electric lamps in place of the more extravagant carbon ones; to buy a new rug or a new chair from time to time. Why, therefore, should he neglect to maintain the usefulness and even the appearance of his car?

Progress In Detail Noted

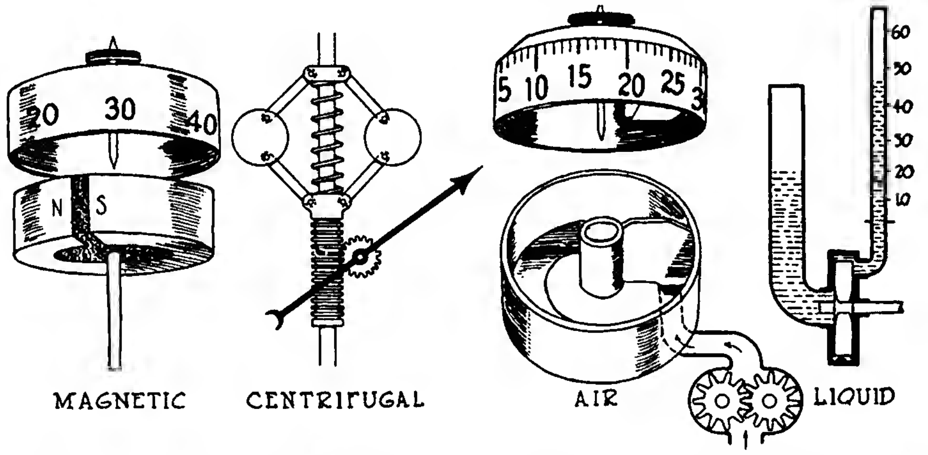
Whether stock parts or true accessories the great change in the past year is in sturdiness of design. Simpler and stronger parts, better adapted to the rough and tumble usage of automobile service, have become the rule. It is particularly noticeable that quality is taking its proper place as a selling argument, and it seems that the buyer is coming to understand that a good article at a fair price is better value than a poor accessory at any price.

Amongst the major accessories, the things which manufacturers have taken up and are now taking up THE AUTOMOBILE reviewed those of the greatest importance during the fall. There remain several others in the making of which progress is to be recorded and these are dealt with in a general way in the pages which follow.

Better Trip Reset on 1916 Speedometers

Flush Mountings for Instrument Boards also a Feature —No Changes in Principle

Magnetic, Centrifugal, Air and Liquid Are Four Systems Used



The four principles of speedometer operation: Magnetic, in which a revolving magnet exerts its drag on the dial; centrifugal, in which revolving weights supply the energy due to centrifugal force; air, in which a current of air flows against a vane carrying the dial, and liquid, in which a column of liquid is lifted a height proportional to the speed of pump drive

WHILE at first glance it would hardly seem that road route books and speedometers could be in any way interconnected as regards the design of the speed and distance recording instrument, yet the refinements of the year show this to be so. When touring by route book it is essential that the readings of the odometer correspond with the book mileage. Consequently the odometer part of the speedometer, to reach its maximum usefulness must be so arranged that the trip mileage reading can be set to whatever distance is required. The 1916 speedometer is equipped with a wheel or other efficient reset mechanism which permits of this, and the universal adoption of the trip resetting mechanism is the distinctive speedometer improvement of the past year.

The wide adoption of the instrument board has given rise to the second improvement, flush mounting. With this style of mounting only the face of the instrument projects through the instrument board, thus giving a neat appearance which coincides exactly with the harmonizing lines of the interior of the cowl. On some of the high-priced cars an additional speedometer is mounted flush with the back of the driver's seat. The driver's instrument is then carried on a frame at the toe board in the custom-made bodies and the instrument board is abandoned.

Two Main Refinements

These two refinements, the accessible trip reset and the flush mounting, are the two features of speedometer improvement. In fundamental principle none of the makes has been altered and the broad classification of magnetic, centrifugal, air and hydraulic operation includes the four basic methods by which the car speed is transformed into mileage readings on the dial.

The magnetic principle as indicated in Stewart-Warner and American Ever-Ready instruments, utilizes a revolving magnet positively driven from the car wheel or other part. The magnet exerts its influence on a metal part which is separated from it by an air gap and which in turn is connected with the indicating mechanism. The metal part is generally aluminum as the inertia of the part must be kept as low as possible to make the speedometer quickly sensible to speed changes. A feature of the magnetic design is that the travel of the dial bears a direct ratio to the speed of travel of the magnet, and in order to compensate for changes in the drag due to temperature differences, a compensating unit is fitted.

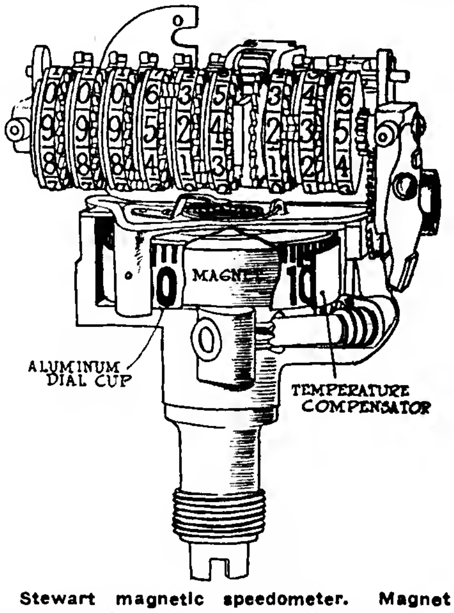
Centrifugal control as utilized in speedometers is very much the same as that on a fly-ball engine governor. Standard, Johns-Manville, Sears-Cross, Corbin-Brown, Hoffeker and Garford use this principle. Weights are mounted on the revolving shaft by bell crank levers which allow them to travel further from the axis of the shaft as the speed of the drive increases. The centrifugal force of the weights increases as the square of the velocity of the shaft.

Weights Actuate Needle

This tendency of the weights to fly from the axial center of the shaft under the influence of centrifugal force furnishes the basis of the indicating needle movement. An ingenious feature in centrifugal design is that although the movement of the weights would naturally vary as the square of the speed, the levers or cams governing the movement are so calculated that calibrations on the dial are uniform or nearly so. Another feature which is carefully watched is the balance of the weights. The governors are made very sensitive so that even at low speeds the correct rate of travel may be indicated. Improvements in this direction have been made within a year by at least one of the centrifugal speedometer manufacturers.

The air principle is used only on one make, the Van Sicklen, in which a blast of air from a pump within the speedometer forms the source of operation of the indicator needle. As the speed of the drive increases the volume of air flow becomes greater, thereby increasing the travel of a pivoted dial, calibration of which is effected by governing the size of the passages through which the air flows.

One instrument, the Veeder, which employs the hydraulic system, uses a centrifugal pump which is connected



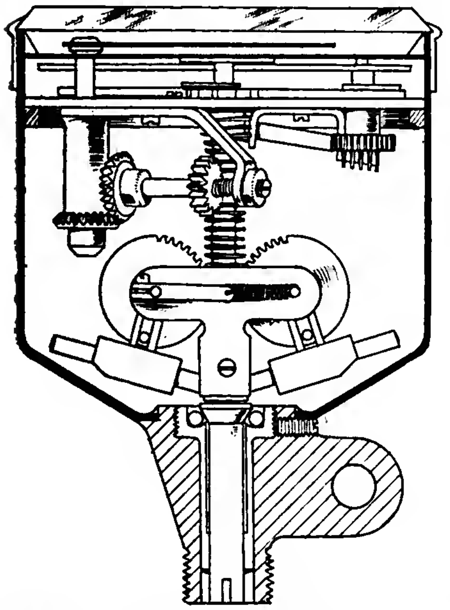
Stewart magnetic speedometer. Magnet revolves exerting pull on aluminum cup carrying the dial. The faster the magnet revolves the greater will be the pull on the cup against the action of the hair spring above the cup. Temperature compensation is taken care of by a thermostat which surrounds the dial with the drive and which lifts a liquid to a height proportional with the speed of the drive. The tube in which the colored liquid is lifted is calibrated to register speed.

Stewart-Warner

Stewart-Warner magnetic instruments are made with flush mounting and with a convenient form of wheel reset. The instrument has but one moving part, a circular magnet over which fits an inverted aluminum cup. This cup does not touch the magnet, being separated from it by an air gap through which the lines of magnetic force travel. On the outer rim of the cup is the dial.

The magnet is positively driven as the car travels, at a rate proportional to the speed of the car and the faster the magnet revolves the greater the pull exerted on the cup and dial. A hair spring controls the movement of the cup and the greater the pull exerted by the revolving magnet the further the cup is pulled against the action of the spring.

The indication of very low speeds is one of the features of the Stewart instrument. The tungsten steel magnet being in the form of a circular ring acts as its own keeper, thus rendering it permanent. Delicacy of action is secured by having the pivot point mounted on a jeweled bearing and the upper support of the cup is also a jewel bearing. The temperature compensator is a thermostat which is nearly a complete circle surrounding the dial but leaving the part which comes before the reading window uninterrupted. This compensator maintains the correct adjustment of the hair spring under varying temperature conditions.



Standard centrifugal speedometer. The feature of this instrument is the ingenious arrangement of the spring tension applied to the levers mounted on the governor weights. By this system of levers it is possible to have the divisions on the dial of the instrument equally spaced, although the centrifugal force varies with the square of the speed. The movement of the rack is proportional to the speed of the car

The passenger car types cover a wide range and can be secured in various combinations with clocks and electric lamps. Probably the most important announcement made by the Stewart-Warner Corporation regarding its speedometer line is the Ford type at $10, which is the lowest price of any instrument.

Standard Thermometer

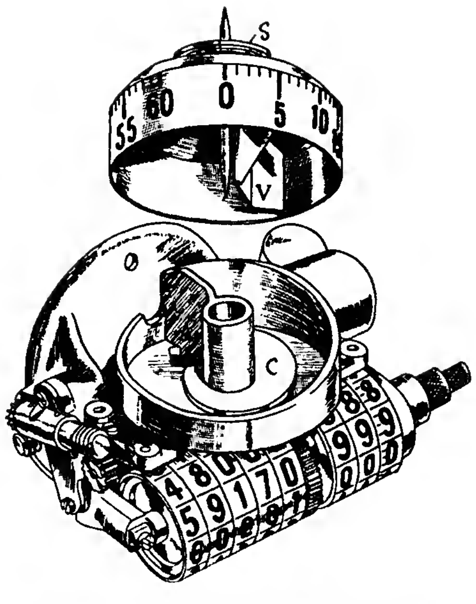
Illustrating the tendency toward accessible and quick trip resetting mechanism the Standard Thermometer Co. has incorporated in its 1916 instrument a wheel reset which can be operated in 3 sec. This new resetting mechanism and a model adapted for rear drive are the principal improvements. Two distinct types of speedometers are at present being made by this concern, both operating on the centrifugal principle and known respectively as the Ford and Chevrolet 4-90 designs. There is no difference between these two in respect to the speed and distance measuring parts, the only variation being in the form of case and method of installation on the dash or control board.

The Chevrolet 4-90 type represents up-to-date practice in having the speedometer mounting flush with the control board. All portions of the case and supporting flange are finished in nickel plate with the trip reset button projecting from the upper right portion of the flange.

In carrying out the centrifugal principle two weights are carried upon a light arbor, driven through a flexible shaft from the front wheel. The rotation of the arbor causes the weights to fly from the axial center due to centrifugal force and as they move a sleeve is actuated, which slides along the shaft, a distance proportional to the speed of the car. The movement of the sleeve is transmitted to the indicating hand on the dial by means of a rack or series of rings turned on the surface of the sliding sleeves. These rings being in engagement with a toothed sector which, by means of a multiplying gear train, actuates the indicating hand.

Since the indicating hand of the speedometer is not actuated by the rotating arbor but by the centrifugal weights the speedometer hand will not vary in its indication unless the speed of the car varies. This is true because only an increase or decrease of speed will cause the weights to depart from or approach the axial center.

A feature of the speedometer is the uniform scale divisions throughout the entire range of speeds. Although the centrifugal force increases as the square of the angular velocity, the compensating arrangement in the Standard speedometer due to the use of suitably formed levers mounted in conjunction with the weights and spring tension units permits of the uniform speed division.

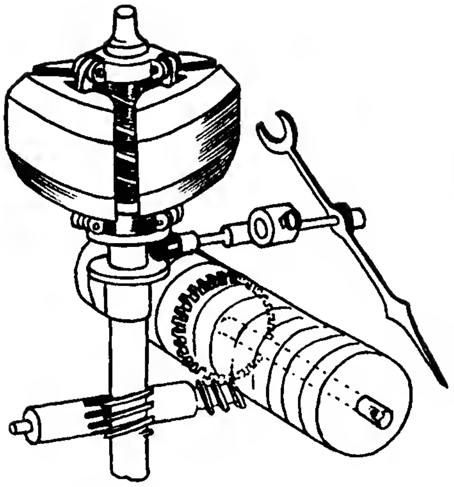


Van Sicklen air-system speedometer. Air current from gear pump enters through an opening on the other side of the wall from the outlet A and flows against the vane V in the inverted cup, which carries the dial. The cam C regulates the escapage of the air and compensates for the greater flow at increased speeds. The dial cup is limited in its movement by the hair spring S

A new development makes impossible an error in the trip reading of more than 0.05 mile. This gives a feature which is valuable in following mileage readings in route books, as it is often impossible to determine if the car is in the first or last half of a tenth mile. Another new feature is a new pressed steel adjustment bracket for Fords installed by removing the right spindle nut. The Ford type sells for $12 and the Chevrolet design for $15.

Van Sicklen

The Van Sicklen air speedometer utilizes the drive of the flexible shaft to create an air current by a small gear pump. This air current flows against a vane on a pivoted aluminum cup on the outside of which is the moving dial. A hair spring holds the cup normally at zero, and as the strength of the air current increases the vane tends to rotate the cup against the hair spring to the correct registering position. The direct means of governing the travel of the dial is by varying the volume of air increases, but the pressure is prevented from rising by the proper governing of the air openings. Thus, for any position of the dial there is a definite amount of air flow which does not vary until the speed varies, thus keeping the dial steady at definite speeds. Conforming



Johns-Manville centrifugal speedometer. The centrifugal weights are carried on bell crank levers and are controlled by a spring. The combination of spring and levers is such as to proportion the travel of the sleeve to the speed of the car. The sleeve action is transmitted to the needle through a small crank. The odometer action is by worm and gear

to modern practice a wheel reset is used so that any mileage desired may be set on the trip odometer.

Corbin-Brown

Improvements on Corbin-Brown centrifugal speedometers, that are now also made in the flush mounted type with wheel reset, include a new form of attaching bracket which allows the instrument to be adjusted to four positions on either the right or left side of the dash by merely removing two set screws. The swivel gear section in which the gears are made and hardened, is in one piece with the shaft, to which the cables are attached. Large collars hold the gears in correct position and considerable space remains for grease to be packed into the housing.

The centrifugal weights are balanced about the shaft and as they fly from the center they move a rack consisting of a number of rings turned on the vertical shaft. As the rack moves up or down, according to the speed variations, the hand is caused to travel along the dial through a gear train mechanism.

Prices vary from a Ford type at $12 up to $30 for a flush-mounted design with a 3-in. dial.

Johns-Manville

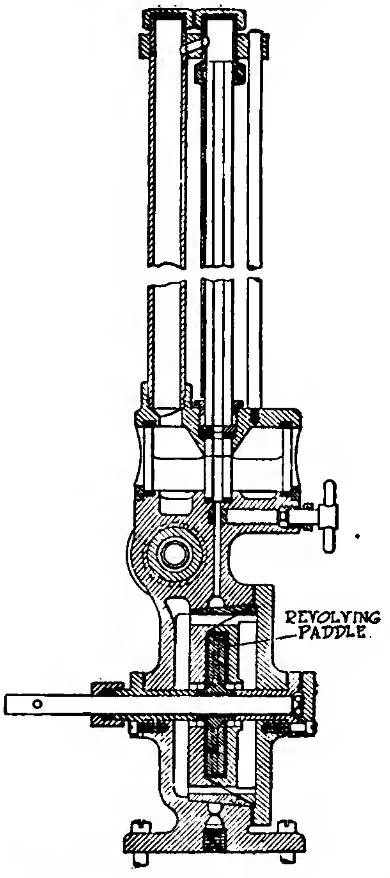
The Johns-Manville centrifugal speedometer is the development of what was formerly known as the Jones. The instrument has been redesigned so that now the entire mechanism is assembled as a unit on a framework, before being put in the shell or casing. This framework can be lifted out of the shell allowing an easy inspection. The instantaneous reset plunger has been replaced by a wheel reset which allows of putting the trip mileage at any figure. Another improvement is in rendering the governor mechanism more sensitive so that it will accurately indicate very low speeds. Better balance of the weights, thus eliminating the vibration of the indicating hand, has been secured. The speed scale is redesigned, giving increased scope with larger figures and the indicator pointer does not pass in front of the odometer window to obscure the figures on mileage.

Johns-Manville, in working out the centrifugal system, uses three balanced brass weights connected with links and swinging freely on fixed pivots mounted on the driving spindle. When the spindle is rotated through the medium of gears and the flexible shaft the weights tend to separate, operating a cam movement which moves the indicating hand to the correct position on the speed scale.

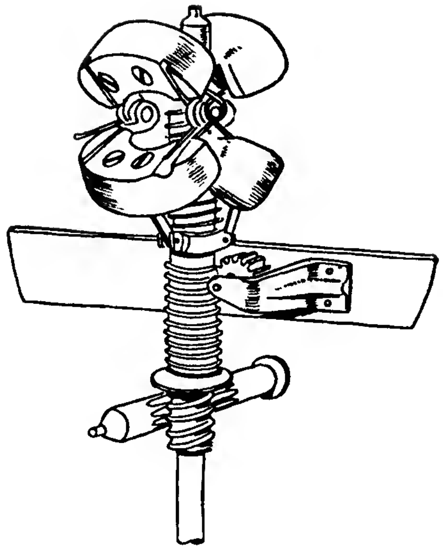
The season mileage reads up to 100,000 and the trip mileage to 100. The number of models manufactured is nine, four of which are 3¼ in. diameter, four of 4-in. diameter and a special model for Fords. The 3¼-in. instruments range from $25 to $30 in price, and the 4-in. $50 to $60. The Ford type is $12.

Hoffecker

The Hoffecker models include a new Ford type at $12. This has a wheel reset and the detail improvements show that the number of working parts have been reduced and rendered stronger than heretofore. The instrument has a 100,000-mile season mileage and registers a speed up to 50 m.p.h. Trip mileage is shown by a separate hand which travels around the same dial as the speeds are recorded upon but with a separate scale outside of the speed scale. The total trip mileage is 100.



Veeder tachodometer. The liquid or hydraulic principle is utilized in this. The centrifugal pump lifts a column of liquid to a height proportional to the speed



Elements of the Corbin-Brown speedometer showing how the centrifugal principle is worked out. The weights actuate a cylindrical sleeve carrying a rack which is made up of a series of rings turned on the sleeve. The odometer system is operated by the worm turned on the shaft below the rack

Veeder

Veeder speed indicating instruments have not been changed for 1916. The hub odometer is the feature of the Veeder line. This instrument is mounted on the hub of the wheel and registers the distance traveled backward as well as forward. It is sealed on the hub of the wheel and cannot be removed except by breaking the seal. The tachodometer is the instrument for registering both mileage and speed and, as previously explained, the speed is indicated by the height of a column of liquid which is governed by a centrifugal pump. With all fittings this sells for $50.

American

The American Ever-Ready magnetic type is made in four models, one of which has been changed for 1916. All are of the needle-indicating dial design. The 60-mile instrument with season mileage only lists at $15 and with trip mileage at $20. In addition there are two 80-mile designs at $25.

Sears-Cross

A new Ford model has been brought out by Sears-Cross under the trade name of Spedindicator.

(*Continued on page* 168)

Horns Better and Lower in Price

Electric Types Continue to Gain in Popularity with the Universal Use of Electric Starting and Lighting Systems—Simpler and More Accessible—Hand Horns Also Improve Greatly

REFLECTING the progress and tendencies in automobile design, the developments in the horn field during the past year have been toward lower prices, simplified construction, improved workmanship and better quality materials, together with greater accessibility of parts for lubrication and adjustment. There has been another tendency, too, peculiar to the horn field, which is toward rendering the instruments more flexible in tone, that is, enabling the operator to evoke either a loud, startling note of warning for emergencies or a softer, more courteous tone for occasions where there is no immediate danger but the car driver feels that pedestrians or other drivers should be apprised of his coming.

In motor-driven constructions, there is a tendency toward the use of horizontally-disposed motors actuating a button on the diaphragm by a toothed cam or wheel on the end of the motor shaft, the angle of impact differing in various makes.

An interesting development in hand-operated signals is the introduction of the underhood type in which the standard lever is used, but instead of having this directly attached to the horn, it is mounted in a casing which can be attached anywhere for easy operation while the impulse is transmitted to the horn under the hood through a flexible shaft.

Quantity production and the adoption of improved manufacturing methods are responsible for many refinements. Greater care has been expended upon design, there being more instances than ever before where the manufacturer has provided adequate bearings, automatic lubrication for the working parts and greater durability, which is to be expected from both the quality of the materials used and the arrangement of the components for least wear and maximum ease of operation.

Prices Are Much Lower

The manufacture of automobile horns in quantity, bringing with it the improvements mentioned, has also brought much lower prices, especially in the hand-operated and vibrator classes, though there are also a number of motor-driven signals at prices very much lower than any listed at the beginning of last year. In fact, it is now possible to buy a good motor-driven horn at a lower price than was charged for a hand-operated type a year ago. As for the prices of the hand horns, simple, strong constructions are now obtainable at about half the price demanded for similar instruments at the beginning of 1915.

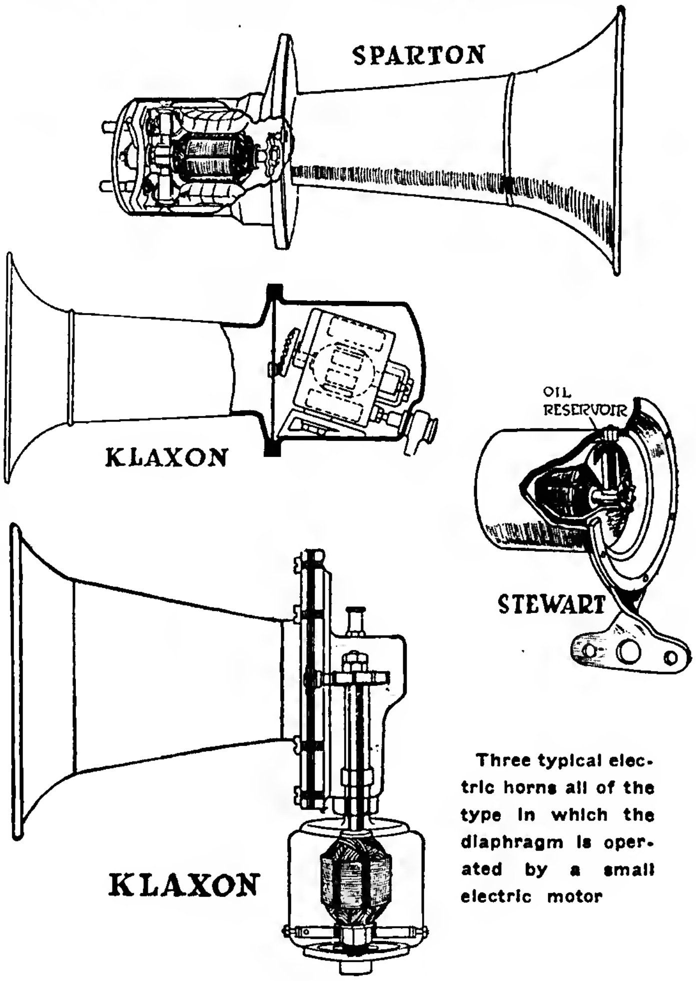
Accessibility Is Greater

In the way of making things easy for the car owner, increased accessibility for adjustment, lubrication or possible repair show marked advances over the progress registered in these features at the opening of 1915. Automatic lubrication of the parts, where friction is a factor, may also be included in this category. It is these little bits of thoughtfulness on the part of the manufacturer which go to make automobiling more of a joy each year and automatically enlarge the field for his instruments by the reflex action of creating more automobilists. This year some horns have adjustments outside where they were formerly inside the casing and more or less fussing was required before the pitch or tone could be altered in the slightest degree. It is much easier to get at the parts for inspection and oiling, it being no longer necessary to practically disassemble the entire horn to carry out these simple steps. In some of the constructions now employed it is but a moment's task to loosen a thumb nut or two and the entire mechanism is revealed. Many diaphragm types are adjusted for pitch by turning the screw button in the diaphragm.

Another feature is the use of an oil pad which keeps all the working parts of the horn constantly lubricated, while wells for retaining and distributing the oil applied to horns with the conventional lubricating arrangement are more widely used and better shaped than was formerly the case.

Electric Horns Are Improved

A notable improvement in motor-driven types is the simplified construction adopted by the Sparton, manufactured by the Sparks-Withington Co., Jackson, Mich., the housing having been made a much better manufacturing proposition by replacing the curved exterior with a straight type, while the adjustment has been brought outside so that the pitch, etc., may be varied simply by turning a thumb nut. The



Three typical electric horns all of the type in which the diaphragm is operated by a small electric motor commutator is much more accessible for inspection and oiling than formerly.

A number of new motor-driven horns have been placed on the market during the past year, a prominent example being the Stewart, made by the Stewart-Warner Speedometer Corp., Chicago, Ill. It is a horizontal type in which a toothed wheel on the end of the motor shaft impinges on the button on the diaphragm. Economy of current is one of the aims in its design as well as light weight and immunity from motor trouble. The large mushroom buttons used with this horn may be operated by a push from any angle with the horn or elbow.

The most recent additions to the line of the Lovell-McConnell Mfg. Co., Newark, N. J., are the U. H. Klaxon and U. H. Klaxet, the former having a straight-side projector and the latter a bell-type projector. Both use the horizontal motor construction in which the motor is set somewhat at an angle so that the toothed cam on the motor shaft strikes the diaphragm button. These two new models are much lower in price than any previous Klaxon instruments of this character. The rest of the line, including the large type L, using a vertical motor, is continued without change in design. A feature of the Klaxon horns for 1916 is that they are all to be finished in a new black enamel called Klaxon black, this step being a reflection of the tendency in car construction to use plain black finishes, doing away with finishes requiring care and polishing on the part of the car owner.

Another concern of importance continuing a standard line of horizontal motor-driven horns is the Automobile Supply Mfg. Co., Brooklyn, N. Y.—manufacturing the Newtone in both outside and underhood styles, as well as a magneto-driven vibrator horn for Fords and the Apollo vibrator type.

In addition to four vibrator types, the Garford Mfg. Co., Elyria, Ohio, has produced the Rexo II, horizontal motor-driven type at a low price, its construction being a good illustration of the possibilities of simplified manufacturing processes, the electrical element being mounted on a one-piece stamping. A feature of this horn is the fact that there are no friction surfaces to lubricate or adjust. The only adjustment necessary is made once a season with a screwdriver to take up wear.

Another horizontal motor-driven horn recently put on the market is the Eaco, produced by the E. A. Laboratories, Inc., Brooklyn, N. Y., which is made in two types, the conventional and underhood styles. In addition to the regular size a smaller size is made for small cars and has no projector.

A horizontal motor design has been added by the Electric Spark Appliance Co., Brooklyn, N. Y., under the name of Olympic, being made in two styles for outside mounting and under the hood. The other types made by this company are vibrator designs in the same styles as the motor-driven.

Two motor-driven horns and two vibrators are made under the name of Samson, by the American Electric Co., Chicago, Ill., both types following standard principles of construction.

A new low-priced vibrator horn for the Ford flywheel current is the Heco, which is made by the Heinze Electric Co., Detroit, Mich.

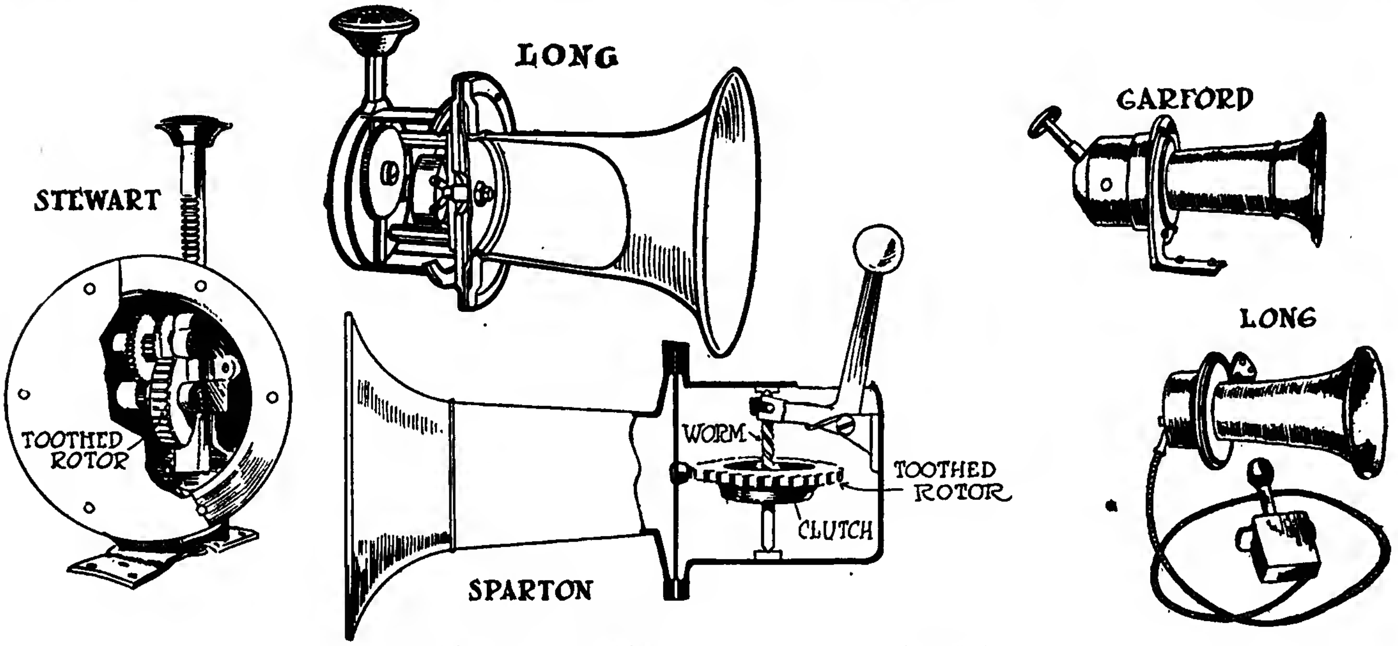
One of the makers who have aimed to produce a motor-driven signal that will not shock or disconcert pedestrians or drivers is the Holtzer-Cabot Electric Co., Brookline, Mass., and Chicago, Ill., which manufactures the Reacto hammer-blow type. This horn is adjusted by simply turning a screw to the left for a louder tone and to the right for a lower tone, it being arranged so that this screw cannot work loose. No tools are required to make the change.

Hand Horns Simpler and Less Expensive

Developments in hand horns have been chiefly in the way of lower prices made possible by increased production and simplified manufacturing processes and in stronger, better and simpler construction. Practically the same improvements which mark the Sparton motor-driven type have been embodied in the hand horns, made by this company, the housing having been treated in exactly the same way to render it a better-appearing and more practical manufacturing proposition, while the exterior adjustment for pitch is also furnished. The horn operates through a nut on a vertical worm shaft which carries the toothed rotor against the diaphragm button.

An important event in the hand horn field, late in 1915, was the taking over of the sales of the Long horn by the Edward A. Cassidy Co., New York City, from the H. W. Johns-Manville Co., the latter concern intending to market a hand horn under its own name early in the spring. An underhood hand type has been added to the Long line, this corresponding to the standard construction except that the operating lever may be located on the side of the driver's seat, on the dash or some other convenient place, whence it operates the horn by means of a cable. The Long construction uses a rack and train of gears to actuate a weighted wheel having rollers radially disposed around its surface to engage the diaphragm button.

The Stewart hand horn, which preceded that company's



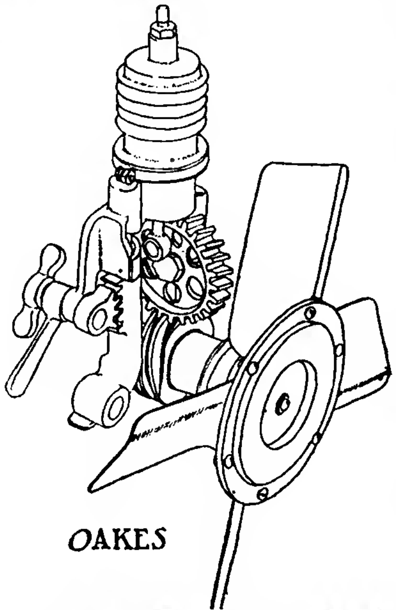
A representative group of mechanically operated horns with hand control motor-driven type embodies standard principles of construction, being of the rack-and-gear type. Besides its lower price for 1916, one of its distinctive features is the use of an oil-soaked felt pad which rubs against bearings and wheels continually, insuring constant lubrication, while another is the use of a double supporting bracket for the horn, which prevents it from getting loose and wobbly even under the most severe usage.

As an indication of the thoughtfulness of the horn manufacturer, the 45-deg. plunger used on the hand Garford is an interesting illustration, this construction permitting maximum ease of operation inasmuch as the operating movement is a compromise between a vertical stroke and a horizontal push. Other features of this horn are: Only four points to oil once a season and three-point suspension mounting bracket insuring rigid attachment. The rotor is on the center line of the horn and the cam wheel is on the shaft between two sets of bearings and acts direct on the diaphragm button.

Many New Hand Horns

Among the new hand horns on the market are: The two new Seiss instruments made by the Seiss Mfg. Co., Toledo, Ohio, which are of the type operated by turning a crank in either direction, the drive being by a bevel pinion and bevel wheel.

The Standard, made by the Standard Metal Mfg. Co., Newark, N. J., employs a vertical spiral shaft and a train of gears. The Eaco made by the E. A. Laboratories Co., Brooklyn, N. Y., in two sizes and employs a rack and pinion mechanism, the rack being on the plunger and the pinion cut in the shaft. Samson-Lion and Samson-Tiger are made by the American Electric Co., Chicago, Ill., the Samson-Lion having a vertical plunger action and the Samson-Tiger being of the rotary type, operated by a twist of the wrist or elbow. The Wondertone, made by the Motor Appurtenances Corp., New York City, has its rotor set at an angle to the diaphragm button instead of perpendicular to it. Thus, the ratchet handle is on the center line of the horn, making it suitable for cars with either right or left steer, the ratchet driving the rotor shaft direct. With this horn it is possible to give either long or short blasts; the A-K, made by the Angsten-Koch Co., Chicago, Ill., in two lengths of projectors. This is a plunger-operated type; the A. W. T., made by the American Watch Tool Co., Waltham, Mass., in which solidity of mounting is obtained by curving the horn body downward so that the supporting feet are short and strong. This allows the operating knob to be placed at a convienient angle for either the hand or foot. The striker may be easily adjusted by unscrewing the horn bell. Another feature is the fact that the bell and the operating knob may be combined to form an emergency drinking cup or receptacle for putting water in the radiator. The Handphone, which is a product of the Automobile Supply Mfg. Co., Brooklyn, N. Y., operates on the plunger principle; the Heco, which is manufactured by the Heinze Electric Co., Detroit, Mich., employs a spirally-cut plunger. This company also makes a horn under the same name especially for trucks which produces a long, rolling note. The Evergood, made by the Emil Grossman Mfg. Co., Brooklyn, N. Y., is another horn built specially for truck use, operating by a vertical plunger.



The Oakes Beartone is a mechanical horn operated directly from the fan and controlled by a button

An Underhood Hand Horn

Some of the leading manufacturers of hand horns who continue their standard models are: Lovell-McConnell Mfg. Co., whose hand Klaxon is a vertical plunger instrument while the hand Klaxonet has a horizontal plunger operated from the rear; the Fitzgerald Mfg. Co., Torrington, Conn., producing the two Clero models, the long projector types being for use on any car while the short projector style is especially for small cars; the Nonpareil Horn Mfg. Co., New York City, which makes the Pilot in two styles with either horizontal or vertical rotary handle working in either direction and also in an underhood type, operated through a 36-in. cable. This company also makes the Noxal ratchet principle hand horn. The Talking Horn Co., Middletown, N. Y., makes the Double-Warning, which is operated by pulling a strap, the signal being repeated when the strap is released. This horn may be mounted either close to the driver or at some distance where it may be operated by a leather cord.

Combined Horn and Fan Styles

There are two leading examples of the combined fan and horn type of construction, these being the Oakes Co., Indianapolis, Ind., which manufactures the mechanically-controlled Beartone for Ford cars, and the Marvel Accessories Mfg. Co., Cleveland, Ohio, which makes the Marvel, using a diaphragm in the hub with a lever-operated vibrating mechanism.

Bulb horns combined with electric types are made, among others, by the Lovell-McConnell Mfg. Co., Newark, N. J., in Klaxon and Klaxonet styles, and the American Electric Co., Chicago, Ill., which makes the Samson.

Exhaust-Operated Types

There are a number of exhaust-operated horns on the market, some of the leading instruments of this type being: Gabriel, made by the Gabriel Horn Mfg. Co., Cleveland, Ohio; Aermore, Fulton Co., Milwaukee, Wis.; Gemco, Gemco Mfg. Co., Milwaukee, Wis.; Autochime, Gray-Hawley Mfg. Co., Detroit, Mich.; Nightingale, Riley-Klotz Mfg. Co., Newark, N. J.; and Barco Chime, Barco Brass & Joint Co., Chicago, Ill., and Princton combination horn and cutout, S. B. R. Specialty Co., East Orange, N. J.

Two Bell Signals

Two of the leading bell type warning signals on the market are the Liberty Bell, made by the Liberty Bell Co., Cleveland, Ohio, and the Trinity Bell, Trinity Bell Electrical Mfg. Co., Chicago, Ill. These signals are rigidly mounted bells having electrically-actuated clappers, and embody other features such as a small red light, which is switched on while the signal is operated, semaphore direction signals, emblems, etc.

Cow Driver Secures Judgment of $150 Against Motorists

Judgment was recently rendered against a motorist for $150 in Alabama. A woman who had been run down and injured while driving a cow and a calf along the highway sued a motorist for her injuries. The court held that as she was giving her entire attention to the animals she was driving, and did not notice the automobile approaching from the rear, she should be given judgment, as travelers on a public highway owe a duty to others traveling on the highway, which duty requires them to so reasonably conduct themselves in the use of the highway that they will not injure other people on the highway.—*Dozier vs. Woods,* 67 *South (Alabama)* 283.

Many Types of Spark Plug

Spark Plugs Have Reached a Stage of Marvelous Reliability, Insulators Are Improved and Life Increased

IT is difficult for a layman to tell the difference between one spark plug and another. For each a special claim is made, some are designed to work particularly well in certain sorts of motor, as instance the long patterns which are made for Ford cars. Others have their chief feature in some device intended to prevent short-circuiting by reason of oil accumulation, but there are two main things the maker of a spark plug strives for. Of these the first is the evolution of means to hold the insulator absolutely tight in the shell so that neither when new nor when old will there be any leak through the packing, and the second is to find an insulator which will withstand the high temperature of the modern type of high-speed engine without injury. There may be added the necessity for sparking points which will not burn away quickly and the desirability for so shaping the insulator that its exposed end shall be as difficult as possible to clog with oil or carbon.

Insulating Materials Improved

Insulating materials such as are now used have taken years to discover, and every year almost, they are improved. Porcelain insulators are no ordinary china factory production, they need to be made of special clays and by special processes. Thousands upon thousands of plug porcelains used to be imported from Europe, prior to July, 1914, and the American market has had to turn around and find home sources of supply. It has done so successfully and to-day the American plugs, better than ever before, are all-American.

High Motor Speeds Make Trouble

Also, increasing motor speeds spell increased average temperature in the cylinder; the plug points and insulator have less time to cool off between each explosion, and this has made the conditions of plug operation more arduous. Better insulators, tighter packing and larger electrodes have been made necessary. All these troubles have been tackled by the manufacturers, have been overcome and done away with, but it has needed much difficult work to bring this about.

It is possible to take the drawings of a motor and to deduce with reasonable accuracy what the performance ought to be. It is not possible to do the same by a spark plug, the differences between one and another are too small on the surface. Inspection does not show how well the packing is done, how impervious to moisture is the porcelain, how high may be the resisting power of the points to burning.

All Plugs Good Value

Plugs may be bought in two ways, on price and on recommendation. It does not always follow that a particular motor will perform any better with expensive plugs than with cheap ones, but a fairly general rule is that really cheap plugs will not give good service in a high-speed engine. In an old motor the expensive plugs may give longer life, but often the cheap ones perform equally as well, and susceptibility to oil has often more to do with design than with material and workmanship in the plug. The high-priced plug is like the high-priced car, it is just as well worth its price as the cheaper type, but the latter is capable of giving excellent satisfaction and of returning an equally full value for the money expended.

Mention has been made of porcelain as an insulator, but this is far from being the only material used, or even the predominant material. In addition there are many mica insulated plugs and many with insulators of natural or artificial stone. The latter might reasonably be classed as a variety of porcelain so, if a division is desired, it might be made by calling porcelain and stone insulated plugs the solid insulator type and so contrasting them with the mica pattern, for mica is obtained in thin sheets and has to be made into insulators by the compression of many small pieces threaded upon a core. The customary method is to punch minute washers from the sheet, to thread them upon the central electrode and clamp the lot together with a nut, a process of heavy compression preceding the final assembly.

Mica and Porcelain Equivalent

It is only possible to generalize in a very broad way, but the most obvious point in favor of mica is that a plug which uses it is less liable to accidental injury, since it cannot very well be chipped or broken by a blow. The stone or porcelain insulator is a little easier to make waterproof and is a simpler manufacturing proposition, once the plant for making the porcelain itself is got in proper shape. There is much argument as to the effect of heat on the two insulating materials and it is worthy of note that racing car drivers are not yet agreed, nor has it ever been settled that either one or the other was always the better for aeroplane motors; and the aeroplane engine provides about as hard a test for plug qualities as can be found.

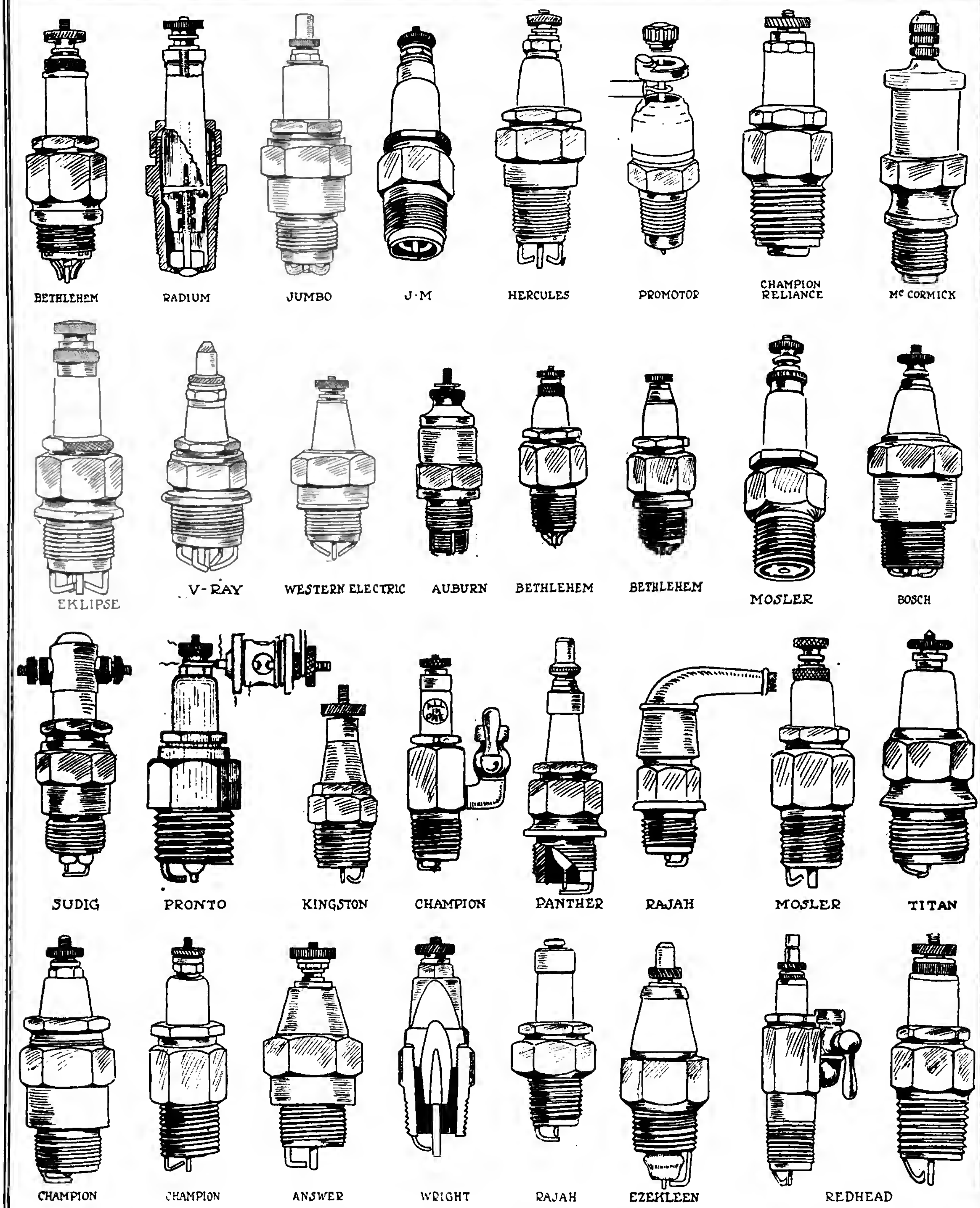
Many Styles of Gap

Another thing which has been productive of much discussion is the relative value of single point electrodes giving but one path for the spark, and multi-point constructions providing two paths or more. There are more single point plugs in use but this does not necessarily prove anything. The single point pattern is easy to clean and is easy to adjust always, and the same applies to many multi-point designs, though not to all. The argument for the multi-point is that when the spark has burned away the two points that are closest together it can go to the next pair and so, by distributing the wear, the time for setting the points will be postponed, but this can be done with single points by increasing their size.

Avoiding Shorts

To prevent shorting it is now an almost universal practice to keep the lower end of the insulator well within the shell of the plug and to give it a wide contact with the shell so that it has opportunity to part with its heat, for the cooler it is kept the slower will carbon deposit upon it. This year it is noticeable that insulators are larger and have a greater area than formerly, this being testimony to the harder conditions under which they are now asked to work.

One of the surprises of the year has been the way in which racing cars managed to overcome plug trouble which, early in the season, was their most serious difficulty. This was done partly by alterations in the motors, but the credit belongs entirely to the spark plug manufacturers, for so speedily tracing the trouble to its source and finding the remedies.



Spark plugs can be divided into two simple classes by grouping those with single point spark gaps and those in which the spark has a choice of route. The sixteen plugs illustrated on the upper half of this page show many different ways of providing more than one spark gap. The sixteen in the lower half of the page are all of the single gap type. Observe the great variation in the shape of the insulator.

Improving the Suspension

There Are Very Many Devices Intended to Assist the Action of the Springs and so Give Greater Comfort in Riding. Wide Variations in Price and Complexity Are to Be Observed

THE term "shock absorber" is commonly used to describe two fundamentally different types of mechanism. The function of a car spring is to give under sudden shocks, and the reason coil springs are not used is that they would give too readily and rebound too vigorously. The leaf spring acts more slowly, because of the friction between the leaves which damps the action, and the true shock absorber is a frictional attachment which, when placed between the frame and axle of a car, will add to the amount of friction inherent in the leaf spring.

Now, a leaf spring with or without a shock absorber has a natural sluggishness which is deliberately sought and is necessary, but this sometimes is not entirely an advantage. Short, sharp shocks are possible which come too quickly and are over too soon for the leaf spring to begin to operate, for such shocks as these we need a greater flexibility.

Supplementary Spring's Purpose

To meet this condition there was created the supplementary spring idea which adds a flexible spring of small amplitude to the end of the leaf spring. Usually a coil spring is employed which, having no lag in action responds instantly to a shock of any size, cares wholly for a small shock and eases the beginning and end of a large shock which is heavy enough to disturb the leaf spring.

There is no reason whatever why a car should not have both shock absorbers and supplementary springs fitted to it, for the functions of each are different, and there have been a few devices designed which combined both principles.

Two Types of Shock Absorbers

Shock absorbers divide into two types also, for some are intended to offer frictional resistance to both the compression and the rebound of the leaf spring, while others are so designed that they move without friction on the compression and only exert restraining force on the rebound.

It cannot be too clearly understood that the use of aids to spring action, whether shock absorbers or supplementary springs, is no reflection upon the original leaf spring. The leaf spring is essentially a compromise affair. Considering its simplicity it is wonderful that it acts as well as it does. Almost any spring is the better for a shock absorber, as it helps it to resist the abnormally large shocks, and it would be wrong to design a leaf spring solely for big blows to the neglect of the little ones.

Similarly, the supplementary spring has its place at the other end of the scale; it cares for shocks too small to affect the leaf spring, so small that a leaf spring could scarcely be designed to absorb them. One might almost regard the effect of the supplementary spring as similar to that of doubling the tire section or of lowering the pressure in the tire.

In the design of shock absorbers the ideal is to provide an easily adjustable amount of friction and frictional surfaces which will be lasting. Also easy attachment is a thing that has had to be studied, and provision made to prevent rattle developing after long use. Each maker has worked out the problem in a different way and all sorts of different ways have been adopted for creating the friction desired. In some instances we see the simple case of two plates or disks gripped together, a sort of diminutive disk clutch. In others the friction of an expanding piston inside a cylinder is used. Others again have a liquid inside which is forced to pass through a small hole.

Different Systems Similar Effects

Each design has its special claims, but there is no reason why they should not all prove equally effective if the mechanical excellence is equal and the proportions are equally well chosen. Design and workmanship count about equally, and there are plenty of shock absorbers having both these qualities highly developed.

Supplementary springs also vary a great deal. We are limited in the range of action that can be allowed by the distance between the frame of the car and the axle, so the travel of a supplementary spring cannot be very great in any case, but having this limitation we can use springs of many types. Some devices are single coil springs, others are duplex, others again use a strong coil spring with a short range and add multiplying levers to increase its amplitude. Some others do not use coil springs of the conventional type, but employ volute springs, or single leaf springs in a flat coil like a clock spring.

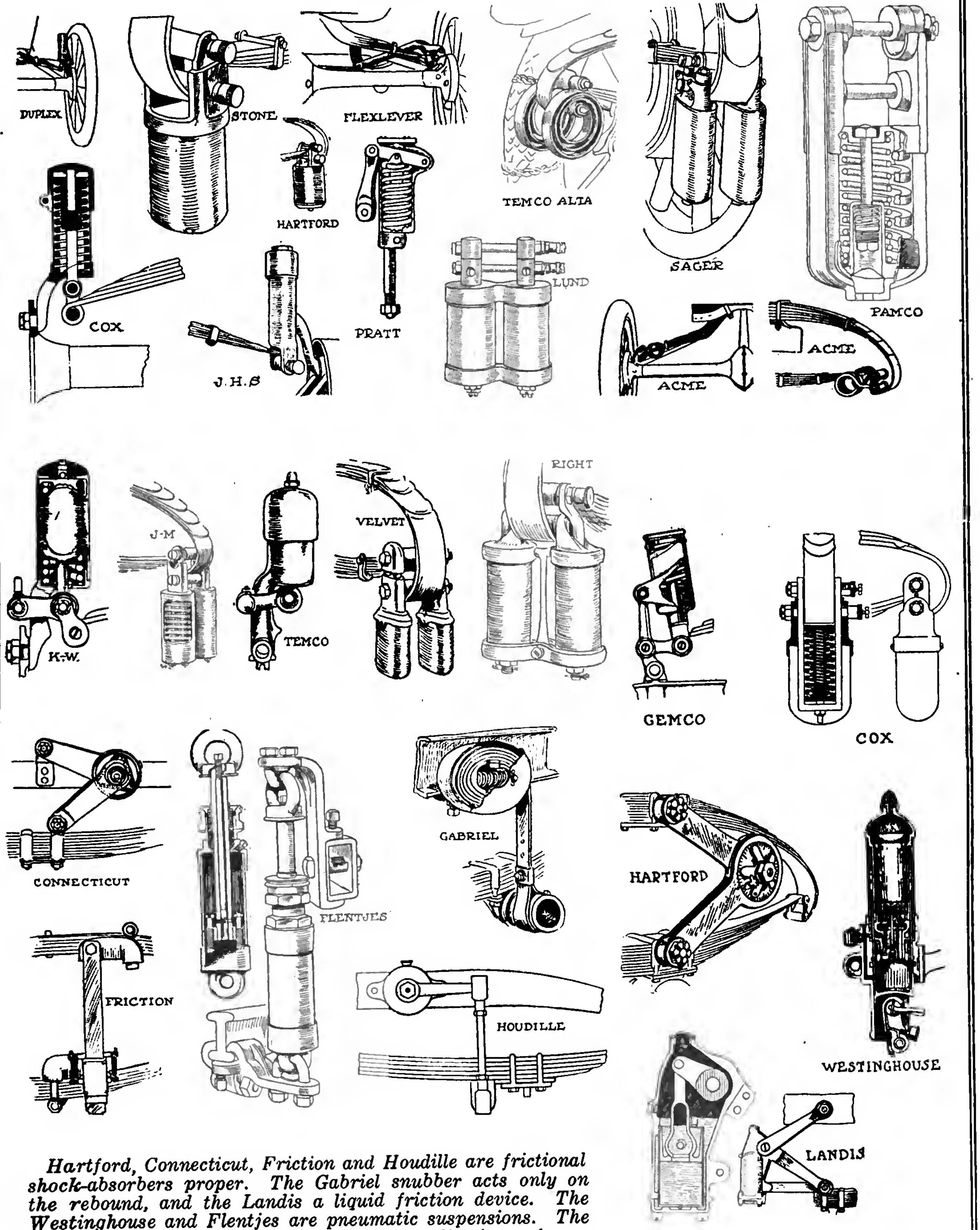
Springs Need Protection

Here again, just as with the frictional spring dampers, the variations in design represent different ways of working out an engineering problem. First, the spring must be properly proportioned to the work it has to do, to the weight of the car and the amplitude of travel. Then any slides or pivots used must be protected against dirt and grit which would cause wear and perhaps squeaking. Lubrication is a little problem by itself, and many ingenious schemes have been evolved to care for it with a maximum of effectiveness and minimum of trouble.

Air Springs Separate Class

There remains the air spring which is an attempt to combine the functions of damper and supplementary spring as well. It is possible to design an air spring which will have all the elasticity of compressed air for absorbing small shocks, and will care for shocks also by the bringing into action of an automatic damping device which puts in frictional resistance in proportion as the violence of the shock increases. Such suspensions have been designed entirely to replace leaf springs, but they have the drawback of being rather clumsy and difficult to work in with an automobile chassis of conventional design.

The air spring can be adapted as a supplementary spring simply, and there are sundry devices of this nature, and it can be also made in such a way that when attached to a leaf spring it is supplementary and shock absorbing also. Probably cost has stood mostly in the way of a much wider use of this variety of attachment, and the air spring may yet have a future before it. To use it most effectively means designing the chassis to suit it.



Hartford, Connecticut, Friction and Houdille are frictional shock-absorbers proper. The Gabriel snubber acts only on the rebound, and the Landis a liquid friction device. The Westinghouse and Flentjes are pneumatic suspensions. The remainder illustrate different sorts and applications of supplementary springs.

Fundamentals of Electric Equipment

Functions of Various Parts and Sundry Quesitons of Design Discussed

By Joseph Bijur

(Concluded from page 90)

As to generator size, if a certain output is wanted at a speed of say 1000 r.p.m. and under other circumstances the same output were to be required at a speed of 500 r.p.m., the slower-running generator would have to be substantially twice as large as the faster-running machine. Conversely, the higher the speed at which the generator may run when it must furnish a certain current, the smaller and cheaper the machine can be. Roughly speaking, the bulk and cost of a generator come down in proportion to the rise in speed at which it is considered necessary for the generator to furnish any given output. This speed is usually found to be that which can be counted on in the hands of a typical driver who is occupied in business pursuits during the day and has time to drive the car only in the evening. Under these conditions no daylight charging can be counted on. For all stops during which the generator is idle and the lamps are turned on, full compensation must be provided. For all of the minutes during which the car is run at a speed when the generator output is less than the current consumption, this deficiency must be made up. Therefore, in order to keep the battery from becoming depleted, the average current supply of the generator must at least equal the average consumption; as a matter of fact it must exceed the consumption, because it can be taken roughly that in order to keep a battery full, the input to the battery must be 25 per cent higher than the output from it. In considering this question we not only have to deal with the current consumption during the periods when lights are left burning, but to take into account the current consumption from starting, as well as the "phantom" load of leaving the car standing idle. During such periods there is a loss of charge in the battery which has to be compensated for exactly the same as if current were taken out of it. From these considerations the following reasoning may be taken. A car driven at night can be counted on to average not over 14 m.p.h. Often this average is taken at 12 m.p.h. If the figure that we consider is 14, then we assume that the current generated during the time when the speed exceeds 14 m.p.h. will compensate for the battery drain of standing, starting and battery loss during periods of no car operation. If the lamp load is assumed to be 8 amp., and the generator current is assumed to be 10 amp. at 14 m.p.h., then for this average speed the generator is supplying 2 amp. more than the current consumed, which excess can be used to compensate for the battery losses above referred to.

If the regulation is such that the current does not ever rise above 10 amp., this amount would be insufficient for a lamp load of 8 amp. and a higher current value would be necessary—something like 14 or 16 amp. constant would be nearer right. This current, however, might greatly overcharge the battery on a car usually operated in daylight hours. Assuming that the regulator is such that for speeds above 14 m.p.h. a higher current will be generated, the value of 10 amp. at 14 m.p.h. would probably suffice. In either event, we see that one of the most critical factors in the adequacy of the generator for its work is its capability to deliver a current in excess of the lamp current at the slow average of night driving. In the example just considered it was essential that the generator should deliver 10 amp. at 14 m.p.h., and assuming that the generator and engine are so arranged that on high gear the generator makes 70 revolutions for each mile per hour of car speed, then it was essential that the generator should deliver 10 amp. at a generator speed of 14 times 70, or 980 revolutions. This is substantially the determining factor in the generator size. If it were adequate to have the generator deliver only 6 amp. at 980 revolutions, or if it were satisfactory to have it deliver 10 amp. at 1200 revolutions, such machines could be made smaller than the one first cited.

Cut-In Speed Not Important

From a consideration of the foregoing it will be evident that the speed at which the generator is connected to the battery and begins to deliver some current, is of relatively small importance. This speed is popularly known as the cut-in speed and refers to the point at which generator charge begins. To understand this better, considering the case first cited, and assuming the generator cut-in point to be at 9 m.p.h., the generator current output will be about as follows:

9 miles per hour	0
10 miles per hour	2 amperes
11 miles per hour	4 amperes
12 miles per hour	6 amperes
13 miles per hour	8 amperes
14 miles per hour	10 amperes

When driving at 13 m.p.h., the generator output only equals the lamp load and no surplus remains to take care of the other battery losses. At speeds below this, the generator output is deficient by greater and greater amounts. It can now be seen that whether this cut-in takes place at 10 m.p.h. or at 4 m.p.h., no assurance can be derived from it that the generator supply will be equal to the demand. It is only the speed at which the generator supply exceeds the load by the desired amount, that is the determining factor in considering whether or not the generator will keep the battery full.

In connection with low cut-in speed, at the point of cut-in, armature reaction has not yet come into play, since the armature only begins to deliver current from here on, and the current is zero or nearly zero. The cut-in point is often determined as the speed at which the generator gives a voltage equal to that of a fully charged battery, or about 7 volts. At this point the resistance of the armature does not come into play, because no current is being carried, and therefore no resistance drop takes place. We can then in a generator get a low cut-in point by disregarding armature reaction and armature resistance and simply wind the generator armature with many turns of fine wire. Such an armature generates the requisite of 7 volts at a low speed and furnishes the low cut-in which has often been desired. The high resistance and high reaction of such an armature operate against its promptly delivering more current with slight increase in speed, since as soon as the current becomes nearly equal to the lamp load, a large armature loss from these two factors results, and the machine, which has been built particularly to give a low cut-in point has to have its speed raised inordinately in order to furnish the critical current at the minimum speed.

Factors that affect the minimum size of generator are the permissible heating and the permissible sparking at the brushes. The heating is proportional to the resistance and to the square of the current. Therefore, for larger currents we have to wind armatures with larger wire and if the number of turns is still the same as it is if the speed remains the same, then armatures that provide room for this larger wire, and consequently the whole machine, must be larger. As to the sparking at the brushes, this may be a determinating factor, but usually is not when the design of the machine is along the lines of low armature reaction without reference to early cut-in speed.

Passing now to the subject of starting motors, we utilize the tendency of a conductor lying in a magnetic field to move at right angles to its length when it is traversed by electric current. This force is proportional to the strength of the magnetic flux and to the value of the current. The characteristics required of starting motors are well met by making them series motors in which the entire current passes around and magnetizes the field before entering the armature. In such motors, if the iron did not become saturated with magnetic lines, the pull would increase proportionally to the magnetizing current and therefore to the flux, while the pull due to increased current in the conductor would increase due to this current alone, so that the resultant of increase both in flux and in current would produce a pull increasing as the square of the current. However, we have to deal with iron in which the magnetic flux does not increase proportionally to the current, on account of the iron becoming saturated, so that the pull of starting motors varies more nearly in direct proportion to the current over a large part of their useful range.

Starting Motors

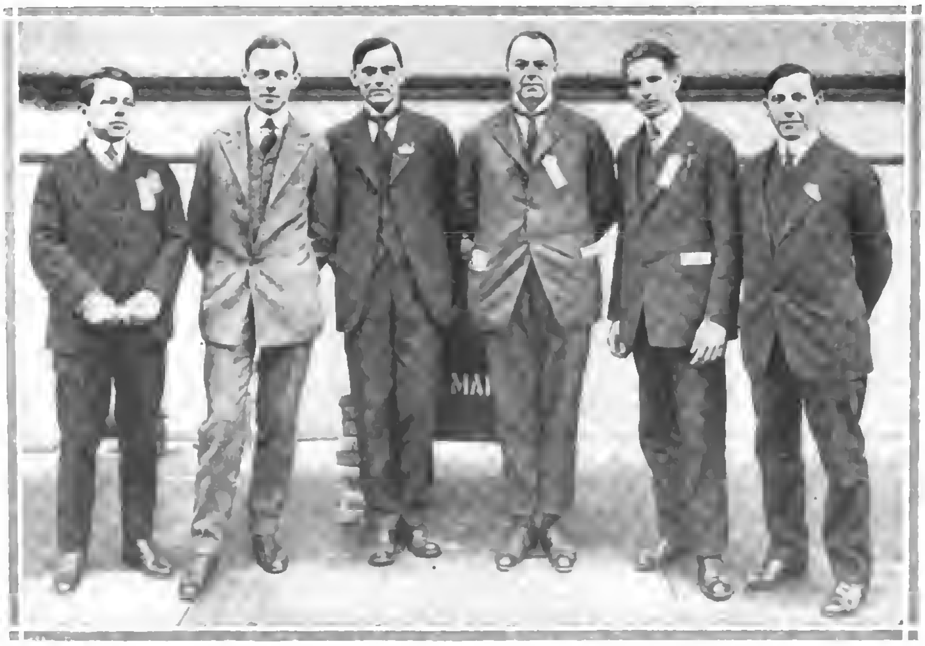
In general, for any given amount of horsepower required, the size of a motor diminishes as the permissible speed goes up, but at the same time many losses arise with speed, such for example as the loss due to friction of the brushes on the commutator, and the loss from the reversal of magnetism or hysteresis in the armature, and other losses due to stray or eddy currents in the armature conductors and in the faces of the magnetic poles. Where the work is large, it is often desirable to take advantage of the possibility of high speed by using a motor which, instead of acting on the flywheel direct, is geared-up so that the ratio between motor and engine shaft approximates 30 to 1, or even higher. However, where the engine is small and the work to be done less, the cost and extra parts of gearing are not warranted in view of the smaller and smaller saving to be made in the motor as its size goes down, and in view of relatively large losses in gearing and bearings, so that it has come about that geared-up motors are used to crank the larger engines, whereas for small engines, or for those for which less cranking ability is required, direct-acting motors are employed working with ratios in the neighborhood of 10 or 12 to 1. For such motors, it is desirable to have the ratio as high as possible in order to utilize the benefit of higher motor speed and so diminish motor size and cost, for which reason it is better to be able to use a ratio of 12 to 1 than one of 9 to 1; a motor employing the higher ratio would be about three-quarters as large as a motor employing the lower ratio.

The power required to crank an engine depends greatly on the temperature since as the temperature falls, the viscosity of the oil increases, offering much greater resistance to turning. Under the conditions that prevail at present, the prime requirements seem to be that the motor should be able to break the engine loose at whatever temperature is fixed upon as being reasonably low and that at this temperature it should be able to crank the engine fast enough to make ignition readily take place. Experience has shown that starting is not obtained as easily when the engine is turning over only say 12 r.p.m. as when it is being cranked at 60 r.p.m. This is for a variety of reasons, including the difficulty of drawing in the proper mixture at very low speeds and the excessive dissipation of the heat of compression at low speeds. Therefore the starting motor has to be proportioned with these conditions in mind.

If it is feasible to ascertain the torque on the crankshaft required to break the the engine loose, and if the torque required to keep it turning at a given temperature is also known, and if the ratio between motor and crankshaft is fixed, the adequacy of a motor can be determined. In fact, the relative performance of motors can be considered best by assuming that the torque required is the same and considering the other conditions which prevail at various values of torque. In most cases the torque is fixed by the engine and the possible gear ratio, and it is frequently known exactly or from comparison with other engines; in which case, if the motors can be compared on the basis of torque, the performance of motors in connection with the engine can be closely predicted, and the relative qualities of motors more easily determined.

Characteristics of Starting Motor

A convenient chart for comparing motor action is shown in Fig. 1, which has the results from a certain motor plotted on it. On this chart the abscissae are the values of torque in pounds-feet and the ordinates the revolutions per minute of the electric motor. On the same chart other ordinates are laid out. The column on the left immediately next to the column of speed relates to brake-horsepower. The next column relates to volts measured at the motor terminals. The next column refers to the electrical efficiency of the motor when converting electrical into mechanical power. The right-hand column relates to amperes. To further explain this chart, the speed of this particular motor when it had a pull or torque of 2 lb.-ft. was 1600 revolutions and with double the torque, or 4 lb.-ft., the speed dropped to 1140 revolutions. At 6 lb.-ft., the speed was 910 revolutions and at 16 lb.-ft., dropped to 260.



Section Secretaries of S. A. E. From Left—W. H. Conant, Detroit—B. B. Bachman, Pennsylvania—R. C. Combs, Indiana—Coker F. Clarkson, General Manager S. A. E.—J. E. Schipper, Metropolitan—D. S. Hatch, Mid-West

The value of the volts at the motor terminals and the other data corresponding to these torques are shown by the remaining curves. Thus, for the torque of 8 lb.-ft., where the speed is 740 revolutions, the amperes, by referring to the proper column, are 280, the horsepower is 1.13, the efficiency 57 per cent and the volts at the motor terminals when this torque reading was obtained, were 5.15. In connection with this latter, it has been found useful to approximate in these tests the voltage at the motor terminals which prevails on automobiles under service conditions. There will, of course, be some difference according to conditions of tests, but a comparison between motors can be made if these conditions are assumed at approximately sensible values.

The motors are tested with the voltage at the terminals regulated to lower and lower values as the current rises. The following table will serve to indicate the voltage that can often be expected at the motor with various values of current flowing into it. The reason for the increasing drop with rising current has been referred to in considering the storage battery, and to the battery drop there must be added the increasing voltage loss in the leads and connections between battery and motor.

Amperes Into Motor	Volts Assumed to be Maintained at Motor Terminals
30–40	6
100	5.7
150	5.6
200	5.4
300	5.1
400	4.8
500	4.4
600	4.0
700	3.5

Similarly, the performance of another direct-acting motor of smaller size is shown in Fig. 2. Considering the larger motor, as shown in Fig. 1, the highest torque obtainable is 21.8 lb.-ft. with 630 amp., which flow as a result of 3.6 volts across the motor terminals. In other words, the locked torque is 21.8 lb.-ft. Assuming a gear ratio of 12 to 1, this corresponds to a torque of 262 lb.-ft. on the crankshaft to break it loose. If we assume that around 60 revolutions is the lowest point at which starting will take place readily, then on the curve we look for about 720 revolutions of motor speed and find that the motor speed drops to 740 when the torque rises to 8 lb.-ft. In other words, this motor will develop 96 lb.-ft. at the crankshaft before the engine revolutions drop below 62.

Cranking Torque and Speed

The torque needed to crank in cold weather may often be taken as about three times the torque required under ordinary conditions (around 70 deg. Fahr.), and if it is desired to provide for extreme cold, an assumption that the torque will be four times as great is usually not far from correct. Making this latter assumption, if the torque for the slower cranking was 8 lb.-ft., then the normal torque would be 2 lb.-ft., corresponding to a motor speed of 1610, or with a ratio of 12 to 1, about 134 crankshaft revolutions.

Putting the matter in a different order, we find that this motor when geared 12 to 1 would perform about as follows: Applying 24 lb.-ft. on the crankshaft it will spin the engine at the rate of 134 revolutions with a current of 108 amp., if the volts across the motor terminals are 5.7. At four times this torque, developing 96 lb.-ft. on the crankshaft, it will crank the engine 61½ revolutions, taking 280 amp., if the volts at the motor are 5.15; and before it can be stalled, it will apply 262 lb.-ft. on the crankshaft to break loose a cold engine.

Torque and Current

To grasp readily the difference between a large and a small motor, or rather to see readily what sacrifices are made as the motor is made smaller and cheaper, we will assume that the smaller motor is applied instead of the larger one, all other things being left the same. The gear ratio, which we would like to have increased above 12 to 1, cannot be increased by merely making the motor smaller, since the gear ratio is usually dependent on the size of the flywheel gear compared to the motor pinion and is not affected by the motor size. Examining the curves of the small motor (Fig. 2) and taking the same values of torque, we find that it will develop 24 lb.-ft. on the crankshaft with a cranking speed of 1880 ÷ 12 = 157, using 160 amp., if a voltage of 5.6 is maintained at the motor terminals. For a crankshaft torque over 96 lb.-ft. it is entirely inadequate, and assuming the curve of revolutions to be prolonged, it would crank with a speed of about 324 ÷ 12 = 27 engine revolutions, with a current of 435 amp., if 4.6 volts were maintained at the motor terminals. Before the engine stalls, it will develop on the crankshaft 11.6 × 12, or about 140 lb.-ft. to break the engine loose.

We see from this comparison that the little motor would actually crank the free-running engine in a moderate temperature, when the torque was 24 lb.-ft., faster than the large motor, but this is now shown to be no indication whatsoever of what the cranking will be in cooler weather. In order to do the cranking under easy conditions, the small motor uses considerably more current than the large motor. The small motor performance falls away down as the load rises; the motor is incapable of exerting anywhere near the breaking loose effort afforded by the larger motor.

A further comparison between large and small motors can be made as in Fig. 3, where I have superimposed the curves showing revolutions, amperes and horsepower, but omitted the curves of efficiency and voltage to avoid confusion. On Fig. 3 the curve for the large motor is shown in full lines and the curve for the small motor in dotted lines. One of the first things we notice is that for all torques the current used by the small motor is greater than the current used by the large motor. Another point is that the locked or stalled torque of the large motor is about twice that of the small motor. Looking at the horsepower curve we see that the small motor exerts its greatest horsepower when its torque is about 5 lb.-ft.; whereas the large motor exerts the maximum horsepower at nearly twice this torque, or 10 lb.-ft. As far as speed is concerned, cranking by the small motor is faster than that by the large motor when the torque is less than 4½ lb.-ft., or 54 lb.-ft. on the crankshaft, but for torque beyond this, the large motor is far superior, and if the critical speed of cranking is taken at 50 revolutions, which is a commonly used value, the small motor will sustain this speed so long as the cranking effort does not exceed 6½ × 12, or 78 lb.-ft.; whereas the larger motor will crank faster than 50 r.p.m. until the cranking effort has risen to 10 × 12, or 120 lb.-ft.

In connection with these curves, it may be noted that in most cases, until the size of the motor is forced down to the smallest possible, the locked torque is usually not the limiting factor, if the condition for cranking a cold motor at adequate speed has been met; that is to say, any motor which will crank fast enough with a reasonable current consumption under cold weather conditions, usually has sufficient locked torque to break the gas engine loose. Of course this is only a generalization and does not always apply. In practice, it has been the speed of cranking in cold weather that has limited the size of the motor in most cases, rather than the ability to break loose.

Determining Motor Size

With curves plotted in this manner, it is a comparatively short undertaking to determine the smallest motor that will meet any conditions laid down, as a cranking test can be made on the engine with any motor, although preferably with one about the size likely to be used. From this test the cranking torque of the gas engine is determined and the probable cold weather torque anticipated, and from these data a motor of the minimum size can be selected or designed with tolerable accuracy.

Single-Unit and Two-Unit Systems

If the operation of the two-unit system is clear, the functioning of a single-unit system will be understood more easily. I am referring now only to the simplest of the single-unit systems, in which we have a motor-generator directly connected to the crankshaft with a ratio of about 3 to 1, usually through a silent chain. Not only is the motor-generator driven at about twice the speed at which an ordinary generator would be used, but it is a large machine whose armature has larger inertia and whose drive is subjected to considerable strains in cranking which do not occur when the drive is to a generator alone. The reason for the high ratio is that a machine of this kind needs, as a motor, as high a ratio as it is feasible to obtain. We have already seen in the consideration of the two-unit systems that the generator is suitably driven from many engines when its speed is 1½ times crankshaft speed, whereas the motor is well geared when its ratio is about 12 to 1. It is, therefore, obvious that in the motor-generator we tend to gear it higher than the generator, which accounts for the fact that it should run at about three times crankshaft speed.

It is characteristic of single-unit systems that for cranking they usually develop a lower locked torque on the crankshaft as compared with the same weight of apparatus arranged in the two-unit system. For equal weights, the single-unit system while somewhat deficient in the locked torque, is also somewhat lacking in ability to crank a cold motor around 60 revolutions, but the difference between the single-unit and two-unit systems is not as great as generally supposed.

It is characteristic of the single-unit system, operating with constant engine ratio and with only one armature winding, that it is most efficiently operated at 12 volts; whereas the two-unit system is perfectly satisfactory at 6 volts. A large part of this difference is due to the characteristics of the brushes required for good operation as a generator, which must also serve as motor brushes when the machine is cranking; whereas with the two-unit system the motor can be designed without any reference to the generator, and thus adequate provision made to keep the losses small on a 6-volt system.

In discussing Mr. Bijur's paper several of the members commented on the fact that the voltage regulation should be sufficient. It was pointed out that a lighting concern would be put out of business by the public service commission if a variation in voltage amounted to 5 per cent. Good results, it was said, cannot be expected without constant voltage. It is a difficult matter to exactly regulate voltage, but this regulation should be attained if possible.

H. W. Slawson asked what would happen to the battery due to a continuous overcharge. To this L. B. Brown replied that while he could not give any exact information he thought that it would be possible to get it from the Delco men who had abandoned the ampere hour meter and could probably tell why. Mr. Kettering of the Delco company said that while the ampere hour meter was good in its way and did the work he knew of one instance in which the engineer had cut off its hands. He further stated that if it were not for the different kinds of drivers the entire work of design would be easy.

A. D. Libby made a plea for smaller units. During the past year the electrical equipment on our cars has been becoming larger. Mr. Libby said that he had made some tests in which he had reduced the lamp load from 7 amp. to 3 and secured twice as much illumination. The loads can be reduced, he said, and therefore the cost merely by efficient design, proper focusing, etc.

Safety Control for Electric Vehicles

SAFETY is sometimes better secured by engineering than by legislation. By a simple change in the control mechanism of all its electric trucks, the department of welfare and safety of the Eastman Kodak Co., Rochester, N. Y., has effected an infallible safeguard against the cause of many serious accidents.

The illustrations show one of the devices mounted in a box similar to a driver's seat in the rough. The driver sits at the left side of the box, operating the control lever with his left hand. The rheostat selector shaft, to which the controller lever is attached, also carries a sector which prevents the operator from engaging the switch except when the selector is at the neutral point. A lever has been attached to the main switch from which the handle has been removed and this lever has a pawl while there is a slot in the sector through which the pawl on the lever actuating the switch must pass in order to close the switch. The sector is so located that when the switch is closed, the rheostat selectors are all at the neutral point. As the pawl is held forward by a pressure spring, the switch lever can disengage the switch at any position of the selector.

Starting with the controller lever at neutral and the switch open, as in Fig. 1, the switch may be closed, as in Fig. 2, the pawl slipping through the slot in the sector, and passing clear through so that the controller may be moved to any desired notch. If the switch be opened, say in one of the reverse notches, as in Fig. 3, it cannot again be closed until the controller lever has been moved to neutral position.

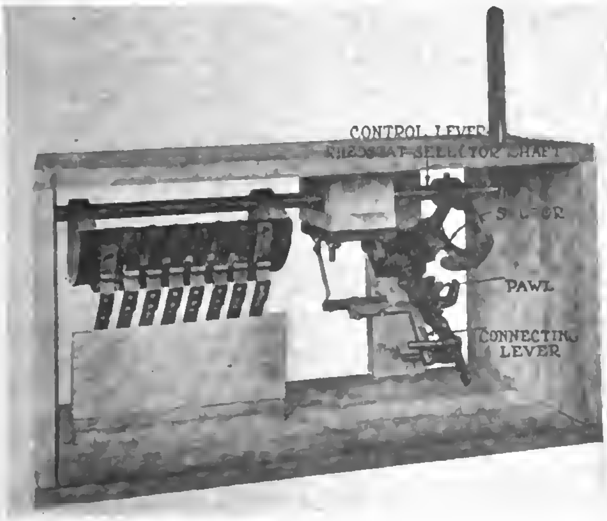


Fig. 1

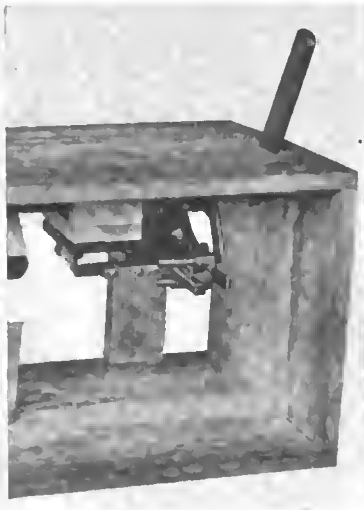


Fig. 2

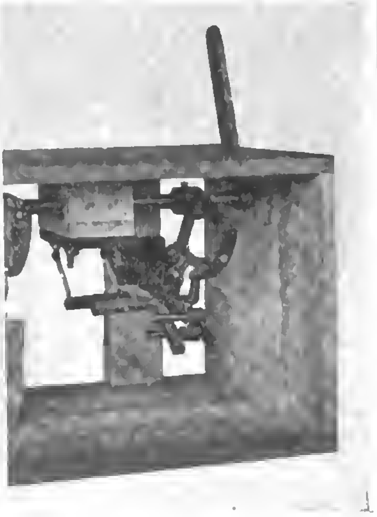


Fig. 3

The Rostrum

Fitting Flanders Camshaft Bearings

Editor THE AUTOMOBILE:—The following questions are relative to a Flanders 20 model 1912, motor 3⅝ by 3¾, L-head centrifugal water pump.

1—Can aluminum alloy pistons be used to advantage on this car? If so, what clearance should they have?

2—Would you advise using the hour-glass type or the wiper-ring type as used on the King? This car uses four rings, one of which is a wiper, the oil system being the vacuum splash. Would you use the same number of rings as on the cast iron piston?

3—Will the additional clearance for alloy pistons cause much oil pumping, at low speeds, without a wiper ring?

4—Can a slightly scored cylinder be repaired without being rebored?

5—I want to fit new camshaft bearings, middle and rear end. I have an old camshaft and would like to know if it would be practical to lathe off say 0.002 in. of these bearings of the old shaft and cast bearings from Fahrig metal right into place. Of course the middle bearing would have to be cast split so that it could be removed, scraped and replaced with the new shaft.

Stephens City, Va. E. E. C.

—It is doubtful if the introduction of aluminum alloy pistons to a model as old as this would be justified. There are so many other features of design which govern the speed of a motor that the use of aluminum pistons in a motor of 1912 would not have any appreciable effect.

2—This is answered under question 1.

3—While the initial clearance of alloy pistons is greater than that with cast iron the greater expansion of the aluminum soon compensates for this. The number of rings would be about the same as on the cast iron type.

4—A slightly scored cylinder can be remedied by lapping or grinding.

5—New bearings can be cast in place, but this is a job which requires skill and practice.

Racing Records Held by Oldfield

Editor THE AUTOMOBILE:—Kindly give me the records held by Barney Oldfield and officially allowed by the contest board of the American Automobile Association.

Yonkers, N. Y. C. W. L.

—The following tabulation gives the records held by Barney Oldfield to date:

Speedway Records Regardless of Class

20 miles	—13:58.14	Oldfield	Stutz	Indianapolis, May 30-14
25 miles	—17:30.40	Oldfield	Stutz	Indianapolis, May 30-14
5 miles	— 4:01.36	Oldfield	Knox	Indianapolis, May 30-10
5 miles	— 3:38.61	Oldfield	Knox	Los Angeles, Apr. 16-10
10 miles	— 7:20.66	Oldfield	Knox	Los Angeles, Apr. 16-10
1 mile	— 40.53	Oldfield	Benz	Daytona, March 16-10

Firing Orders of Typical Twelves

Editor THE AUTOMOBILE:—Please publish the firing order of a few of the standard twelve-cylinder motors.

Richmond, Ind. R. N. L.

—The firing order of the Packard twin six is 1R-6L-4R-3L-2R-5L-6R-1L-3R-4L-5R-2L. The letters R and L refer to right and left cylinder block, respectively.

The firing order of the National twelve is 1R-6L-5R-2L-3R-4L-6R-1L-2R-5L-4R-3L.

The firing order on the Enger is 1R-1L-5R-5L-3R-3L-6R-6L-2R-2L-4R-4L.

For your further information the firing diagram of the Pathfinder twin six is given in Fig. 1.

Finding Corresponding Gear Teeth

Editor THE AUTOMOBILE:—Kindly give me the formula for figuring the number of revolutions a gear must be turned to bring corresponding tooth marks together on timing gears set with odd teeth.

2—What causes end play in a crankshaft to develop?

3—What cause can be attributed to the Remy magneto used on Buicks in 1910 and 1912 making the engine fire on only two cylinders? Is it advisable to grind the worn cam down?

Watsonville, Cal. A. W. A.

—The method of figuring the number of revolutions a gear must turn to bring corresponding tooth marks together on timing gears set with odd teeth is simply to calculate the least common multiple of the numbers of teeth on each wheel. For instance, if one wheel has sixteen teeth and the other has ten teeth the least common multiple would be 80. Then for every eight revolutions of the ten-tooth wheel or five revolutions of the sixteen-tooth wheel the same teeth would come into mesh.

2—End play in the crankshaft is very often due to thrust by the clutch springs. It may also be due to the mis-alignment of the pistons and connecting-rods.

3—It very often happens that a cam will wear in one point only and it is quite evident that you have a case of this kind. Since the shape of the cam determined the synchronism of the magneto and since special machinery is necessary to get the proper face angles on the cam, the cam itself should be replaced with one of the standard Remy cams.

Determining Area of Poppet Valves

Editor THE AUTOMOBILE:—How is the valve area determined in a poppet valve, having the two diameters given; also, the lift.

2—What is the co-efficient of friction used in designing a poppet valve?

3—Of a Knight type valve?

4—How is the inertia of the reciprocating parts of a motor calculated?

5—How is the velocity of the gas in the intake and exhaust pipes determined?

6—Why should counterweights on crankshafts be placed in the same planes that the crank throw is in?

7—What is the critical speed of crankshafts? How is it determined?

8—What is a harmonic vibration?

Frankfort, Ind. T. S. W.

—By valve area it is presumed you mean the area of actual opening. The area through which the gas passes is the surface of a truncated cone. Referring to Fig. 1, let the sketch represent an ordinary 45 deg. poppet valve. The truncated cone is that bounded by the edges *D A* and *D' A'*. The area of the surface is then the quantity desired as the two diameters you mention are *DD'* and *AA'* and the lift is *DB*.

$AD = BD \cos 45$ deg. or, $AD = .707\ BD$.

The area of the truncated cone will be *AD* multiplied by the mean diameter or $\frac{DD' + AA'}{2}$ times π. The expression for area then becomes by substituting:

$\text{Area} = \pi\ (.707\ DD' \times DB + .353\ DB^2)$

If *h* be the symbol for the valve lift and *d* the symbol for the clear diameter the expression for area for a 45 deg. valve becomes:

$A = \pi\ (.707\ d\,h + .353\ h^2)$

2—The coefficient of friction is only taken into account in an empirical manner.

3—This is also empirical.

4—The inertia is calculated by the ordinary formulae for energy in mechanics.

4—Inertia of any moving part can be calculated by the basic inertia formula for acceleration. In other words, acceleration is the act of overcoming inertia and it is expressed as the change of velocity which takes place in a unit of time. Where *F* is acceleration, *M* the mass of a body, *V* the velocity and *T* the time, *F* is equal to *MV* divided by *T*. However, in designing the motor it is just taken for granted that the inertia of the reciprocating part will be at a minimum when the weights are at a minimum and hence every effort is made to keep the weights low.

5—The velocity in the manifolds is calculated by dividing the volume of flow by the area of the passage, and the volume is determined by the displacement per unit of time multiplied by a factor which takes into account the volumetric efficiency.

6—This is by no means always the case and depends entirely on the individual system of balance employed.

7—The critical speed of a crankshaft is the point at which vibration due to speed commences. It is determined experimentally.

8—The term harmonic signifies a connection with sound and connected with the word vibration signifies a rate of vibration which is a multiple of the fundamental note. The pitch of the note varies with the period and amplitude of vibration.

Regulation of the Heinze Generator

Editor THE AUTOMOBILE:—Will you give a circuit diagram of the voltage regulator and connections as used in the Heinze generator 1916?

2—Do any other systems other than the Westinghouse, Bosch, Heinze and Bijur use voltage regulators? If so, give names and are they of the vibrating contact type?

3—Are the Leece-Neville and Wagner 1916 systems using third brush regulation? Has Bosch done away with using the pole pieces to draw in the armature and now using a piece of iron on the armature and a separate coil for this operation and do the Bosch still short the armature on the meshing contact of the starting switch?

4—Why is the positive shunt lead carried all the way to the battery instead of grounded on the Bijur system on 1915 Scripps-Booth?

Newark, N. J. R. J.

—The circuit diagram of the voltage regulator and connections in the Heinze 1916 generator is shown in Fig. 1. Wire *A* connects to the generator field, the other end of the generator field being grounded to the frame of the generator. The negative brush is also grounded, this being a single wire system.

Wire *B* connects to the ground, this being the outer end of the potential winding, the inner end of this same winding connects to the regulator cut-out magnet frame, which is insulated from the grounded frame of the generator.

Wire *D* is the outer end of the current winding and connects to the positive lead of the storage battery, the inner end of this winding connects to the contact shown on the cutout side.

Wire *C* from the regulator cutout magnet frame connects through the generator switch to the positive brush of the generator. The generator switch is a part of the main switch on the dash, and is so arranged as to break this circuit when the starting button is depressed.

2—All electrical systems on cars have a means of regulating the voltage. In some this method is inherent with the machine due to the type of winding. In others there are exterior means. At any rate every complete system must have voltage regulation.

3—The Leece-Neville system is regulated by the third brush method, and the Wagner also employs the same system. The Bosch company has not done away with the construction in the flywheel starter, that causes the armature to be drawn into the electrical center through the magnetic influence of pole pieces. The Bosch company does not short the armature when the gears come into mesh but through the use of a shunt table the current in the armature is limited and not shorted.

4—The wiring diagram for the Scripps-Booth is shown in Fig. A for all cars numbered from 1 to 1100. Fig. B shows the wiring diagram for cars numbered above 1100.

Referring to Fig. A the shunt field lead is carried to the positive battery terminal instead of being grounded direct, so that removing the storage battery opens the shunt field circuit of the motor generator, which prevents any damage to this machine in case the gas motor is operated without the battery.

The starting switch shown in Fig. B has three positions, On, Off and Idle, and the field circuit of the motor generator is broken through this switch when the switch is moved to the Idle position, which would be the normal operating position when running the car without the storage battery.

Switches on cars from 1 to 1100 inclusive were not provided with the Idle position, hence the necessity of carrying the shunt field lead back to the positive of the storage battery.

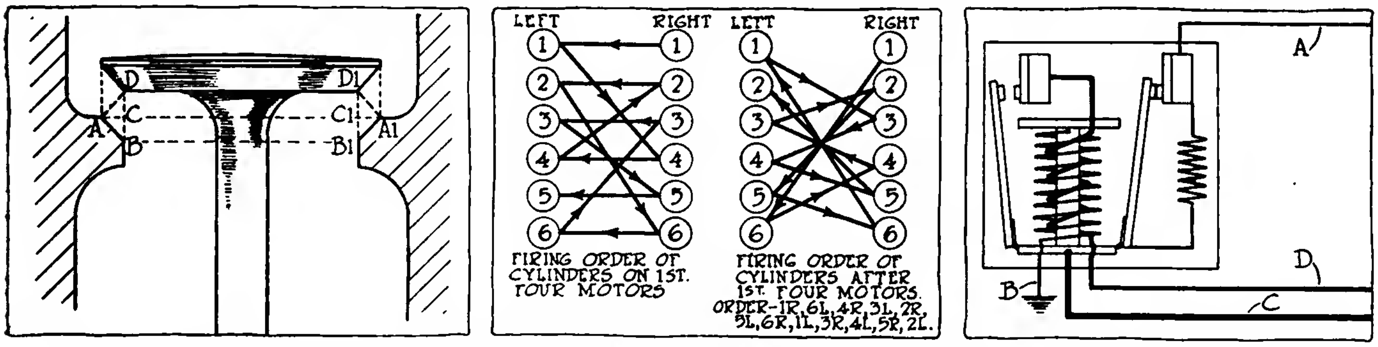


Fig. 1—Left—Diagram referring to method of calculating clear opening of a valve; center, firing order of Pathfinder twelve motors; right, control system used with 1916 Heinze generator

The History of the American Automobile Industry—13

Steam Vehicles in England, 1860 to 1870, Immediately Before the Invention of the Flash Generator in France, which was Responsible for the Great Modern Development in Steam

By David Beecroft

WE now come to the last few years preceding the modern movement for the development of steam vehicles in France, associated with such names as Bollee, Serpollet, and DeDion Bouton, around which clusters the inventions which brought steam into the prominence it obtained in Europe and America until a few years ago. This group was responsible for the flash boiler design which was so extensively used in this country by the White company. Before proceeding with this great development of the flash generator some of the developments in England and Scotland between 1860 and 1870 are of interest as showing the development made in these countries in spite of the handicap of road laws which made operating vehicles on the road practically impossible.

At the exhibition of 1862 were shown automobiles by Yarrow & Hilditch and also by Tangyes of Birmingham. The former had a vertical tubular boiler and a separate engine for each wheel. It would carry thirteen people and weighed 5000 lb. The latter used a very similar engine arrangement. In the same year A. Patterson built a carriage having the boiler and engine both mounted on the front wheels which served for steering and propelling.

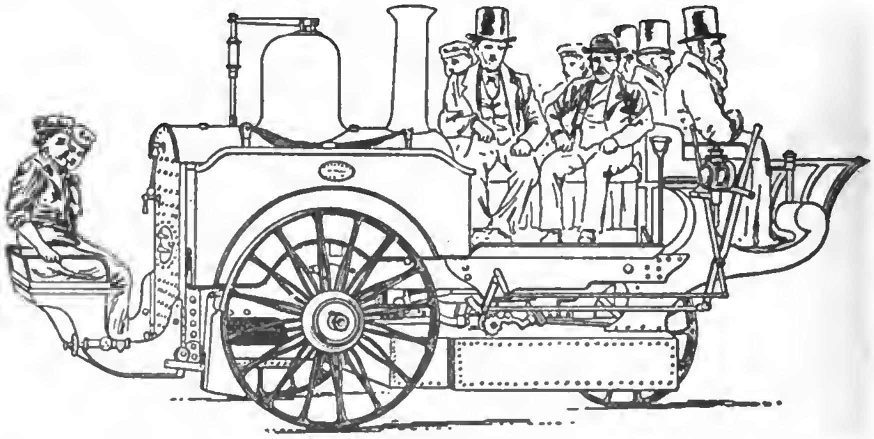
A steam super-heater was used on the wagonette of Catley & Ayres of York, built in 1869, and frequently used, carrying four people. It weighed 1500 lb. empty, and could run 20 m.p.h.

About 1870 several Scotch engineers took up the work and produced vehicles, but the most successful seems to have been the road steamers of R. W. Thompson, the inventor of the air tire some 25 years before. His vehicles were fitted with solid rubber tires as much as 6 in. thick by 12 in. wide, and these splendid road smoothers doubtless had much to do with the satisfaction given by these goods. They were sold in India, America and other places for hauling omnibuses and similar work.

L. J. Todd of Leith, Scotland, built several steam vehicles between 1869 and '72. One of these was a light carriage, having three wheels, and each rear wheel driven by a belt from its engine. Nairn, also of Leith, made a three-cylinder omnibus in 1871, which carried 50 passengers and weighed 10 tons loaded. He seems to have used a rope tire to deaden shocks.

A Scotch Experiment

In 1873 Charles Randolph of Glasgow built a very successful vehicle having the operator's cab at the front, a coach body at the center and mechanism with stoker's compartment at the rear. Its capacity was ten people; its speed about 6 m.p.h., and its weight loaded over 4 tons. He used a vertical coal fed boiler and discharged the exhaust into a silencer from which it passed to the smoke stack and thus no steam could be seen. Elliptic front and coil rear springs were used. Although it worked successfully and the authorities shut their eyes at his violations of the law it proved to be something of a white elephant and after being unable to sell it he turned it over to the South Kensington museum. There were a number of others, but all working along much the same lines and meeting the same obstacles.



One of the interesting steam road vehicles shown at the exhibition of 1862 in England was developed by W. O. Carrett of the firm of Carrett, Marshall & Co., Leeds. This vehicle had an interesting history in that it was run approximately 800 miles at night over the roads of Kent, in order to get some use of the highways in spite of the road laws which prevented the use of motor vehicles on them. It was christened the Fly-by-night and was summoned many times for violations of the locomotives act. It bore a strong resemblance to a fire engine and at night the passengers were dressed as firemen with brass helmets. In this way it was possible to escape much interference, but later it was impossible to use it on the highways and it was finally converted into a slow-moving engine. It was made with three wheels and used a locomotive type boiler adapted to stand 175-lb. pressure per square inch. It incorporated a two-cylinder engine which was geared to the rear axle. The axle had the usual differential gear. The vehicle weighed 12,000 lb.

Light Weight as an Ideal in the Designing of Large Cars

A Sequence of Facts and Reflections on Both Sides of the Question—By M. C. K.

AT one time, about 1901, when European cars were immeasurably superior to American cars in nearly all essentials, the American public and industry were stampeded into a somewhat uncritical adoption of the European type of car but soon took sharp distance from the European methods of producing it. Numerous technical details have come across the water since that day and usually have been found worth studying with a view to modification and adoption in the modified form. The high-speed motor represents the latest large wave of technical reform coming over here with strong European endorsement (practically unanimous up to about 2400 r.p.m. or about 1200 ft. piston speed with a stroke of 6 in.) and it has been accompanied in Europe by a considerable effort for reducing the weight of cars. Arrived to these shores the high-speed motor movement with its accompanying demand for lightness—to help in fuel economy and compensate for the weight of lighting and self-starter equipment—has met great hospitality but has encountered a popular reluctance against the frequency of gear-changes which so far has been found necessary with light motors and which of course is more in evidence the more difficult the road conditions are.

In this situation the various factors are yet to be adjusted to American demands. It is not yet quite settled what the normal speed of motors had better be, whether lightness of cars should be accomplished at all costs, or whether, as a rule, we had better strike a medium in stroke length, piston speed, motor size and car weights. To be again stampeded into a complete imitation of the European development, when it is a fact that the most successful European manufacturers have followed it only in part and with great reserve, and when nearly all the practical conditions in America are different, does not recommend itself as the most sensible proceeding at this advanced stage. One of the factors in question, the light weight of cars, especially invites analysis, because its appeal escapes all criticism in theory and leaves it in doubt only to what extent such lightness may be reconciled with other requirements in practice and to what extent it is likely to be economically valuable in the future. That the lightness should always be as pronounced as all due consideration for other car factors will permit—cost of production, strength, anti-fatigue quality, rigidity where wanted, road ability, durability, efficiency of lubrication, etc.—is so nearly self-evident that lightness may easily become accepted as an ideal for car construction if public opinion accepts it as such without viewing the subject from many other angles than that of the conspicuous and popular advantages. It is the object here to let some of these other related ideas file in review before the reader, to produce, so to say, a perspective and a cross-section of the possibilities for light car construction rather than merely front and plan projections.

Lightness by Reduced Size Came First

For more than ten years past the average car both in Europe and America has been getting heavier, with corresponding increase in tire, oil and gasoline bills. During the same period upkeep expense has gone down, repairs getting much lighter and cheaper with improved construction. But the operating expense—mainly for tires, fuel, oil and garage—became more onerous in the measure as cars were used more and more by the less wealthy. The wages of chauffeurs can here be ignored. The remedy for the economical burden has been sought and found very generally in small cars, in which the weight is escaped through reduction of the size. The much lower first cost pointed the way in this direction unmistakably. In some of these small cars the driving speed was also reduced, but in the most successful case on record, the Ford car, the weight reduction due to small dimensions was very much accentuated by using a new grade of steel throughout, while the driving speed and its indirect cost were practically left at the car owner's discretion. It was low-priced and cheap to run long before methods for its production were developed which increased the profits to the makers, and it is still a good example of lightness due to design as well as to small size. In general the small car, spite of diminished luxury, was found suitable—first here and subsequently in Europe—for many people's daily use of a vehicle. Still, the large car remains a necessity for as many others, and it remains heavy; heavier in 1915 than in 1905—costlier to operate though cheaper to keep in condition for operation. Only a few manufacturers of the larger cars have from the beginning aimed constantly at reducing the operating cost by minimizing the weight, and the very general adoption of alloy steels for parts subject to wear or special stress has had only a feeble tendency to prevent the gradual and apparently unavoidable increase of total weight from becoming excessive.

"Life" Largely a Carbureter Question

Now, under the pressure of the demand for economy and efficiency, the difficult problem of making large cars light is rather suddenly coming to the front. As said, it has come in conjunction with a demand for light, high-speed motors. The need of producing a car which can be accelerated promptly by the throttle alone, although the motor has small cylinder volume, may have had as much to do with the desire for reducing the weight of the whole car as the view to operating economy. It would scarcely do to let small cars with relatively sluggish motors have an advantage in acceleration over their larger and more pretentious sisters, since prompt acceleration or "life" is one of the luxuries on the road which is appreciated as much in a motor as in a horse by the American public. On the other hand, to accept in advance the conclusion that reduction of vehicle weight represents the simplest and best method for getting prompt acceleration for a car equipped with a light motor is not convincingly clever so long as little effort has been made to find out if a similar result could not be attained by simpler means, such as, for example, by an auxiliary carbureter action.

Among the carbureters found most suitable for high motor speed it is hard to think of any that does not necessarily, by its principle of design, make acceleration more gradual than the exacting car driver would like it to be. He is more interested in what the car will do in the first second after the throttle has been opened than in any ability to accelerate from 10 to 40 miles per hour in 16 seconds, which is about the best that can be done with a car of average weight for its power and a carbureter action depending mainly upon an increased volumetric efficiency at the opening of the throttle for gradually producing the higher motor speed with the stronger suction at the nozzles which in turn will speed the fuel feed and the motor progressively. This system of acceleration—falling far short of steam throttle promptness—is too indirect for a heavy car, although it is sufficient for one that is light and strongly powered. It is slightly assisted in practice by opening wide first and moderating a few seconds later, but this can only be done with high-class gasoline, so long as the cooling-system fails to keep motors at a uniform temperature at all speeds. For the moment the possibilities for an improvement at this point which might eliminate the need of weight reduction for the mere purpose of facilitating acceleration may be conceived in the form of an injector attached to the carbureter conduit and operating automatically, for a second or two, with small stores of compressed air and gasoline, whenever the throttle is being opened, the extra injection compensating for the anomaly that, with ordinary carbureter action, the relatively weak suction of the lower motor speed necessarily causes the first explosions after the turning of the throttle valve to be weaker than the subsequent ones. Without pretending to say that the suggested boosting device, or one of equivalent effect, is advisable, one can safely infer from its possibility and from its simplicity in comparison with weight reduction that the popular demand for prompt acceleration does not in itself constitute a compelling reason for undertaking a radical reduction of the total weight of the vehicle, so long as simpler means to the same end are not adopted.

The active reason for undertaking such a weight-reducing campaign must therefore be the economical one of reducing operating expenses. The better acceleration of the lighter car can only be an incidental advantage, and this is perhaps also the usual view. The main facts are admitted; namely, that a desire has become general among American manufacturers for reducing the weight of cars, while holding the size of motors down, and that the economy in tire, fuel and oil expenses gained by such weight reduction has been abundantly proved. THE AUTOMOBILE said editorially in the issue of Dec. 23: "Light weight is the greatest factor in reducing the upkeep and so is of immense importance to the owner." Before long, since ideas travel fast when plainly containing a large element of truth, this view may become accepted as an axiom and may be taken to cover the whole field of constructive varieties of automobiles. And, on the other hand, the majority of engineers and manufacturers will probably not see their way clear to any considerable reduction of the weight of their cars and will be able to present excellent reasons for not allowing construction to be dominated by the consideration of minimum operating cost.

Broader Paths to Economy

At first glance one would be inclined to say that, if the object of light weight is economy, it should be materialized economically and without increase in the first cost of production, but it is of course a simple financial question of capital and interest which is here involved. The saving in upkeep due to light weight may be large enough to justify a higher first cost, and the incidental advantages of quick responsiveness to the throttle, to gear change and to the touch of the pilot's hand on the steering wheel—as well as a probability for less bother with tire troubles—may be sufficient to place the light-weight large car in a class by itself, a class where high price and high merit go together until the light-weight design and construction become standardized, or at least fully established to the satisfaction of the manufacturer and his customers, whereafter the price may become normal while all the special merit remains, unless the rest of the industry meanwhile has learned to produce equal merits by other means. IT IS CONCEIVABLE THAT CARS MAY BE CONSTRUCTED WHICH ARE NECESSARILY HEAVIER THAN THE LIGHT-WEIGHT IDEAL BUT POSSESS ALL ITS ADVANTAGES ON THE ROAD AND IN ECONOMY OF UPKEEP WHILE POSSIBLY BEING ALSO MORE CHEAPLY PRODUCED OR LESS SUBJECT TO FLAWS DUE TO ERRORS IN THE APPLICATION OF THE PRODUCTIVE METHODS. With regard to the last point, all remember, for example, the time when a large percentage of cars from certain factories went wrong through the failure of light component parts which had not been properly heat-treated or were made of unsuitable steel or were too closely designed and succumbed to fatigue or lack of rigidity. Most steel troubles are over—mainly because conservatism and specialization are in command of the metallurgical departments of automobile and parts factories—but light-weight design still requires the tip-top of ability and experience if it shall afford the same guarantees for the avoidance of troubles which have been worked out with standard types of construction through the collective efforts and experience of the industry.

In order to keep very sharply in mind where a complete acceptance of the ideal of light-weight construction for large cars leads to, it is necessary to compare with other means at disposal for accomplishing the same or a similar degree of upkeep economy and "road ability" and to face the fact that such other means may be widely applicable to all sorts of motor vehicles, while nearly all the advantages of light-weight construction of a vehicle disappear if the vehicle is required to carry heavy loads.

Operating Cost and Total Upkeep Expense

A distinction between operating cost and upkeep cost is among the first ideas suggesting themselves when the subject is analyzed. As a rule the term "upkeep cost" is used to cover the whole expense of keeping and using an automobile, once it is paid for. But, while it is proved sufficiently that the light car can be driven more cheaply than the heavy one—so long as the question is of two cars of about equal grade and both weighing more than about 1500 lbs.—and can be kept tire-shod more cheaply, it is not nearly so well proved that it can also in other respects be kept in commission more cheaply, general durability and repairs being in doubt. The actual weight of the average car, being the result of an evolution and a process of survival, in which the pros and cons relating to dimensions, materials and shapes have come up for consideration many a time, argues in the opposite sense. Indeed, the new art of building light cars, in the sizes which so far have been heavy, consists perhaps mainly in applying very close reasoning and experimentation to the finding of new constructive expedients which will permit the weight reduction without endangering durability and increasing the upkeep expense. In other words, the acknowledged risk in undertaking to lighten construction is that the upkeep expense depending upon liability to trouble and repairs may be increased more than the operating expense is reduced. The ideas advanced by Mr. Brush on frame and running-board design, the details of the new Marmon car, the Chandler, the Fergus car, the broader adoption of aluminum alloys, compared, for example, with the means employed for a number of years to make the Franklin cars lighter than other cars of equal size and power, can scarcely fail to convey the belief that it is no easy matter to reduce weight without increasing maintenance expense, unless some of the standard organs of the average automobile are omitted (all the water-cooling organs in the Franklin) and chrome-steel and aluminum are used throughout in closely studied shapes.

While there is no doubt that weights can be reduced SOMEWHAT without great or lasting increase in the cost of production and with economical benefit with regard to the entire upkeep and operating expense, it seems equally certain that RADICAL light-weight construction must for the present remain a difficult specialty, with the economical advantages depending strictly upon the individual engineering ability devoted to it and the production facilities behind it. Radical light-weight construction is new construction and cannot be inaugurated to-day and materialized next summer without exposing both maker and buyer to risks.

Any argument based upon the pounding to which a car is subject on the road (with the severity supposedly in proportion to its weight) applies without fail to the wear and tear and sizes of tires, but loses in force when applied to the mechanical construction, just because tires and springs temper the shocks and usually temper them most effectively in heavy cars. A better point for the light-weight construction relates to the lubrication. If bearing areas are not reduced with the weight, the specific pressures are reduced and the lubricating oil gets a better chance to perform its saving function, being neither squeezed out or heated unduly. That bearing areas should not be reduced in light-weight large cars, to correspond with the normal reduction of pressures, follows from the experience alone that every car, and especially every large car, is liable to be overloaded to its full volume-capacity occasionally.

Light Car Results by Other Means

Assuming, in accordance with the foregoing, that the principal inducement for undertaking radical light-weight construction lies in the economy and responsiveness in the operation of the car to be accomplished by it (while the upkeep economy as a whole must remain in doubt until proved in each case), the manufacturer may contemplate other means for attaining the same advantages, while combining them with the safety of conservative design and with a wider application of the type of chassis produced. If he placed a limousine body on a light-weight chassis, he would not have much left of operating economy and responsiveness based on light weight. He prefers to gain economy also for those cars in his output which are to be heavily equipped. Suppose that he aims to cut down the weight of the open touring car conservatively—say 10 per cent for the chassis and all he possibly can for the body—doing this by improved design and not by paring down dimensions and also reducing the factor of safety. He can then choose a motor of slightly larger cylinder volume than would be needed for a car of still lighter weight, and can from this larger motor get the desired responsiveness of the car, but the fuel and oil consumption will be a little higher. A special study in carbureters, as referred to above (and giving such results as are said to have been accomplished by one of the prominent Detroit companies) will place his car on an equality with the very light construction, so far as responsiveness is concerned. The fuel consumption may or may not be larger, depending upon his degree of success with the carbureter, similarly as light-weight success depends on an unfailing ability to provide against slips in design, materials and workmanship. At worst he has an economical margin against him for fuel, oil and tires, while being even on acceleration and ahead on safety against repair bills and usefulness of his chassis for several kinds of body and load. The margin against him he can make up in any manner that will produce a corresponding saving in operating cost. He can save lubricant on the plan so capably organized in the Fergus car. Outside of the cylinders more oil is ordinarily wasted than is used. By arranging to oil every six months only, the waste is stopped, damage from failing to lubricate is stopped and work is reduced—all items of economical value. He can design his slightly larger motor with a slightly larger cylinder bore than that used for the motor in the radically light-weight car, thereby also gaining connecting-rod and crankshaft bearing area, and his consumption of cylinder oil will then compare favorably with that of the smaller motor pulling the smaller weight. The whole motor economy here involved can of course not be expressed in a few words, but it is quite well established that oil economy is not the forte of the ultra-light motor, and a shade of conservatism is in the matter of this item a source of operating economy. The use of eight-cylinder or twelve-cylinder motors of relatively short stroke and comparatively small specific pressures for a given power may also be worth investigating with a view to fuel, oil and tire economy. Neither is the Knight motor out of question.

Paring Down Over-All Dimensions

Comparisons must of course always have reference to cars of substantially the same size; giving the same degree of comfort for the same maximum number of occupants, the same degree of style. Economy gained by stinting any of these factors and in reality producing a medium-sized car which will serve the same purposes as are served by a large car, only not quite so generously, does not count in these reflections, though it may count for making sales and demonstrations. But if a general reduction of carriage dimensions is actually so managed that the comfort and style features remain unimpaired while the weight is reduced approximately in proportion to the dimensions, and tire economy is correspondingly increased, so as to equal that of the radically light construction, the means that may be adopted to that effect are properly to be seriously considered, as against the option of shouldering the problems of radical light-weight construction. All are not infatuated with large over-all dimensions, and it is proper to cater to variations in taste and to throw economical inducements into the bargain when possible. For example, if the backs of seats can be made thinner by new methods while the seating remains equally luxurious in all respects and ample, and by this means, in conjunction with a short type of motor, the whole frame length may be shortened 8 in., with the load better centered and suspended, the general reduction in weight due to the shortening is entitled to be considered on equal terms with a weight reduction accomplished without reducing the carriage dimensions. Some possibilities of this nature were exhibited at the recent show in New York, and while only time can fully demonstrate their worth they confirm the belief that studies in weight reduction, from a conservative standpoint, can be commenced in the carriage work with smaller risk and greater reward than in the chassis and running-gear—the motor remaining always a separate consideration. The advantage of the V-type for keeping the total weight down, where the luxury of more than four cylinders is wanted, may for cheaper cars even lead back to the four-cylinder upright placed crosswise which never was discarded for final reasons. With piston displacements constantly decreasing and thoroughly automatic production, even the use of two small four-cylinder motors crosswise may not be out of question for load-carrying vehicles, serving for fuel economy if one of them is always held in reserve for hard pulls. These remoter chances give a certain breadth to the question of means for effecting operating economy coupled with responsiveness.

Many Roads to Final Results

The order in which improvements are undertaken is after all the main issue in which there can be any divergence of opinion, since all must aim for final perfection and the case where one concern by one year's work accomplishes everything that can be done for such a comprehensive set of purposes as here in question, has never yet been better than imaginary.

Competing for Tire Economy

Reverting to the main line of thought, which deals solely with existing types of cars, the question now comes up: Having a car in which weights are somewhat but not radically reduced and in which the motor, the carbureter, the bearing areas and the lubricating system have been studied energetically with a view single to equalling the responsiveness and the fuel and oil economy of a still lighter car of comparable size, what can be done to equal or surpass this new competitor in tire economy?

It may be assumed that the ultra-light car itself is built with considerable thought in this direction, though it mainly relies on light weight. It probably has wire wheels, a rather low unsprung weight, a long wheelbase, a fairly well-centered load (without which the long wheelbase is useless for tire economy), springs of up-to-date material and design, with dampers attached.

To get full benefit of light weight it must however be equipped with tires whose fabric is so flexible as to absorb inequalities and thereby reduce the bouncing which the relatively light weight accentuates, and which cannot ordinarily be avoided economically by lower inflation. There is a choice between larger tires (which give increased flexibility) and cord tires (which also admit of lower inflation) for the radically light car, and in either case the question of the tire economy actually accomplished is one yet to be decided by tests. It is also to be viewed in connection with the question of comfort and of liability to tire injury. Just at what point on the scale of vehicle weights tire economy can be made to come unalloyed with drawbacks is not very well known, but on the whole and at equal speeds minimum weights make for economy and maximum actual weights make for comfort. The same degree of more than average ability which can give light-weight cars a comfortable tire action can probably give cars weighing 20 per cent more an economical tire action. Such an ability can aim to surpass all in tire economy with as good a chance of succeeding as the radical light-weight constructor has for surpassing standard construction in lightness without slipping into drawbacks of the kind that appear later or sporadically in a year's output.

Means Not Yet Exploited

Brakes and spring suspension afford a field in which to dig, probably the most promising one. Chains show a clear superiority in tire economy over shaft drive, partly owing to the smaller unsprung weight going with chain drive, but they have practically been ruled out for lack of a really good chain casing and for cluttering the space between wheel and carriage body. Other features have been ousted once, however, and have returned successfully under new conditions, and chains may again become standard for large cars of one price class or another; for example in connection with worm drive to the countershaft and remodeled brakes and springs. The worm would permit dispensing with a gear reduction between the sprockets, and parallel chains would make a chain casing simpler and sightlier, adjustments more satisfactory (as the two sprockets would wear alike). For the present, however, other changes are more in line with the trends in manufacture.

Smooth Gear Changes

In gear ratios there is a fully acknowledged study subject bearing more directly on tire wear than usually suspected, the ideal being that a change of gear shall cause no change in vehicle speed and therefore no sudden changes in wheelrim pull. THE AUTOMOBILE of Sept. 3, 1914, pages 450-452, and Oct. 1, 1914, pages 630-632, had articles on this subject adapted from the German originals by F. Achilles, and other material is available in French, German and English.

Brakes Worst Present Offenders

Brakes retard more rapidly and suddenly than carbureters, gear-changes or clutches can accelerate and must therefore in practice cause more strains and wear of tires than any which may be due to unsuitable gearing. Unlike clutches which have been developed and become gentle, brakes are still harsh when used harshly. In their improvement alone there may be more tire economy than in a 20 per cent weight reduction. Eventually, it would seem, rubber tires should not bear the brunt of any emergency brake service, as they now do. Drags are an alternative so far too rashly rejected. In spring suspensions, which temper the direct knocks and glancing blows that it is the business of tires to receive from all directions, it must of course be the object to establish as wide a range of suitable spring action as variations in speed, load and roads necessitate, and a glance around among the many efforts now being made for the bettering of spring action leaves it beyond serious doubt that the best and final spring suspension system is still at large. When recognized and developed, it may be enlisted in the competition for effecting operating and upkeep economy through special construction. Meanwhile, in the gradual improvement which is going on, there must be room for special efforts to surpass the average results, not only in the vehicle springs but in the cushioning of stresses throughout the car.

Extreme Light-Weight Always a Specialty

The means indicated—comprising better brakes, most suitable gear ratios, improved spring suspension and perhaps a modified chain drive for certain classes of vehicles—should suffice for relieving the search for upkeep economy of strain and excess in any one direction, while having the advantage of being widely applicable to all kinds of vehicles, in contrast to extreme light-weight construction which must be designed afresh for each model.

Means for Reducing the Glare of Lamps

WHEN regulations are contemplated by which the glare of automobile headlights may be reduced, one of the principal considerations is to avoid working a hardship upon the hundreds of thousands of motorists who are already the possessors of a complete lighting equipment. The measures recommended are therefore made as consistent with such normal equipments as possible and may consist only in prescribing that the headlights shall be mounted at such an angle and height that the center of the light cone is not above waist height at a certain distance, say 100 ft., in front of the car.

The subject can also be approached more radically and with a view to regulating the kind of lamps to be placed in the market in the future. Then it becomes important to know what is the cause of glare. A French lamp designer has answered this question in one word: Contrast. He maintains that a spot of strong light causes glare by contrasting so strongly with everything around it that the human eye cannot accommodate itself to both effects at the same time, and that the same amount of light extended to a line illuminates equally well, when correctly managed, while not troubling the optical nerves. He has designed a headlight board, as long as the car is broad, in which are set a dozen incandescent lamps, each with its reflector, and he mounts this board in a pair of pivoted arms by means of which it can be placed in three positions of different height above the ground. As the illumination received by the roadway is greatly increased if the light rays strike it at a large angle, he thus claims to accomplish at the same time a stronger illumination—with shortened shadows—and the elimination of all objectionable glare.

One Coat of Paint Better than Four

EXPERIMENTS conducted for the Royal Society of Art in England have shown that each fresh coat of pain put on top of another on an iron plate increases the amoun of rust which forms on the plate. Four plates painted wit one, two, three and four coats were exposed to steam for on day, the paint was dissolved off and the results mentione were observed. The explanation given is that each subsequent coat tends to dissolve a part of the previous one an renders it more porous. Air and moisture penetrate to th iron by way of the pores.

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Watch-Like Accessories

RIVALING the watch in delicacy and accuracy of manufacture some of the accessories which are now placed on cars as standard equipment are monuments of painstaking care. The improvements which have been made this year in speedometers, horns and other equipment are as important as the improvements in the design of the car itself. The close limits of workmanship accompanied by lowering of prices due to the solution of problems of production have rendered accessories as a whole better although lower in price than ever before.

We have not come to the end of the movement toward better accessories, however, and the tendency toward better materials and finer workmanship must be carried on in answer to the demands of the general public for the best there is to be had in equipment. It is true to such a large extent that the equipment sells the car, that the manufacturer of automobiles cannot afford to neglect the quality of what he puts on his car. The consequence of this is that the manufacturer of an accessory, if he wishes to bid for a contract for standard equipment on a stock car, must show something beyond mere low price before his product will be considered.

In speedometers, for instance, the public has grown accustomed to the use of the road route book. In following these it is necessary to have the mile-
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bile body of 1916 is much better on the average than it has ever been before, it is not to be assumed that finality has by any means been reached.

There are still only a few bodies which are perfectly comfortable. There are equally few that are quite as light and strong as they might be, and it is easy to criticize the appearance of many others. Interest in body designing and in body engineering is quite recent; it is only within a few years that the subject has received the attention it deserves, so it is reasonable to expect extended development during the next several years. The progress made since January, 1914, is remarkable, and if the pace is maintained another couple of years may easily see something like a final type evolved.

The Chicago Show

IT seems likely that this year the Chicago show will differ less than usual from the show just concluded at New York, so far as concerns the exhibits. In 1915 the manufacturers announced their new models early, and we have had nothing to correspond to the rush of eights which occurred in January of last year.

At the 1915 Chicago show were a good many new cars which could not be got ready in time for New York and were sprung as surprises, though anticipated by the inner circle. This year there are scarcely any forethoughts of this nature.

berg, the axles Sailsbury, the transmission Covert, the steering gear Ross, the ignition system Bosch, and the tires Firestone pneumatic, 33 by 4½. The radiator is of the cast tank type, vertical tubes. The springs are semi-elliptic, 36 by 2¼ in front and 56 by 3 in. rear.

The truck was designed by an English engineer, W. L. Bodman. Those interested in this new company are: J. A. Moritz and L. F. Mullin, members of the firm of Moritz-Mullin Co., distributor of the Signal trucks, and J. E. Hannon.

Equipment for Fords

The Detroit Auto Products Co. shows its roadster de luxe body and equipment for the Ford for the first time. This complete equipment consists, in addition to the special body, of a one man top with boot and side curtains, ventilating windshield, radiator, hood, crown fenders, lamp bracket extensions, tire holder brackets, splash plates, dust shields, foot accelerator, starting crank and running board hangers. A Ford roadster thus equipped weighs 1540 lb. The standard color is Brewster green. The body is 45 in. wide at the seat, back of dash to front of cushion, 30 in.; cushion, 18 in. deep, 10 in. high at front and 7 in. high at back. The price of this equipment is $197.50 f.o.b. Detroit. A closed top to convert the roadster into a coupé will also be brought out by the company.

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Fritchle Preparing Gas-Electric Model

DENVER, COL., Jan. 15—The Fritchle Automobile & Battery Co., this city, is bringing out a gas-electric car to be operated the same as its electric model with one electric unit and a four-cylinder air-cooled motor. There will be no change gear mechanism or a clutch, the electric battery power being consumed only on low speeds and heavy pulls through mud and up hill, the engine cutting in automatically. The battery is charged automatically at speeds between 12 and 20 m.p.h. Higher speeds are obtained by using both the engine and battery at the same time.

General Rise in Tire Prices

NEW YORK CITY, Jan. 19—Republic tire prices went up 5 to 10 per cent today, thus supplementing the general rise which was started Monday when the United States Tire Co. advanced its prices 10 per cent on all grades of its tires. Yesterday, Goodrich, Goodyear, and Firestone announced increases. Goodrich tires are now selling 10 per cent higher on the usual sizes of both cord and fabric types, no changes as yet having been made on the unusual or less popular sizes. Goodyear also increased its prices 10 per cent on both its cord and fabric types; and Firestone announces a 10 per cent increase. Goodrich has raised its prices on the 28 by 3-in. tires from $8.50 to $9.35; on the 34 by 4 from $19.40 to $21.34; and on the 36 by 4, from $20.50 to $22.55. The Goodyear 32 by 3½-in. size is now selling at $14.70 as against the former price of $13.35; the 34 by 4 is now $21.35, compared with $19.40; and the 36 by 4½ quotes at $30.10, compared with $27.35.

A number of the tire companies have not as yet announced any changes but expect to. The Hardman company expects to go up 10 to 20 per cent in the near future and is at present taking few orders at the prevailing prices. The Ajax company expects to raise its prices the last of the week, and Diamond tire prices, it is stated, are slated to go up.

These rises now include ten since Jan. 6, when Kelly-Springfield started the increase with a 7½ to 26 per cent jump. As announced in THE AUTOMOBILE last week, Empire list prices went up 15 per cent; Falls rose 10 per cent, and Globe and Pennsylvania went up approximately 25 and 20 per cent each.

Some of the new prices on United States Tire, Goodyear and Goodrich are as follows:

Goodrich Tires

Size	Old	New
28 by 3	$8.50	$9.35
34 by 4	19.40	21.34
36 by 4	20.50	22.55

U. S. Tires

Size	Old	New
32 by 3½	$13.35	$14.70
34 by 4	19.40	21.35
36 by 4½	27.35	30.10

Coghlan a Klaxon Director

NEWARK, N. J., Jan. 18—At the annual stockholders' meeting, W. P. Coghlan was elected a director; and at the directors' meeting was made secretary of this company. He will continue as general sales manager.

Blood Bros. Elects New Directors

GRAND RAPIDS, MICH., Jan. 14—At the annual election of the Blood Brothers Machine Co., Allegan, Mich., manufacturer of the Cornelian car, the following directors were elected: F. I. Chichester, L. H. Mattingly of Kalamazoo, Judge O. S. Cross, C. C. Blood and Mr. Potter.

Couple-Gear Directorate Chosen

GRAND RAPIDS, MICH., Jan. 14—The folowing directors have been chosen for the Couple-Gear Co., Grand Rapids, Mich.: George Hummer, W. C. Hopson, A. J. Brown, F. E. Brown, Alexander Dodds, Clayton Church, W. B. Church, M. S. Hopkins, A. B. Knowlson. According to reports of officers the company has just completed a successful year. Most of its product is disposed of in Boston and New York.

Four Buildings for Chicago Show

Nearly All N. Y. Exhibitors Have Space with Several Others Added

CHICAGO, ILL., Jan. 19—Chicago will be host to the 1916 models, the newest accessories and legions of motor car connoisseurs and dealers Saturday and the week following when the sixteenth annual motor show, held under the auspices of the National Automobile Chamber of Commerce and the management of Samuel A. Miles, will be staged in this city. So large is the impending display of cars that four buildings will be required to house them—the Coliseum, the Coliseum Annex, the First Regiment Armory and the Greer Building.

As at previous shows, the cars will be shown on the main floors of the Coliseum, Coliseum Annex and the First Regiment Armory, with the overflow in the Greer Building, while the accessories will be displayed in the basement and the gallery of the Coliseum and the balcony of the armory and Coliseum annex.

New York Exhibitors Represented

With only one or two exceptions, all the car makers exhibiting at New York will play a return engagement here. The most notable absentee will be the Fergus, the stripped chassis from the land of the Shamrock which attracted so much attention at New York because of ease of maintenance and simplicity of lubrication. Several companies, however, that did not show at New York will have models here, including the Farmac, Elgin, Monitor, Elcar, Halliday, Champion, Crow-Elkhart and Chicago Electric.

More than 200 manufacturers of parts and accessories have reserved space and this insures a display of fitments equal to that of past exhibitions.

Japanese Decorations

When the doors of the four exhibition buildings open at 2 o'clock Saturday afternoon, four gardens of old Japan will be revealed as decorations symbolic of the Mikado's realm have been selected for the 1916 show and the decorative scheme will be carried out in each of the buildings. The work of transforming the bare structures into places of beauty was started last week and the decorators will be through by Thursday when the cars, which now are sidetracked in local freight yards, will be put in place.

Nothing, from the artistic viewpoint, has approached in beauty the decorative scheme which prevails in each building. Four parks of quaint Tokio have been reproduced by artist Tietzel at a cost of approximately $50,000. Monumental gates, towers and pagodas have been erected. The walls are screened with the foliage of cherry trees. Ninety thousand square feet of canvas have been used to obtain a blue sky effect. In fact, the Chicago show will have a Nipponese atmosphere that might seem to be more suited for the display of jinrickishas than the exhibition of motor cars.

As Chicago is the center of a great distributing territory, the local show will be the mecca of dealers from all points of the compass for a radius of 200 miles and luncheons and dinners, at which the men who deal directly with the ultimate consumer will be guests, will feature the week. Wednesday will be Society day and also the occasion of the annual meeting of the National Automobile Chamber of Commerce.

Dealers from Texas

A feature of the week will be the visit of a delegation of 150 Texas dealers who are scheduled to arrive Monday morning on special trains from Fort Worth and El Paso. The Overland representatives in the Northwest will give the Chicago show the double O on opening day before going to Toledo to inspect the Willys-Overland plant.

An appeal will be made to the patriotism of the motorists of the Middle West during the week of the show by the Chicago Automobile Club, which will maintain a recruiting office in the Coliseum where owners of cars may enlist in the motor car reserve corps and thereby take an active part in the preparedness campaign for national defense.

Jeffery Has New Sales Force

Kenosha, Wis., Jan. 17—E. S. Jordan, who for nearly eight years has been in entire charge of sales for the Thomas B. Jeffery Co., having resigned, the sale of Jeffery pleasure cars hereafter will be in charge of E. G. Howard, as sales manager, and W. B. Riley as assistant sales manager; the truck sales department will be in charge of H. C. Hart and the foreign sales department will be in charge of J. A. Rose. All of these men have been connected with the Jeffery company for a number of years.

Premier Board Elected

Joliet, Ill., Jan. 18—Stockholders of the new Premier Automobile Co., Indianapolis, Ind., mostly composed of capitalists of Joliet, held their organization meeting this week, directors being chosen as follows: H. L. Thompson, C. F. Jensen, E. W. Steinhart, J. C. Flowers, Theodore Gerlach, F. W. Woodruff, and G. E. Woodruff. The directors then elected these officers: President, J. C. Flowers; vice-president, E. W. Steinhart; secretary, C. F. Jensen; treasurer, H. L. Thompson.

Many Trucks in Detroit Show

Fewer Electrics and a Good Range of Gasoline Cars

Detroit, Mich., Jan. 15—Although there were twenty less cars on a floor of the three buildings used this year at the fifteenth annual automobile show promoted by the Detroit Automobile Dealers' Association, it was held by the first nighters and by exhibitors to be the best one as yet seen in the automobile metropolis of the world.

It is a more interesting show than its predecessors, as practically all the novelties in construction that were shown in New York are also to be found here. It is, as an Easterner said, a miniature New York show with an excellent commercial vehicle section in addition. Perhaps one most regretted absentee is the new Marmon car, but its local distributor is showing the car in the lobby of the Hotel Statler, not having been able to secure the desired space.

No Newcomers

A feature this year is practically the entire absence of entirely new cars. In the passenger car line there is no newcomer. There are, however, quite a few cars which had never previously been seen in this city. In the commercial car line there is a new truck, the Lincoln. Several other trucks unknown to Detroit heretofore, but well known in the country otherwise, are shown. Among the accessories and parts exhibitors there are several who either are new in the business and thus show their wares for the first time, as for instance the Detroit Auto Products Co., Dr. Schorr's suspension, and the Meyer Motor Co.

Cars and chassis on the floor totaled 183 as compared with 203 last year. There are 115 gasoline passenger cars and sixteen chassis; thirty gasoline commercial vehicles and twelve such chassis, and ten electric passenger cars. It is the latter class which shows shrinkage in number, although not in quality, as last year there were twenty-five electrics at the show.

New Lincoln Truck

The Lincoln Motor Truck Co. has its new ¾-ton truck on display. With express body and the usual accessories, it sells at $985. The chassis only is listed at $925. Electric starting and lighting system will be furnished at an addition of $100. The wheelbase of the truck is 122 in. The maximum body length is 10 ft. The motor is a four-cylinder Beaver, 3¾ by 5 in.; the carbureter a Stromberg, the axles Sailsbury, the transmission Covert, the steering gear Ross, the ignition system Bosch, and the tires Firestone pneumatic, 33 by 4½. The radiator is of the cast tank type, vertical tubes. The springs are semi-elliptic, 36 by 2¼ in front and 56 by 3 in. rear.

The truck was designed by an English engineer, W. L. Bodman. Those interested in this new company are: J. A. Moritz and L. F. Mullin, members of the firm of Moritz-Mullin Co., distributor of the Signal trucks, and J. E. Hannon.

Equipment for Fords

The Detroit Auto Products Co. shows its roadster de luxe body and equipment for the Ford for the first time. This complete equipment consists, in addition to the special body, of a one man top with boot and side curtains, ventilating windshield, radiator, hood, crown fenders, lamp bracket extensions, tire holder brackets, splash plates, dust shields, foot accelerator, starting crank and running board hangers. A Ford roadster thus equipped weighs 1540 lb. The standard color is Brewster green. The body is 45 in. wide at the seat, back of dash to front of cushion, 30 in.; cushion, 18 in. deep, 10 in. high at front and 7 in. high at back. The price of this equipment is $197.50 f.o.b. Detroit. A closed top to convert the roadster into a coupé will also be brought out by the company.

Beyerline to Organize New Mfg. Co.

Detroit, Mich., Jan. 17—J. G. Beyerline and W. L. Daly, who were respectively president and general manager, and general sales and advertising manager of the King Motor Car Co. are among those principally interested in a new automobile company which will make a six-cylinder car to sell at $900. Both the manufacturing and selling organizations of the new concern are now being perfected and a complete detailed announcement will be made shortly.

Motor Body Co. Building New Plant

Detroit, Mich., Jan. 17—A new plant is now in course of construction for the Motor Truck Body Co. at Central Avenue and the M. C. R. R. It will be a one-story structure, 64 by 245 ft. There is in addition 2½ acres of ground which may be utilized for further expansion. The company manufactures special truck bodies. E. G. Proctor is president and E. G. Thurber is secretary and treasurer of the company.

Detroit, Mich., Jan. 17—The Liberty Motor Car Co. capitalized at $400,000 has been formed here. The incorporators are George B. Allen, J. B. Clark and F. W. Henning.

41,000 See Milwaukee Show

Business Transactions Largest Ever Held—Wis. Dealers Hold Banquet for 600

MILWAUKEE, WIS., Jan. 17—Approximately 41,000 people passed through the gates of the eighth annual show of the Milwaukee Automobile Dealers, Inc., held in the Auditorium from Jan. 7 to 13, inclusive.

Exhibitors declare that more actual business was transacted at this show than at any previous Milwaukee exposition. While the volume of business is less, due to the general drop in average price of cars for 1916, more cars were sold and the purchases of detachable winter tops have never been equaled. The number of Wisconsin dealers who actually registered at the show is 15 per cent larger than for 1915, indicating that wholesale business increased in a similar proportion.

From a financial standpoint the 1916 show was the best of the eight expositions which Milwaukee dealers have put on.

The weather ran riot during the seven days of the show. Friday, opening night, was accompanied by mist and a temperature of 23 deg. above zero. On the following Wednesday morning the thermometer showed 20 deg. below zero, the coldest Milwaukee has experienced in ten years. In the interim there was rain, snow, fog and mist. No more unfavorable weather has ever been known during a Milwaukee show. On only a few days was it possible for exhibitors to make outdoor demonstrations with the least degree of comfort at all.

Prosperity talk was rife, both among the banqueters and the speakers. Wisconsin registered 79,791 cars in 1915, a gain of nearly 27,000 cars for the year, and predictions were freely made that 30,000 cars will be absorbed by the Badger State in 1916, making a total of nearly 110,000. It was pointed out that motor car business varies with the size of the annual crop, and bumper crops in 1915 mean big sales in 1916. Approximately 60 per cent are purchased in the rural districts and 40 per cent in cities.

Practically every State agent or agency tendered dinners to its sub-dealers during show week.

250 Cars in Baltimore Show

BALTIMORE, MD., Jan. 18—Baltimore's tenth annual automobile show opened at the Fifth Regiment Armory to-night. It is being held under the auspices of the Automobile Club of Maryland and the Baltimore Automobile Dealers' Association. It will close on Saturday night.

The show is by far the greatest local exhibition of pleasure and commercial cars ever held in Baltimore, there being sixty-eight exhibitors showing 250 machines. The estimated value of the exhibits and decorations is $1,500,000. Fifty-one different makes of pleasure cars and twenty-eight different makes of trucks are included in the exhibit.

Schrader, Tire Valve Inventor, Dies at Sea

NEW YORK CITY, Jan. 14—G. H. F. Schrader, formerly president of A. Schrader's Sons, Brooklyn, N. Y., and who invented the Schrader valve for tires, died on Nov. 15 last on board a fishing boat en route from Iceland to Norway. Mr. Schrader left this country about six years ago for England and after spending two years in Falmouth he suddenly went to Iceland. About three months ago he became ill and decided to return to the United States. He could get no passport, however, in Iceland, and so decided to take passage aboard a trawler for Norway, where he could establish his identity.

Mr. Schrader was a few months less than sixty years old. He was born in Hoboken. He was a bachelor, and, so far as is known, had only one relative, a sister now supposed to be in Germany.

Form Tractor Club in Kansas City

KANSAS CITY, MO., Jan. 17—The Tractor Club of Kansas City has been organized by the local representatives of about fifteen tractor manufacturers. A. J. Pray, of the Universal Tractor Company, is president, with W. F. Roth, Emerson-Brantingham Company, vice-president, and Guy H. Hall, Hall Bros. & Reeves, secretary and treasurer. The directors are E. J. Anderson, Avery Company; A. F. Norton, J. I. Case Threshing Machine Company; J. P. Smith, Rock Island Implement Company; G. C. Weyland, J. I. Case Plow Works, and C. E. Haynie, International Harvester Company.

Lehr Co. to Build Saginaw Eight

SAGINAW, MICH., Jan. 14—The Lehr Motor Co., this city, has been formed under Maine laws with a capital of $500,000 to build the Saginaw Eight at $1,050. The designer and general manager is Harry D. Mackey; president, William M. Guilder; vice-president, F. F. Myer, and secretary and treasurer, K. M. Schwahn.

Jackman Is Westinghouse Representative

CHICAGO, ILL., Jan. 14—A. E. Jackman has been appointed as the Western representative of the automobile equipment department of the Westinghouse Electric & Mfg. Co., this city.

Automobile Shipments Delayed

Only 59,000 Freight Cars Available — Several Railroads Building New Cars

DETROIT, MICH., Jan. 14—At a meeting of the traffic committee of the National Automobile Chamber of Commerce, Inc., together with traffic managers of various railroads, the traffic managers decided to ask that the automobile industry make it a rule to unload all incoming freight cars the day of their arrival. This step was taken in order to guard against the shortage of freight cars which is pending at the present time because the railroad companies have not kept pace with the expansion of the automobile industry by adding to their equipment of automobile freight cars.

At present there are only 59,000 automobile freight cars available. The New York Central is building 9000 additional, and the Pennsylvania is building 1000 extra. This puts the total at 69,000, which is not adequate to meet the demands. Up to the present time Detroit, Toledo, Flint, Lansing, Cleveland, and other manufacturing cities have not been severely handicapped in a shortage of cars. Shipments have been held up a day or so but the prospects are that when production is at its height in February there will be a very great shortage, and it is to guard against this shortage that the decision above referred to was arrived at.

N. A. C. C. Probes Situation

The N. A. C. C. through its traffic committee is following every automobile freight car from the time it leaves the factory until unloaded by the dealer and returned to the factory. This committee is working to guard against delays by the dealer in holding a car on the railroad siding for several days before unloading.

During 1915 approximately 200,000 carloads of automobiles were shipped by members of the N. A. C. C. or about 60,000 more than in 1914. During the last three months of 1915 members of the N. A. C. C. shipped 47,600 carloads or 24,000 more than during the corresponding period of 1914.

The following officers were elected at the meeting for the year 1916 by the Detroit traffic committee. C. W. Eggers, Willys-Overland Co., chairman; E. N. Hodges, Hupp Motor Car Co., vice-chairman; W. L. Schultz, Hudson Motor Car Co., secretary-treasurer.

Those in attendance in addition to the above were: M. S. Graham, Reo Motor Car Co.; C. J. Shaar, Packard Motor Car Co.; H. J. St. Aubin, Federal Motor

Truck Co.; George A. Main, Maxwell Motor Co.; Hugh Higginbottom, Dodge Bros.; H. R. Moule, Chalmers Motor Co.; H. E. Johnson, Studebaker Corp.; T. M. Smith, National Motor Vehicle Co.; W. L. Pierce, King Motor Car Co.; E. B. Rodgers, Olds Motor Works. There were also at the meeting, J. S. Marvin, traffic manager of the National Automobile Chamber of Commerce; William E. Metzger, chairman of the traffic committee of the N. A. C. C.; Arthur T. Waterfall, traffic commissioner of the Detroit Board of Commerce.

Springfield Body Offers $750,000 Preferred Stock

New York City, Jan. 19—For the purpose of putting its Springfield plant on a large production basis and for the construction of a plant in Detroit, which will supplement that in Springfield, the Springfield Body Corp. has offered, through Renskorf, Lyon & Co., New York City, $750,000 8 per cent cumulative and participating preferred stock at par. The stock is redeemable at 200 at the option of the company after Jan. 1, 1917. This is the first offering of an authorized issue of $1,000,000 preferred stock.

All of the common stock of the company, amounting to $1,500,000, was issued to holders of the old stock in payment for the company, which was formed when it took over the old Springfield Body Co. last year.

Waukesha Bridge to Build Tractors

Waukesha, Wis., Jan. 17—The Federal Bridge Co., Waukesha, Wis., formerly Modern Steel Structural Co., has booked another large contract to manufacture gasoline tractors for outside concerns, and during the present year will produce approximately 2500 farm machines. It was announced some time ago that the Waukesha plant would build tractors, but it was explained that this line was being undertaken only as a contractor. A short time ago the Nillson Farm Machinery Co., Minneapolis, Minn., contracted for the manufacture of 300 tractors, and now the Paramount Farm Tractor Co. has contracted for 1200 machines.

Signal Truck Increases Capital

Detroit, Mich., Jan. 15—The Signal Motor Truck Co., is completing arrangements to increase its capital stock from $85,000 to $450,000. Of this amount $300,000 will be common stock and $150,000 7 per cent accumulative preferred. It will be provided for protection of preferred stockholders that no dividends will be paid on the common which will reduce the net current assets to a total of 125 per cent less than the amount of preferred outstanding. Furthermore, it will be provided that for each dividend on common stock cash of an equal amount is to be appropriated to a reserve for the retirement of the preferred stock. The common stock will be placed in a five-year voting trust.

The company will be known as the Signal Motor Truck Co. of Maine, under laws of which State it will be incorporated and it will take over the assets and business of the Signal Motor Truck Co. of Michigan. Application will be made for the listing of the stock on the Detroit Stock Exchange.

Stephens Car is New Product

Freeport, Ill., Jan. 17—The manufacture of automobiles by the Moline Plow Co. will commence March 1, in the Henney Buggy plant. The car will be known as the "Stephens." The test chassis which has been constructed at Detroit as a model, reached Freeport this week, being driven overland by M. A. Steele, general manager; J. T. Trumble, chief engineer, and J. C. Holden, head draftsman. The car has six cylinders.

Rubber Club to Expedite Tire Shipments

New York City, Jan. 19—The Rubber Club of America, which is officially handling the crude rubber situation in America, during the period of the rubber embargo by Great Britain, has been working to make it easier for American exporters to get quicker service on tires for motor cars or trucks which have been shipped to neutral countries, and which must be shipped without tires under the restrictions of the embargo. The Rubber Club is circulating to the manufacturers a special form which when filled out will be forwarded by the Rubber Club to the war trade department in London. These forms are for licenses for tires for the vehicles shipped to neutral countries. At present sometimes months pass before tires can be secured through London for such vehicles, and the purpose of the present form is that this time can be greatly reduced. The forms are really a hurry-up certification from the Rubber Club to the war trade department that the orders are reliable and should be filled with the utmost dispatch.

Dorris Reduces I A W 2-Tonner Price to $1,190

St. Louis, Mo., Jan. 15—The Dorris Motor Car Co., this city, has reduced the price of its I A W 2-ton worm drive truck chassis to $1,990, f.o.b. St. Louis. There is now to be an extra charge for the governor and driver's seat, if wanted. The former price on this truck chassis was $2,500.

Truck Trade Flourishing

General Motors Dealers' Convention Shows Orders Sufficient for All Year

Pontiac, Mich., Jan. 18—With the new year less than a month old, orders in the hands of many dealers and distributors of trucks are ten times, and more, better than at this time last year. In some instances there have been 25 per cent more sales. The situation is without precedent, and, according to old truck dealers, it means that truck manufacturers will have to provide themselves with ample means as far as materials are concerned, if they want to cope with the demand, or rather with the orders they will receive right along from their dealers.

These were the chief points brought out at a three-days' convention of branch managers and salesmen of the General Motors Truck Co., held here this week. They came from all sections of the United States and some from the Dominion, and the feature of the gathering was the unanimous opinion of those present, that the truck business of 1916 will far surpass in the number of commercial vehicles sold, any figure anticipated or predicted at the present time.

The conditions are good everywhere for the truck business. The education of the prospective users of commercial cars has made such strides that to-day there is hardly any successful business man who does not intend to take on the motor-driven vehicle, or add some to those he already has.

From what some dealers say, orders for trucks now on the books of truck manufacturers are sufficient to keep them well busy practically all year. And many will have day and night shifts a greater part of the year.

New Tractor Ready Feb. 21

Big Rapids, Mich., Jan. 1—The Four-Drive Tractor Co., this city, has been formed to build a tractor after the invention of John Fitch. A plant 45 by 200 ft. will be built on the company's property near the Père Marquette Railroad. The building is expected to be finished April 15.

The Four-Drive Tractor Co. expects to have a tractor ready for the Grand Rapids automobile show which begins Feb. 21. President Finch has been out scouting for material and already a quantity of machinery has arrived at the plant of the Binney Machine Co. in preparation for manufacturing operations in that city.

Gasoline Prices Soar to New Marks

Quotations in Six Cities Reach 22-Cent Mark—Panama Slide Important Factor As It Cut Off Cheap Transportation from Cal.

NEW YORK CITY, Jan. 18—The further increase of gasoline prices last week in this and other large cities throughout the country has caused many of the automobile owners to wonder just when the upward movement is going to stop. There seems to be no set price as the quotations given do not seem to coincide with the location of the city with reference to that of the refineries. For instance, Chicago is less favored in respect to manufacturing facilities than New York, yet the prices in the latter city are at the present time 4 cents higher than in Chicago. Both cities are well served by refineries and have excellent connections with the oil fields. Looking over the appended table of prices, it will be seen that there are just five cities in the United States that are paying prices as high as those now quoted in New York, and among them are several remote from the base of supplies, one being Tucson, Ariz. Detroit prices at the present time are quoting under 20 cents.

Transportation Rates Higher

It is stated, among many of the reasons for the recent increase of prices, the Panama slide was an important factor, as it cut cheap transportation from California, and the reopening would have afforded some relief. The oil now coming from California to the East must pay trans-continental gasoline railroad rates. The oil produced in Eastern Mexico was practically all going to England in tank steamers requisitioned by the British Government.

It is stated that a tank car of gasoline which cost $500 a few months ago now costs $1,500, same delivery, Oklahoma or elsewhere. A tank car of oil that could have been had at 1¼ to 1½ cents a gallon now costs 3 to 3¼ cents, and lubricating oils have advanced 40 to 100 per cent.

Exported Gasoline Higher

Last week the Standard Oil Co. of New York advanced the export price of gasoline stove grade 1 cent a gallon and all other grades 2 cents a gallon. Retailers in New York City have raised the price in some cases to 28 cents a gallon. One wholesaler gave the opinion that 3 cents a gallon was a fair profit for retailers, but the retailers state that no profit under 5 cents a gallon is possible to make fair earnings, as allowance for overhead charges and evaporation and waste must be accounted for.

The call for substitutes or new processes to cheapen production has been manifest during the last few months. The latest process is that of H. T. Yaryan of Toledo, Ohio, who states that by his process gasoline can be produced for 10 cents a gallon by means of an invention of his which will get 90 per cent of gasoline out of the crude oil, instead of 20 per cent, which the present oil companies are stated to be getting. According to the inventor, by his process he can make all of the by-products of crude oil, including kerosene, paraffine, tar and greases, up into gasoline. When his process is finished, nothing but tar is left, the rest being gasoline.

The Atlantic Refining Co. in Philadelphia and Pittsburgh has raised the price of gasoline 1 cent to 21 and 22 cents, respectively.

Portland, Ore., prices were advanced last week 1 cent to 15 and 16½ cents, retail. Tacoma prices again advanced 1 cent to 16½ cents.

Investigation in New Jersey

The recent rise in gasoline prices in New Jersey has caused a resolution to be be passed in the House of the Legislature for a thorough inquiry of the conditions leading to the higher prices. The Judiciary committee of the House will conduct the investigation. It is conceded by many in that State that gasoline is no longer a luxury, but a necessity, because of the extensive use of the commodity for commercial purposes.

$1 Tax for Overcharge

A bill intended to reduce the price of gasoline was introduced yesterday by Representative Ben Johnson of Kentucky. It proposes that whenever the first vender sells a gallon of gasoline at a price as high as 15 cents, he shall pay a tax of $1 for each gallon, and an additional tax of $1 a gallon for each cent above that figure.

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Farmers Oppose Gasoline Tax

FRESNO, CAL., Jan. 14—Automobile owners, dealers and farmers using tractors on their farms, representing the San Joaquin Valley, attended a mass meeting held in this city yesterday and protested vigorously against the emergency war taxes on gas engine, horsepower and gasoline to President Wilson and members of Congress.

Resolutions strongly objecting to the proposed taxes were passed and adopted. These resolutions are to be sent to Washington. In the resolutions the tax is declared to be unjust on the grounds that automobiles are necessary to progress and prosperity and that the progress of California is largely dependent on the use of automobiles and gas engines in pumping plants and farm machinery.

The following table gives a range of the current prices:

	Present Price	April 1	Increase
Atlanta, Ga.	21	12.5	8.5
Baltimore, Md.	21	11	10
Boston, Mass.	22	13	9
Buffalo, N. Y.......	18	12	6
Charleston, S. C.....	21.5	15	6.5
Cheyenne, Wyo.	20	15	5
Chicago, Ill.	16.5	10.5	6
Cincinnati, Ohio	20	12	8
Cleveland, Ohio	15	11	4
Dallas, Tex.	19	10	9
Denver, Colo.	20	15	5
Detroit, Mich.	16	10.5	5.5
Douglas, Ariz.	22.5	16.5	6
El Paso, Tex.	20	11	9
Fort Worth, Tex....	19	10	9
Hartford, Conn.	21	11	10
Houston, Tex.	19	10	9
Kansas City, Mo....	15.8	9.8	6
Louisville, Ky.	18	11	7
Los Angeles, Cal....	15	12	3
Memphis, Tenn.	18	10	8
Minneapolis, Minn...	16.5	11.5	5
Nashville, Tenn.	16	10	6
New York City......	22	12	10
Newark, N. J.......	21	9	12
New Orleans, La. ...	17.5	11	6.5
Norfolk, Va.	18	12	6
Oklahoma City, Okla.	19	12	7
Omaha, Neb.	15	10	5
Pensacola, Fla.	18.5	15	3.5
Philadelphia, Pa. ...	21	11	10
Pittsburgh, Pa.	22	9	13
Portland, Me.	22	13	9
St. Louis, Mo.	15.9	9.9	6
St. Paul, Minn.	16.5	11.5	5
San Francisco, Cal..	15	11.5	3.5
Savannah, Ga.	20	13	7
Seattle, Wash.	14	12	2
Shreveport, La.	18.5	10	8.5
Tucson, Ariz.	22.5	17	5.3
Vicksburg, Miss.....	19.5	13.5	6

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Government Constructs Armored Car at Rock Island

ROCK ISLAND, ILL., Jan. 17—There is being finished at the government arsenal in Rock Island, an armored car for the United States war department, which is the first of the kind to be constructed in this country. Originally, the car was a Jeffery commercial truck. A 45-hp. engine has been substituted for the thirty, first installed, and when the car is ready for service a test will be made upon the arsenal drives. The entire machine, with the exception of the wheels, is protected with 2/10-in. armor, though armor plate will be substituted later. There are loop holes for the use of field glasses and two revolving turrets, on each of which is mounted a rapid-fire gun, each discharging 450 shots per minute, though this can be increased to 600 if necessary. The car will carry six men. Driving apparatus, which permits the car to go ahead or backward, is in position but is operated separately, thus requiring one man for each, the other four men to handle the rapid fire guns.

Work also has been started on a lighter and speedier armored automobile, which will be armed with one machine gun and carry a crew of two or three men.

Experiments have demonstrated that armor plate 2/10 in. thick will resist small-arms fire. This is as thick as the shields used on the machine guns in use in the European war.

The War Department also is planning a motor vehicle equipped with small rapid-fire guns, but limitation as to weight materially restricts the amount of armament that can be placed on such a vehicle. On account of the character of the roads here it will be impossible to use as heavy armored trucks in this country as in Europe, the limit of safe weight having been found here to be 8500 lb. England has purchased in this country supply trucks that weigh loaded between 12,000 and 13,000 lb. Trucks as heavy as this would wreck many of our country bridges.

To Compel Truck Fenders

CHICAGO, ILL., Jan. 18—Although the ordinance, stipulating that all motor trucks operating in this city shall be equipped with fenders, has been declared invalid, mandamus proceedings have been instituted against Chief of Police Healey to compel its enforcement by five makers of fenders. The bill of complaint states that of the fifty-nine persons killed by motor trucks in Chicago during the past 11 months, twenty-six were children whose lives would have been saved had the vehicles carried fenders.

Durant-Dort Capital Increased

FLINT, MICH., Jan. 15—The capital stock of the Durant-Dort Carriage Co. has been reduced from $2,000,000 to $1,000,000.

War Automobiles Sent Direct to Petrograd

GRAND HAVEN, MICH., Jan. 14—Transfer shipments of war automobiles and accessories have been handled by the local lake lines, the shipments being routed direct to Petrograd in the main. The Grand Trunk railroad is handling the major portion of the shipments.

British Tire Blockade Hits Dutch

PARIS, Dec. 30—Travelers from Holland report that England's tire blockade is so tight that only the minimum number of tires necessary for public service are allowed to pass into Dutch territory. Automobile owners are not allowed to have new tires until they have returned their old casings and tubes, even though they are unfit for any further service.

Notwithstanding the severity of the control and the heavy fines imposed, smugglers make repeated attempts to get rubber across the frontier into Germany. The market price of rubber in Holland is at present about $1.60 per pound. The penalty for those caught in the act of smuggling is $6.40 a pound; but as German agents are willing to pay $10 a pound for all rubber brought across the frontier, smuggling is a profitable, though dangerous, occupation.

Must Notify Insurance Co. Immediately

LANSING, MICH., Jan. 14—The Supreme Court of Michigan in a decision affecting the Oakland Motor Car Co., Pontiac, Mich., held that when a liability insurance company is notified about an accident three months after it occurred that this is not an immediate notification. In this particular case the Oakland company had a liability insurance policy with the American Fidelity Co., covering automobiles used by the Pontiac manufacturer for testing in Pontiac. One of the cars while on a testing run was the cause of a runaway, and a Mrs. Sarah Gregory was hurt. She brought action for recovery of damages, and was given a verdict for $1,500. The Oakland Motor Car Co. brought suit against the insurance company for this amount, but the American Fidelity Co. refused to settle, claiming that its agreement with the Oakland company specifies that it must be notified immediately about accidents, and in this instance the insurance company was notified three months after the accident occurred. In a lower court a decision was rendered in favor of the Oakland Motor Car Co., but now the supreme court reversed the decision without a new trial.

Synthetic Rubber in German Tires

BERLIN, GERMANY, Jan. 14—Automobile tires of artificial rubber are now being made in Germany. In his address to the Reichstag last week Chancellor von Bethmann Hollweg stated that German inventors had discovered a method of producing synthetic rubber. It was stated that at almost the same hour that the Chancellor's statement was made, a factory succeeded in working this rubber into tires which will wear for a year.

Hercules Plant Erection Started

CANTON, OHIO, Jan. 17—Ground has been broken for the erection of the plant of the Hercules Motor Mfg. Co., which will build a light delivery wagon. The plant will be 75 by 360 ft. and will be completed within sixty days.

Consolidated Car Co. Enlarges Plant

DETROIT, MICH., Jan. 17—The Consolidated Car Co. which makes the Abbott-Detroit cars concluded a deal whereby it has taken over the plant of Schweppe & Wilt at Meldrum and Lafayette Avenue, East. The latter company will move into a new plant on Mt. Elliott.

60,000 Cars at French Front

Repair Factories with Power Equipment Behind Lines Can Be Moved Rapidly

PARIS, FRANCE, Jan. 14—According to dispatches sent out from this city, there are at present about 60,000 automobiles, worth $60,000,000, in use on the fighting lines in France. The machines are having the hardest kind of use and yet but 25 per cent are under repair. Each army now possesses a large repair camp. It is a novel feature of army organization. Up to two months ago machines needing repairs had to be sent to garages in the nearest large city. To avoid loss of time, regular factories equipped with machinery for automobile construction have been built behind each army. They consist of about a dozen enormous wooden sheds covered with waterproof canvas.

Electricity generated on the spot operates all the lathes. Two hundred mechanics work night and day in two shifts. Spare parts of every description for every make of car, tires, lamps, headlights and every possible accessory are kept in large stock. Everything is so arranged that the whole camp, including the sheds, can be moved bodily to another part of the country within a week. Emergency workshops, composed of three automobile wagons, carrying all repair tools and an ample supply of spare parts, are kept in perpetual readiness, should the army suddenly advance.

Special Burd Ring for High Speed Motors

ROCKFORD, ILL., Jan. 14—A new Burd piston ring has been developed by the Burd High Compression Ring Co. which will be known to the trade as the "Burd high speed model." In appearance it is not dissimilar to the standard Burd ring, and to the layman there is little or no evidence of change from the former specifications. It is intended to meet the difficult requirements of aeroplane motors and high power car engines.

The aluminum alloy piston calls for greater clearances between the piston and cylinder walls, to provide for the greater expansion. The Burd high speed model piston ring is especially adapted to meet these unusual conditions.

Jones Now Johns-Manville Speedometer

NEW YORK CITY, Jan. 13—H. W. Johns-Manville Co., announces that the name "Jones" has been discontinued in connection with its speedometer, which is now known as the Johns-Manville speedometer.

Five Year Trust for Entz Patents

Six Members Represent General Electric Co. and Owen Magnetic Co.

New York City, Jan. 15—A voting trust has been constituted in connection with the Entz Motor Patent Corp., controlling the Entz electric transmission patents, large interests in which were recently purchased by the General Electric Co., from R. M. Owen & Co., which previously controlled them exclusively. The voting trust will exist for five years and the power of voting the stock of the corporation rests with the following parties: R. M. Owen, president; R. A. Rainey, first vice-president, Entz Motor Patent Corp; D. C. Durland, of the Sprague electric, which is a General Electric property; Geo. F. Morrison, Edison Lamp Works, which is controlled by the General Electric, and R. H. Montgomery and Richard Swartout, representing financial interests.

McClurg Rubber Takes Over S. & M. Co.

Coshocton, Ohio, Jan. 14—Formal transfer of the property of the S. & M. Tire & Rubber Co., to the new McClurg Rubber Co. was made by Receiver E. A. Crawford, the consideration being $35,735.88. A journal entry was filed in common pleas court showing that the old stockholders may complete payment on their stock and receive shares of stock in the new company.

It was stated that the rubber plant will now commence operating to full capacity, with from forty to sixty employees, the number to be increased.

Bull Chairman J. I. Case Board—Davis New President

Racine, Wis., Jan. 17.—The reorganization of the official personnel of the J. I. Case T. M. Co., Racine, Wis., which has been going on for six months, was completed on Jan. 12 at a special meeting of the board of directors. F. K. Bull, for many years president, was advanced to a new position just created, that of chairman of the board of directors. W. J. Davis, treasurer, was elected president and will continue as treasurer. The complete list of officers and directors now is:

Chairman of the board, F. K. Bull; president and treasurer, W. J. Davis; vice-presidents, E. J. Gittins and M. H. Pettit; secretary, W. F. Sawyer; assistant secretary, Stephen Bull; assistant treasurers, C. J. Farney and R. P. Howell; directors, the officers and Frederick Robinson, W. E. Black, F. L. Hine and A. O. Choate.

F. K. Bull's father was one of the four founders of the big institution. He has been its head for nearly thirty years In the new position of chairman of the board, Mr. Bull will have complete supervision of all branches of the business. The new president, W. J. Davis, came to Racine from Marinette, Wis., five years ago to become president of the Manufacturers' National Bank. Two years ago he was elected treasurer of the Case company and now he takes the larger duties of president, being provided with two assistant treasurers.

Increase of Wis. Registrations

Madison, Wis., Jan. 17—During the first 15 days of 1916, 22,250 applications from private owners for 1916 licenses were received by the Secretary of State of Wisconsin. During the same period of 1915, the number of applications was only 9750. Only 6000 sets of plates have been issued thus far, because of the inability of the contractor for plates to make prompt delivery as specified. Permission has been given to operate under former licenses until new plates can be provided.

Overland Capital Raised to $75,000,000

Toledo, Ohio, Jan. 14—At a special meeting to-day of the stockholders of the Willys-Overland Co., this city, the proposed program to increase the capital stock of the company as outlined in The Automobile of Nov. 11 has been authorized. The new capital amounts to $75,000,000 and consists of $50,000,000 common and $25,000,000 preferred. The common stock has been increased from $25,000,000 and the preferred is a new stock issue.

This action formally approves the proposal outlined last November for the capital increase and also the issue of $15,000,000 new convertible 7 per cent preferred stock, which has been offered to common stock to the extent of 71½ per cent of holdings at 110 and to the holders of the old preferred stock on similar terms. The old issue of preferred has been called for redemption at 110. The company has outstanding at present $21,000,000 common stock.

St. Louis Chevrolet Raises Capital to $1,000,000

St. Louis, Mo., Jan. 12—The capital stock of the Chevrolet Motor Co. of St. Louis has been increased from $10,000 to $1,000,000 according to a statement filed with the Secretary of State of Missouri. About the same time a statement was filed by the Banner Buggy Co. showing a decrease in capital stock from $700,000 to $400,000. Russell E. Gardner, president of the buggy company, is also president of the local Chevrolet Co.

Canada Ford Makes $3,202,000

1915 Output 24,500 Cars—To be Raised to 40,000 in 1916

Detroit, Mich., Jan. 14—Earnings of the Ford Motor Co. of Canada, in the past year ended Sept. 30, 1915, amounted to $3,202,000, on an output of 24,500 cars. The company at present has outstanding $7,000,000 capital stock, of which $6,000,000 represents the recent 600 per cent stock dividend. Last year's earnings therefore are equivalent to 45 per cent on the increased amount of stock.

The output for the current year will be 40,000 cars. The present capacity of the plant is 60,000 cars.

The cash dividends paid by the company have amounted to $1,600,000, or an average of about 116 per cent per annum. This has been in addition to stock dividends.

The record of profits and production of the company is as follows:

Year	Production	Net Earnings
1915	24.500	$3.202,000
1914	16,000	2,022,000
1913	11,500	1,317,000
1912	6.500	1.065.000

800 Stockholders Hold Reo Shares

Lansing, Mich., Jan. 5—The shares of stock of the Reo Motor Car Co. are held by about 800 stockholders, according to Secretary-Treasurer Donald E. Bates, of the Reo company. Most of the holders reside either in Lansing or in Detroit and 15 per cent hold less than ten shares each. The par value of the Reo shares is $10. Ever since the company was started the control of stock has remained with the men who started it.

The capital stock, when the company was incorporated in August, 1904, was $500,000. It was later increased to $1,000,000 then to $4,000,000 and last December to $10,000,000. Of the $4,000,000 capital stock $1,000,000 was held in reserve in the treasury. Dividends were:

	Cash, Per Cent	Stock, Per Cent
1905	10	..
1906	37½	50
1907	86½	33⅓
1908	80	..
1909	60	100
1910	30	..
1911	3	..
1912	20	..
1913	10	..
1914	37½	50
*1915	35	100
11 years	409½	333⅓
Average per year	37¼	30

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*Does not include regular quarterly dividend of 2½ per cent payable Jan. 1, 1916.

Since 1905 and up to the end of October, 1915, the total number of passenger cars made and sold by the Reo

Motor Car Co., was 72,050. The annual production was as follows:

Year	Cars
1905	864
1906	2,458
1907	3,967
1908	4,105
1909	6,592
1910	6,588
1911	5,278
1912	6,342
1913	7,647*
1914	13,516**
1915	14,693***
Total, 11 years	72,050
Average per year	6,550

*For fiscal year of 11 months.
**For fiscal year of 14 months.
***For period of 10 months.

Seven Lansing Firms Paid Big Dividends in 1915

LANSING, MICH., Jan. 6—During 1915 seven local manufacturing concerns directly connected with the automobile industry, have paid to their shareholders cash dividends totaling 140 per cent and stock dividends totaling 206 per cent. The amount credited to each concern was as follows: Reo Motor Car Co., 35 per cent cash, 100 per cent stock; W. K. Prudden Co., 30 per cent cash; Auto Body Co., 25 per cent cash, 96 per cent stock; Auto Wheel Co., 20 per cent cash; Atlas Drop Forge Co., Bates & Edmunds Motor Co., and Reo Motor Truck Co., each 10 per cent cash.

Sheet Steel Parts Makers to Double Capacity

DETROIT, MICH., Jan. 17—The Holihan Mfg. Co., Twenty-first Street and West Jefferson Avenue, which makes sheet metal parts, such as gas tanks, flat and crown fenders, hoods and general stampings, is to double its plant. According to officials of the company business was 300 per cent better during 1915 than it was in 1914.

Ampco Re-elects Board

MILWAUKEE, WIS., Jan. 14—At the annual meeting of the stockholders of the American Metal Products Company (producers of "Ampco" bronze), the old Board of Directors was re-elected, being constituted as follows: Peter J. Weber, president; Henry C. Brelie, vice-president; Wm. J. Eberle, secretary and treasurer; Richard Gaertner, manager, and Charles E. Helm and August Littmann.

The officers reported that although the present plant was being worked to full capacity it was impossible to keep up with the demand, that orders on hand were plentiful, and that the many large orders pending absolutely necessitated the immediate installation of additional facilities.

Goodyear Rushes New Plants

AKRON, OHIO, Jan. 14—The new plants of the Goodyear Tire & Rubber Co., this city, are being rushed to completion. These will give the company a capacity of 20,000 automobile tires a day.

Ogren Expands To $1,000,000 Co.

Name Changed to Ogren Motor Works, Inc.—H. W. Ogren Chief Engineer

WAUKEGAN, ILL., Jan. 14—The Ogren Motor Car Co., has changed its name to the Ogren Motor Works, Inc., and has increased its capital stock from $25,000 to $1,000,000. The company this year will inaugurate an extensive expansion policy which includes the above increase of capital and the construction of a plant in Waukegan.

H. W. Ogren, designer of the car, has been appointed chief engineer and general manager of the new company which was incorporated under the laws of Delaware.

On Feb. 1 ground will be broken for a new plant in this city, which will cost $150,000, and as soon as the buildings are ready for occupancy the company will move from Chicago, its present location. The main building of the plant will measure 150 by 900 ft.

It is the intention of the company to continue the manufacture of its present model, a six listed at $2,500, and in addition to put on the market another type of six-cylinder car that will sell for less than $1,000. Production plans for 1916 call for the manufacture of 3000 cars.

The company is building two racing cars for a campaign next season. Tom Alley, has been engaged to pilot the cars in most of the races for this year.

Steel Lower—Oils Higher

NEW YORK CITY, Jan. 18—Market prices in general last week were subject to many changes. Bessemer and open-hearth steel dropped $1 a ton to $32 and $33, respectively, while a majority of the oils and lubricants saw small gains. Another important change and of much interest to the tire makers at the present time is the reduction in Para and Ceylon rubber prices. Last week the reductions of both grades amounted to 7 and 8 cents, respectively. Copper went up ¾ cent a pound in both electrolytic and Lake grades.

Tin has kept up its downward movement, which has reached the $41 mark per 100 lb.

The demand for automobile materials is at the present time very large and the manufacturers, as has been stated in previous issues of THE AUTOMOBILE, are having difficulty in procuring certain metals and other materials. It has been estimated that the crude rubber output during the current year will establish a new high record at 175,000 tons dry weight, worth over $260,000,000. The value of rubber is a fluctuating quantity, but it is estimated that the average wholesale price for the current year will be 75 cents per pound.

Approximately 131,000 tons of crude rubber were gathered throughout the world last year. As the big American consumers of rubber buy several months ahead, it is apparent that they are still working on lower-priced rubber. Even $1 a pound, while it represents an advance of 30 per cent for the year, seems low when contrasted with the average prices in 1910 for the two grades, viz., $2.18 for plantation, and $2.75 for Para.

Lion Tire and Rubber Corp. Formed

LAFAYETTE, IND., Jan. 14—The Lion Tire & Rubber Corp., this city, has been incorporated with a capital of $150,000 to manufacture automobile tires. The company has purchased the Heinze plant on Union Street where it will carry on its manufacturing. The incorporators are Ferdinand Dryfus, Thomas Follen, P. F. Freel, W. A. Klepper, R. K. Bedgood, H. J. Haarmeyer of this city; G. B. Smity of Pittsburgh; J. T. Cullen of Peru; Thomas Crane of Chicago, and Edward Taylor of Montmorenci.

The following officers have been elected: President, Ferdinand Dryfus; first vice-president, Thomas Follen; second vice-president, Edward Taylor; treasurer, P. F. Freel; secretary, H. J. Haarmeyer.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.53	.53	.53	.53	.53	.53	...
Antimony	.41	.40	.43	.41¼	.41¼	.42½	+ .01½
Beams and Channels, 100 lb	2.17	2.17	2.17	2.17	2.17	2.17	...
Bessemer Steel, ton	33.00	33.00	32.00	32.00	32.00	32.00	—1.00
Copper, Elec., lb	.23	.23	.23½	.23¼	.23¼	.23¾	+ .00¾
Copper, Lake, lb	.23	.23	.23½	.23¼	.23¼	.23¾	+ .00¾
Cottonseed Oil, bbl	8.89	8.94	8.95	9.00	9.00	9.20	+ .31
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.48	.50	.50	.50	.50	.50	+ .02
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime	.92	.92	.93	.93	.93	.93	+ .01
Lead, 100 lb	5.90	5.90	5.85	5.85	5.85	5.90	...
Linseed Oil	.70	.70	.70	.70	.72	.72	+ .02
Open-Hearth Steel, ton	34.00	34.00	33.00	33.00	33.00	33.00	—1.00
Petroleum, bbl., Kansas, crude	1.20	1.20	1.20	1.20	1.20	1.20	...
Petroleum, bbl., Pennsylvania, crude	2.25	2.25	2.25	2.25	2.25	2.25	...
Rapeseed Oil, refined	.96	.98	.98	.98	.98	.98	+ .02
Rubber, Fine Up-River, Para	.95	.95	.92	.88	.83	.88	— .07
Rubber, Ceylon, Pale Crepe	1.02	.95	.95	.92	.90	.94	— .08
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	41.50	41.25	41.25	41.25	41.25	41.00	— .50
Tire Scrap	.05½	.05¾	.05¾	.05¾	.05¾	.05¾	+ .00¼

The output will be 200 tires a day and the same number of men will be employed. It is expected that the first tires will be ready for the market on May 1.

100,000 Studebakers for 1916

DETROIT, MICH., Jan. 14—The Studebaker Corp., has planned a production schedule for 1916 which calls for 100,000 cars. The factory has been running full capacity, and more than 5000 of the new models have been shipped since Jan. 1.

Studebaker Succeeds Swander

NEW YORK CITY, Jan. 14—C. D. Studebaker, who has been connected with the local branch of the Firestone Tire & Rubber Co., has been appointed branch manager to take the place of D. C. Swander, who becomes eastern district sales manager. H. Topping, who was Mr. Studebaker's assistant, has succeeded him as office manager.

Ohio's Chauffeur License Law Not Enforced

COLUMBUS, OHIO, Jan. 15—According to instructions issued by W. H. Walker, Ohio Registrar of Automobiles no attempt will be made to enforce the chauffeurs' license law in the State until the highest court finally passes on the question of constitutionality of the law. In a letter written to Joseph Cisan, Jr., examiner of chauffeurs at Cleveland the instructions are given that applicants for chauffeurs' licenses must be informed of the unsettled condition of the law and to discourage all chauffeurs from registering.

Security Prices Lower

General Motors Common Goes Up 10 Points—Rest of Market Apathetic

NEW YORK CITY, Jan. 19—Automobile and accessory issues last week were dull with the exception of General Motors, which picked up in price yesterday, reaching the 489 mark, just 24 points higher than Saturday's quotation. The rest of the issues showed few marked gains. Those stocks which have occupied more or less prominence on the Exchange during the last few months have lately shown a declining tendency, especially Maxwell, Overland and Studebaker. Last week Maxwell common dropped 3 points; Overland dropped 1 point; and Studebaker closed with a 2-point loss. In regard to Overland securities, the committee on securities on the New York Stock Exchange has ruled that all transactions in the common stock of that company be ex-rights Jan. 17, and that transactions in rights must be settled Jan. 19, when due bills must be redeemed. The right to subscribe at 102½ for new convertible 7 per cent preferred stock to the extent of 71½ per cent of the holdings expires Jan. 21.

Last week several small gains were made; Reo Motor Car went up 2 points as did Stewart-Warner common; White rose ¼ point; and Studebaker preferred closed with a 1-point gain.

A few of the drops are as follows: Chalmers, 5 points; Chevrolet, 4 points; International Motors common and preferred, 4 and 5 points; Peerless, 1 point, and U. S. Rubber common and preferred, ¾ and 1⅜ points, respectively.

Chalmers common featured the Detroit securities last week with a 10½-point drop. Continental Motor common went up 5½ points. The rest of the market showed small gains and losses ranging from 1½ to 3 points.

Pratt Leaves Pierce-Arrow

BUFFALO, N. Y., Jan. 11—J. Elmer Pratt, who has been sales manager of the Pierce-Arrow for seven years, has severed his connection with that organization. Mr. Pratt has not yet announced his future plans but is going to continue actively in the industry. He enjoys the country-wide confidences of all who have come in contact with him during his long years of service in the industry.

Shafer Leaves Flint Varnish

FLINT, MICH., Jan. 11—A. E. Schafer, who for the past two years has been associated with the Flint Varnish & Color Works as vice-president and general sales manager has severed his connection with that company.

Overland Talks for Dealers

CHICAGO, ILL., Jan. 18—During the week of the Coliseum motor car show Jan. 22-29, the Willys-Overland company will conduct a series of educational talks for dealers at Overland headquarters, Congress Hotel, at 3 p. m. each day of the show with the exception of the closing date, Saturday, Jan. 29. Henry H. Hower, of the Knight motor department will deliver the talks which are connected with the Knight motor.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	71	71½	+1
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	..	85	85	88½	..
Chalmers Motor Co. com	..	96½	120	150	—5
Chalmers Motor Co. pfd	..	93½	101	103	..
Chevrolet Motor Co	..	..	122	123	—4
Electric Storage Battery Co	..	..	63	64	—1
Firestone Tire & Rubber Co. com	365	370	720	..	..
Firestone Tire & Rubber Co. pfd	110	111	112	..	..
General Motors Co. com	86	87	465	475	+10
General Motors Co. pfd	93	94	113½	115	— ½
B. F. Goodrich Co. com	31⅞	32	72¼	72¾	— ¾
B. F. Goodrich Co. pfd	95¼	96	112	113	—1
Goodyear Tire & Rubber Co. com	193	195	338	342	—2
Goodyear Tire & Rubber Co. pfd	102	103½	114	..	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	16	22	—4
International Motor Co. pfd	..	..	35	40	—5
Kelly-Springfield Tire Co. com	78	79	*290 †73	292 74	—2 ..
Kelly-Springfield Tire Co. 1st pfd	79	80	95	97	+ ½
Kelly-Springfield Tire Co. 2d pfd	100	102	73	74	..
Maxwell Motor Co. com	18	18½	68	69	—3
Maxwell Motor Co. 1st pfd	53½	54¼	89	89½	—1
Maxwell Motor Co. 2d pfd	21½	22¼	53¼	53½	—1½
Miller Rubber Co. com	..	..	260	270	..
Miller Rubber Co. pfd	..	..	113	115	..
New Departure Mfg. Co. com	..	120	..	..	..
New Departure Mfg. Co. pfd	101	..	..	..	..
Packard Motor Car Co. com	..	100	185	195	..
‡Packard Motor Car Co. pfd	93	..	102½	104½	..
Paige-Detroit Motor Car	..	..	..	700	..
Peerless Motor & Truck Corp	..	..	29	30	—1
Portage Rubber Co. com	25	30	70	72	..
Portage Rubber Co pfd	80	85	102	105	..
Regal Motor Co. pfd	..	..	..	18	..
‡Reo Motor Co. pfd	11⅜	12⅛	23	25	..
§Reo Motor Car Co	25	26	32	33	+2
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Worner Speed. Corp. com	53	53¾	89	91	+2
Stewart-Warner Speed. Corp. pfd	100	102	108	..	..
Studebaker Corp. com	41⅛	41¾	157	157¼	—2
Studebaker Corp. pfd	94	95	111	113½	+1
Swinehart Tire & Rubber Co	69	71	89	90½	..
Texas Company	133	134	222	223	—5
U. S. Rubber Co. com	55½	57	55¼	55¾	— ¾
U. S. Rubber Co. pfd	102	102⅝	107⅝	108⅝	—1⅜
Vacuum Oil Co	200	202	230	235	..
White Motor Co. (new)	..	..	49¾	50½	+ ¼
Willys-Overland Co. com	86	88	225	230	—1
Willys-Overland Co. pfd	90	94	..	..	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Chalmers Motor Co. com	..	96½	..	142½	—10½
Chalmers Motor Co. pfd	90	93½	100	102½	+ ½
Continental Motor Co. com	175	200	253	260	+5½
Continental Motor Co. pfd	..	..	91	..	..
Ford Motor Co. of Canada	445	..	..	410	..
General Motors Co. com	86	88	450	475	..
General Motors Co. pfd	93	95	113	115	..
Maxwell Motor Co. com	17½	19½	68	70½	—1½
Maxwell Motor Co. 1st pfd	53	55	88	90½	—1¼
Maxwell Motor Co. 2d pfd	21	23	52	54½	—1¼
Packard Motor Car Co. com	..	100	185	188	—2
Packard Motor Car Co. pfd	93	..	..	104⅛	..
Paige-Detroit Motor Car Co	..	..	..	700	..
§Reo Motor Car Co	25⅛	26⅛	32	33	— ⅛
§Reo Motor Truck Co	11⅞	12⅝	24	25	+1¼
Studebaker Corp. com	41	43	156½	159½	—3
Studebaker Corp. pfd	94	96	110	114	—1½

INACTIVE STOCKS

§Atlas Drop Forge Co	..	25	31½	..	+3
Kelsey Wheel Co	185	..	295	..	..
§W. K. Prudden Co	19¼	..	32	34	+2
Regal Motor Car Co. pfd	..	25	10	15	—5

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*Old. †New. ‡And accrued dividends. §Par value $10.

Hoff Pullman President

Succeeds J. C. Schmidt—Co. Is Operating Plant at Full Capacity

YORK, PA., Jan. 14.—C. L. Hoff, general manager of the Standard Chain Co., this city, has been elected president of the Pullman Motor Car Co., to succeed John C. Schmidt, for the past four months the head of the Pullman company. The duties of former-President Schmidt, who is also president of the Standard Chain Co., having become too strenuous, is given as the cause for the change.

The Pullman company has embarked on one of its most successful seasons, the factory being operated to its fullest capacity. More than 600 men are now employed on the day and night shifts. Improvements have recently been made to the plant at a cost approximating $100,000.

W. F. Grove, for the past seven months connected with the Bell Motor Car Co. as general sales manager and factory superintendent, has resigned his position to become the head of the York Motor Car Co., a new organization established for the sale of Pullman cars exclusively. The company has located its headquarters at 217 North George Street, where a show and salesroom and service station will be maintained. A full line of automobile tires and accessories will be handled by the company. The district covered by the agency includes York, Adams and Lancaster counties. The York Auto Exchange was formerly the agency for the Pullman car in York.

Good Patents Often Unworkable

(*Concluded from page* 119)

inventor will still be deprived of the right to make the improved form of the device without the consent of the second patentee until the second patent expires.

Under these circumtsances, obviously the thing for the parties to do is to reach some business agreement, and this is usually the outcome, and it accounts in a large measure for manufacturing concerns holding a series of patents covering the development of the articles they manufacture. Often a single article, such as a spark plug will be covered by a half dozen or more patents, the earlier ones having broad claims on the particular type of plug, and the later ones going into the detail structure or perhaps to the process of manufacture of the plug or of a part of it, such as the porcelain.

Patents cannot, therefore, be segregated and held up individually as representing the product solely of the patentee; each is simply a step in the advancement of the art; merely the carrying forward of ideas previously expressed in broader terms, each patent being coupled with perhaps a dozen others, all of which are necessary to form the links of a chain of protection for a particular article of manufacture.

Licensing System for Dealers and Users Legal

NEW YORK CITY, Jan. 14—Holding that the Victor Talking Machine Co.'s system of price maintenance is legal, the United States Circuit Court of Appeals in New York has reversed the decision of the United States District Court. The Victor company brought suit against R. H. Macy & Co., this city, the complaint being in regard to its licensing system, by which dealers are licensed to sell Victor goods, and purchasers are licensed to use them. Each Victor machine bears a plate stating that it is not sold, but rented on a royalty under certain patents, and that it becomes the property of the user on the expiration of the patents. It is also provided that for violation of the license the machine may be taken back by the company and the royalty refunded less 5 per cent per year for use. By these provisions the Victor company is given full control until the expiration of the patent.

All-Steel Co. Elects New Board of Directors

ST. LOUIS, MO., Jan. 14—The All-Steel Motor Car Co., this city, has elected a new board of directors as follows: C. L. Smith, E. F. Stockholm, F. V. L. Smith, A. C. Duncan, John Hambeacon, Fred Smith and O. O. Trorlicht.

Brig.-Gen. E. J. Spencer has stepped down as president of the company, and it is stated that a new head will be selected at the next meeting of the board of directors.

The company has a capital stock of $400,000, of which half is paid in. Its plant in Macon, Mo., which will employ about 750 men, will be opened within sixty days.

Patterson and Burrows Are Partners

DETROIT, MICH., Jan. 12—Fred J. Patterson, formerly with the Ferro Machine & Foundry Co., and the Steel Products Co., both of Cleveland, and F. J. Burrows, who was buyer for the old Briggs-Detroiter Co., have formed a partnership as manufacturers representatives. Headquarters have been taken in the Kresge Building. The new firm has thus far secured the representation of the Toledo Steel Tube Co., the Hoosier Castings Co., the Curtis Screw Works and W. W. Wainwright & Sons.

Randall-Faichney Reorganized

Management Unchanged—New Company Takes Over Assets of Old One

BOSTON, MASS., Jan. 17—The Randall-Faichney Co. has been reorganized, the new company taking over all the assets of the old one including the building and good will of the business. The production of motor car accessories will be continued and a number of new products added. The management will be the same as during the past nineteen years and the heads of the various departments are practically the same. The officers of the company are: President, W. A. Randall; vice-president, G. H. Faichney; treasurer, Chas. P. Blinn.

[illegible] the main plant of the Ford Motor Co., Detroit, Mich., the total number of office and shop workers and officials now on the payroll of the company is close to 35,000. Of this number there are more than 24,000 men employed in the plant here. The office force, shop foremen, superintendents and inspectors aggregate another 1,000 men employed here in Detroit.

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Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 28-Mar. 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Paterson, N. J. , Fifth Annual Show, Auditorium.
Feb. 29-Mar. 4	Ft. Dodge, Ia., Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Ia., Show, Tri-City Davenport, Rock [illegible] Tri-City [illegible].

Fuller Plant Progresses

KALAMAZOO, MICH., Jan. 8—Progress is being made on the new plant of Fuller & Son Mfg. Co., this city. This company manufactures parts for automobiles and trucks. The new factory is of concrete and steel construction.

All Pennsylvania Automobile Employees Must Be Insured

PHILADELPHIA, PA., Dec. 24—On Jan. 1, when the new Pennsylvania workmen's compensation act goes into effect, everyone engaged in the automobile business, whether manufacturing or selling, will have to be insured, Compensation will be paid to employees on the basis of 50 per cent of their wages, the minimum being $5 and the maximum being $10, the length of time during which it will be paid depending on the nature of the injury. The premium rates are based on each $100 of annual payroll, as follows:

	Premium	Pub. Liability
Dealers, including executive and clerical force	$0.61	...
Automobile and body manufacturing (exclusively)	.74	$0.05
Automobile manufacturing (turning out automobiles complete)	.56	.03
Automobile manufacturing — assembling of manufactured parts only	.51	.03
Automobile radiator manufacturing	.74	.05
Automobile salesrooms (no garage or repair shop)	.33	.10
Automobile top manufacturing	.45	.05
Automobile windshield manufacturing	.56	.05

Simms Magneto and Generator on Maxwell Record Holder

Los Angeles, Cal., Jan. 14—The Maxwell stock car, which established a record of 22,022.3 miles of continuous running for nearly 44 days under [redacted] him as office manager.

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Ohio's Chauffeur License Law Not Enforced

Columbus, Ohio, Jan. 15—According to instructions issued by W. H. Walker, Ohio Registrar of Automobiles no attempt will be made to enforce the chauffeurs' license law in the State until the highest court finally passes on the question of constitutionality of the law. In a letter written to Joseph Cisan, Jr., examiner of chauffeurs at Cleveland the instructions are given that applicants for chauffeurs' licenses must be informed of the unsettled condition of the law and to discourage all chauffeurs from registering.

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Automobile Securities

	1915 Bid	1915 Asked	Bi
Ajax Rubber Co. (new)	..	..	71
Aluminum Castings pfd	95	100	
J. I. Case pfd	..	85	
Chalmers Motor Co. com	..	96½	1
Chalmers Motor Co. pfd	..	93½	1
Chevrolet [redacted]			
Elect [redacted]			
Fi			
F			

[redacted] Co., has [redacted]ors of the defunct Herreshoff Motor Co., will receive approximately 30 per cent of their claims. Thus far the trust company has paid 17 per cent in dividends. The claims filed totaled $213,967.92. This amount has been reduced to $95,570.49 owing to the discovery of duplications, withdrawals and disallowances. Claims totaling $616.85 are undecided.

Missouri's 1915 Registration 76,462

Jefferson City, Mo., Jan. 12—The total registration of motor vehicles in Missouri during the year 1915 was 76,462, according to figures made public by State officials here. The total amount turned into the State treasury from automobile registrations was $323,292.50. Applications for 1916 licenses are coming in at the rate of 2000 a day.

N. Y. Registrations Increased

Prediction of 275,000 Cars in 1916—31,400 Cars Licensed in Metropolitan District

New York City, Jan. 15—Predictions of automobile registration of 275,000 for New York State in 1916 are based on the rush for licenses during the last fourteen days. In the metropolitan district 31,400 automobiles have been licensed so far, as against 22,000 for the same period last year. Chauffeurs licensed number 11,125, against 12,000 in the first two weeks of 1915. Licenses issued to chauffeurs and automobiles so far this year have brought a revenue to the State of $285,000. Last year's revenue for the corresponding period was $202,000. For all of last year in the district 110,000 automobiles and 55,000 chauffeurs were licensed.

Pennsylvania Registrations for 10 Years $6,000,000

Harrisburg, Pa., Jan. 17—During the past ten years that the State of Pennsylvania has been licensing automobiles more than $6,000,000 in fees has been turned into the automobile division of the State Highway department. In 1906, the first year the State licensed automobiles, the State highway department received $42,460.42. In 1915, the tenth year for licenses, the revenue from motor vehicles was $1,665,276.50. The revenue by years has been: 1906, $42,460.42; 1907, $59,604.91; 1908, $83,920.69; 1909, $126,954.95; 1910, $321,989.12; 1911, $492,523.50; 1912 $597,723.19; 1913, $841,069.41; 1914, $1,184,646.50; 1915, $1,665,276.50.

A Traffic Court for N. Y.?

New York City, Jan. 14—A traffic court has been suggested for this city to settle all traffic cases. Mayor Mitchel, who suggested the plan, thinks that the present traffic difficulties of the city would be greatly lessened by the establishment of a special Magistrate's Court which would have jurisdiction over all traffic cases, or at least over as many as could be brought to one locality, and which would be tried as a class by themselves.

Kansas City Cars Gain 33 Per Cent

Kansas City, Mo., Jan. 1—The registration of automobiles in this city increased practically a third during the year 1915. Final registration figures in the city license department show that the last license for the year was No. 9774, issued on Dec. 24. As all licenses must be renewed on Jan. 4, no others were issued during the remainder of 1915.

The number of licenses granted in Kansas City since 1908 follow:

Year	Licenses
1908 (half year only)	391
1909	1,184
1910	2,194
1911	3,370
1912	4,359
1913	5,430
1914	6,721
1915	9,774

Eight-Story Overland Service Building in New York

New York City, Jan. 14—An eight-story warehouse and automobile service building for the Willys-Overland company at 521 to 531 West Fifty-seventh Street, through to 518, 524 and 528 West Fifty-eighth Street will be built. The plans call for a fireproof structure of reinforced concrete construction which will cost approximately $300,000.

Adds 1500 Automobile Cars

New York City, Jan. 14—The Lehigh Valley Railroad has placed orders for 1500 new automobile cars, which will be 40 ft. long, with 10-ft. double staggered doors, and will have both steel underframes and steel ends.

No Duty on Cars in Paraguay

Asuncion, Paraguay, Dec. 31—A law enacted Nov. 8, 1915, provides that unused vehicles, including automobiles and trucks, together with their accessories and spare parts, shall be exempt from import duty in Paraguay for a period of two years from that date. The suspended duty on motor vehicles imported into that country amounts to 62 per cent ad valorem, including surtaxes.

Better Trip Reset on 1916 Speedometers

(*Concluded from page* 138)

Like similar instruments it is a centrifugal type with a hand covering a dial reading up to 60 m.p.h. The trip mileage reads to 100 and the season mileage to 100,000. The latest Ford type, model FF-16, is mounted flush with the dash or the windshield strip, and sells for $15.

Garford

No changes have been made in the Garford instrument. It is a centrifugal type using a revolving ball race mounted on the main driveshaft. In this race are ½-in. steel balls held in place by an inverted steel cup. The inner surface of the cup is so designed that the centrifugal force of the steel balls which travel in radial cam grooves, raises the cup in proportion to the car speed. The movement of the cup is transmitted to the indicating needle. The Ford type lists at $12.50 and a larger size at $15.

Factory Miscellany

Peerless Tube to Add—The Peerless Tube Co., Bloomfield, N. J., will erect an addition to cost $13,100.

Tower to Build Trucks—R. J. Tower is planning to construct a motor-truck factory at Greenville, Mich.

Winton Building Addition—The Winton Co., Cleveland, Ohio, is erecting an addition to its plant at Berea Road, to be 80 by 300 ft.

Ward-Leonard to Build—The Ward-Leonard Electric Co., Bronxville, N. Y., will build a two-story plant, 100 by 185 ft., which will cost $35,000.

Jackson Top Co. Formed—The Jackson Winter Top and Special Body Works, Jackson, Mich., was recently formed in Jackson, Mich., to make automobile tops and bodies. Headquarters are at North Columbus Street.

Rochester Motors Factory—The Rochester Motors Co., Rochester, N. Y., is erecting a brick fireproof factory on Wren Street at an estimated cost of $9,000. The new structure will be 62 by 150 ft. and one story high.

Chester Rubber to Build—The Chester Rubber Tire & Tube Co., Chester, W. Va., will take bids in March for a plant to cost $720,000, including three structures, one 50 by 170 ft., another 40 by 75 ft. and the third 42 by 75 ft.

Ohio Motor Makes Lease—The Ohio Motor Mfg. Co., Springfield, Ohio, capitalized at $500,000, has leased part of the plant of the Winters-Coleman Scale Co. and will install machinery to manufacture internal combustion engines. The company is contemplating the erection of a large plant at Canton, Ohio.

Takes Over Automatic Screw—The Gas Motor Efficiency Co., Janesville, Wis., has taken over the business of the Automatic Screw Machine Co., Janesville, which has manufactured spark plugs for several years. The spark plug department will be greatly enlarged, while the production of liquid fuel vaporizers will also be increased.

Rockwell-Drake Plant in Plainville—The Rockwell-Drake Co. will begin the building of a one-story factory 100 by 130 ft. on a site in Plainville, Conn., recently purchased by Albert F. Rockwell, late of the New Departure Mfg. Co. The company, among other things, manufactures ball bearings and is now located at 78 Grove Street, Hartford.

Newcastle Co. to Sell Homes to Employees—The Greater Newcastle Co., with a capital stock of $100,000, has been formed in Newcastle, Ind., Jan. 10, those interested being President Walter E. Flanders and others connected with the Maxwell Motor Co. The purpose of the new company is to build, rent and sell homes to workingmen of the Maxwell plants.

35,000 on Ford Payroll—Including the main plant of the Ford Motor Co., Detroit, Mich., the total number of office and shop workers and officials now on the payroll of the company is close to 35,000. Of this number there are more than 24,000 men employed in the plant here. The office force, shop foremen, superintendents and inspectors aggregate another 1,000 men employed here in Detroit.

The Automobile Calendar

Jan. 15-22	Detroit, Mich., Show, Detroit Automobile Dealers' Assn.
Jan. 17-19	Erie, Pa., Show, Erie Automobile Dealers' Assn.
Jan. 17-22	Rochester, N. Y., Show, Exposition Park, C. A. Simmons, Mgr.
Jan. 17-22	Wilmington, Del., Show, Wilmington Automobile Show Assn.
Jan. 18-21	Fargo, N. D., Show, North Dakota and Minnesota Automobile Dealers' Assn.
Jan. 18-22	Baltimore, Md., Show, Fifth Regiment Armory.
Jan. 25-29	Lancaster, Pa., Show, Conestoga Park Pavilion.
Jan. 22-29	Montreal, Que., Show, Almy's Bldg., Automobile Trade Assn., Ltd.
Jan. 22-29	Chicago, Ill., Show, National Automobile Chamber of Commerce; Coliseum and First Regiment Armory.
Jan. 24-29	Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.
Jan. 24-29	Scranton, Pa., Passenger Car Show, Town Hall.
Jan. 24-30	Portland, Ore., Show, Armory, Portland Automobile Dealers' Trade Assn.
Jan. 25, 26, 27	Montgomery, Ala., Show, Klein Bldg., Montgomery Automobile and Accessories Dealers.
Jan. 29-Feb. 5	Columbus, Ohio, Show, Memorial Hall. Columbus Automobile Show Co.
Jan. 29-Feb. 5	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.
Jan. 31	Scranton, Pa., Show, Commercial Car Show, Town Hall. H. B. Andrews, Mgr.
Jan. 31-Feb. 5	Fall River, Mass., Show, State Armory. R. C. Borden, Mgr.
Feb. 1-3	Frederick, Md., Show, Armory.
Feb. 1-5	York, Pa., Show, York Auto Dealers' Assn.
Feb. 2-5	Buffalo, N. Y., Show, Auditorium, Buffalo Automobile Mfrs. and Dealers' Assn.
Feb. 2-5	Poughkeepsie, N. Y., Show, State Armory.
Feb. 7-12	Kansas City, Mo., Show, J. I. Case, T. M. Bldg., Kansas City Motor Dealers' Assn.
Feb. 7-12	Duluth, Minn., Show, Armory, Duluth Automobile Dealers' Assn.
Feb. 8-11	Grand Forks, N. D., Show, Auditorium.
Feb. 9-12	Peoria, Ill., Show, Coliseum, Peoria Automobile and Accessory Assn.
Feb. 12-19	Albany, N. Y., Show.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Nashville, Tenn., Show, Hippodrome. J. A. Murkin, Mgr.
Feb. 14-19	Des Moines, Ia., Show, Des Moines Auto. Dealers' Assn.
Feb. 14-19	Winnipeg. Man., Show, Ford Plant, Winnipeg Motor Trades Assn.
Feb. 19	Newark, N. J., Show, First Regiment Armory, C. G. Fitzgerald, Mgr.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory. B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 28-Mar. 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Paterson, N. J. , Fifth Annual Show, Auditorium.
Feb. 29-Mar. 4	Ft. Dodge, Ia., Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Ia., Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
Mar. 8-11	Mason City, Ia., Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
Mar. 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
Mar. 28-Apr. 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 20	Chicago, Ill., Amateur Drivers' Race, Chicago Motor Speedway.
May 30	Indianapolis Track Race.
June 17	Chicago Track Race.
June 28	Des Moines, Ia., Track Race.
July 4	Minneapolis Track Race.
July 4	Sioux City Track Race.
July 15	Omaha, Neb., Track Race.
Aug. 5	Tacoma Track Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Track Meet.
Sept. 15	Indianapolis Track Race.
Sept. 16	Providence Track Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Track Race.
Oct. 14	Chicago Track Race.

The Week in the Industry

Bissett Sales Mgr.—H. E. Bissett has become sales manager of the Michigan Specialties Co., Detroit.

Valentine Standard Tire Sales Manager—R. F. Valentine has become sales manager of the Standard Tire & Rubber Co., Cleveland, Ohio.

Kearney Heads Fisk Dept.—J. M. Kearney has been promoted to head of the service department of the New York branch of the Fisk Rubber Co.

Herold Joins Dodge Distributor—F. J. Herold has become general sales and service manager of Henry Bros., distributors of Dodge cars in Union, N. J.

Robinson Portland Kissel Mgr.—A. S. Robinson of San Francisco and one-time manager of the Los Angeles branch for the KisselKar, has been appointed manager of the Portland, Ore., KisselKar branch.

Stockbridge Succeeds Johnson—F. W. Stockbridge, sales supervisor in the East for the Winton Co., is new manager for the factory branch in Minneapolis, Minn. He succeeds J. S. Johnson, resigned after eleven years' connection.

Nerney Kissell Mgr. — H. W. Nerney, formerly one of the State representatives of the Pacific KisselKar branch, has been appointed manager of the San Diego house of the Pacific KisselKar, which was opened recently.

Jackson Joins Westinghouse—A. E. Jackson has been made Western representative of the automobile equipment department of the Westinghouse Electric & Mfg. Co., East Pittsburgh. His headquarters will be at 2007 South Michigan Avenue, Chicago.

Dealer

Minneapolis Chevrolet Makes Change—The Minnesota Motor Car Co., Minneapolis, which handles Chevrolet cars in the Northwest, has decided to combine its place of business with the assembling plant which the Chevrolet Motor Co. will build on a site to be announced about Feb. 1. The building is to be completed by July 15.

Gets Sunderman Carbureter for New York City—The J. F. Renfro Co., Inc., New York City, has been appointed exclusive factory distributor for the Sunderman safety carbureter, and the former local sales office has been discontinued. All shipments are being made from Newburgh, N. Y., where 500 carbureters are being made a day.

Motor Men in New Roles

Conlon Federal Truck Sales Mgr.—H. A. Conlon has been appointed district sales manager by the Federal Motor Truck Co., his territory consisting of the Middle West. He was formerly with the company's Boston and Providence headquarters.

Hare Resigns—E. S. Hare, for 10 years with the Philadelphia branch of the Commercial Truck Co. of America, has resigned and will be special representative of the Packard company in that city and New York. Mr. Hare is president of the Philadelphia Motor Truck Assn.

Magruder Makes Change — George Magruder, well known on the Pacific coast and formerly identified with the Northwest Auto Co. of Los Angeles, is now in charge of the repair department for Manley-Thompson Brothers in Tacoma, Wash., Chevrolet distributors.

Scharps Joins Silver—C. E. T. Scharps will assume on Feb. 1 the management of the wholesale department of the C. T. Silver Co., New York representative of the Overland and Peerless cars. He was formerly automobile editor and advertising manager of the Sun, New York City.

Sigwalt Resigns—H. T. Sigwalt, who has been with the Federal Motor Truck Co., Detroit, Mich., during the past 18 months as advertising manager, has resigned. He has been succeeded by G. W. Cushing of the Detroit Board of Commerce, where he was editor of the *Detroiter*, the board's weekly.

Van Horn Oakland Sales Mgr.—W. H. Van Horn, formerly of Findlay, Ohio, has been named sales manager of the Hannon Motor Sales Co. of Tulsa, Okla., handling the Oakland line in several counties of the State. Mr. Van Horn was the Oakland representative in Findlay.

Underberg Advanced to Branch Mgr.—C. H. Underberg, in charge of the Tacoma office of the Fisk Rubber Co. has been advanced to the post of branch manager in Tacoma. W. E. Bayless has been advanced to the position of northern coast district manager, with offices in Seattle. He will have charge of the territory in Washington, Oregon, Idaho and British Columbia.

Thomsen Sells Mitchell in Davenport—Henry Thomsen, Davenport, Iowa, has purchased the McGivern Motor Co., 115 Harrison Street, that city, and the concern will be hereafter known as the Thomsen Motor Co. J. A. Zeaman will be retained as general manager. The Mitchell car will be handled and supplies sold.

Deibler Mgr. for Newman—Harry Newman, Inc., 702 Grand Avenue, Milwaukee, Wis., Chalmers distributer for Wisconsin, upper Michigan and southern Minnesota, has appointed J. B. Deibler, Chicago, general manager. Mr. Deibler is a native of Berlin, Wis., and has been associated with the automobile business for fifteen years. He served the Haynes as Chicago branch manager for eight years and later took the Pope-Hartford representation. In 1901 he made the first long-distance run in a self-propelled vehicle in this part of the country, driving an old Milwaukee steamer from Milwaukee to Oshkosh and return. It was the first product of the former Milwaukee Automobile Co., one of the first motor car manufacturers in the United States.

Dealer

Washington Items — Stewart-Warner Speedometer Corp., Seattle, Wash., has opened a new service station at 1710 Broadway under the management of T. M. Hart. The Seattle station will be run under the name of the Stewart products service station.

Through the initiative of the Portland Garage Owners' Association a meeting has been called to organize a State association of garage men.

Agencies for Hudson cars in the State of Washington have been appointed as follows: Washington Auto Co., North Yakima; F. M. Powell, Everett; W. H. Bland, Bellingham; C. T. Scurry, Aberdeen; Walker's Garage, Hoquiam; Rasmussen's Garage, Kent; Howe's Garage, Port Angeles; E. C. Tew, Olympia; W. J. Bendennick, Bremerton; Raymond Auto Co., Raymond.

Two New Buildings for Minneapolis—Two new automobile buildings are to be erected, one by the Willys-Overland Co. and the other by the Northwestern Automobile Co. The latter is to be at Harmon Place and Willow Street, opposite the new building for the Hudson and Locomobile cars. It will house Saxon and Chandler cars. The former is to stand on a tract made up of a new purchase of land adjoining a tract bought from Bowman & Libby, Inc., when it took over the Northwestern distributing agency. It is one block from the Automobile Show headquarters.

The AUTOMOBIL

NEW YORK, JANUARY 27, 1916

Twenty-five cents a co
Three dollars a year

CHALMERS · MOTOR · CO
Detroit, Mich., U.S.A.

Quality First

This is the car that split the cluttered market wide open to make room for itself. The 3400 r.p.m. engine of the new Six-30 Chalmers touring car records the fastest engine speed of any American stock car. Price, $1050—yet it's as able a car as ever bore the Chalmers name.

CHALMERS MOTOR COMPANY
Detroit, Michigan

The Envied Dealers

HUDSON SUPER SIX TRADE NAME REG.

This Year are Those Selling

$1375
at Detroit

Patented by Hudson
December 28, 1915
Patent No. 1165861

Hudson Super-Six

An Exclusive Motor—80% More Efficient

A **Hudson dealer can say this about the Super Six:**

"My car has a motor 80 per cent more efficient than any like-size motor ever built before.

"It has won the world's stock-car records, against every size and price and type.

"By every test, by every sort of performance, no other motor comes in range of this. No Eight or Twelve can match it. The highest-priced car on the market cannot do what this car does."

YIELDS 76 HORSEPOWER

And that dealer can say this:

"This Hudson Super-Six develops 76 horsepower. The best like-size motors heretofore delivered 42.

"Think of 76 horsepower from a small, light Six. The size is identical with last year's Hudson Six-40. No cylinders added, no complications.

"All that increase—that 80 per cent—comes through wiping out vibration. It is power that other motors waste. It proves this Hudson Super-Six the smoothest-running motor in the world."

"I CONTROL IT"

He also can say, "I Control It."

For this is a Hudson invention, controlled by Hudson patents. No other car, whatever its price, can perform like the Super-Six.

World's Records Broken

All Records up to 100 Miles

At Sheepshead Bay, a 7-Passenger Super-Six—a stock car—made fastest time for a Touring Car, in official tests, under supervision of American Automobile Association.

100 miles in 80 min., 21.4 sec., averaging ***74.67 miles per hour,*** with driver and passenger.

Previous best stock car time was made with a multi-cylinder car carrying driver only.

75.69 miles in one hour with driver and passenger.

Two laps made at 76.75 miles per hour.

Standing start to 50 miles per hour in 16.2 sec. A new record in quick acceleration.

So this car has no rival.

Any man who wants superlative performance can find it in Hudsons only.

THE CAR WILL PROVE IT

The Hudson dealer can make these claims, and the Super-Six will prove them.

This vast reserve power, combined with lightness, does amazing things. And does them without evident effort.

Men have never seen such flexibility.

In quick response, the Super-Six has broken all the records.

But the great fact is that all these things result from utter smoothness. So riding is like flying in the Super-Six. Engine wear is reduced to almost nothing. And all this extra efficiency means that much power saved, that much fuel.

Combined with all this are six luxurious bodies. They were built by master craftsmen, without any stint on cost. No costly car has ever shown more elegance and beauty. So the Super-Six looks its supremacy.

Hudson dealers this year offer all these exclusive advantages. No man who wants a fine car can resist them. And any man who buys an old-type motor, even for one-third less, will in the long run pay more than the Hudson costs.

Don't you think that Hudson dealers are in an enviable position?

7-Passenger Phaeton, $1375 at Detroit

Five Other Body Styles
Super-Six Catalog is Ready

HUDSON MOTOR CAR
COMPANY, DETROIT

Vol. XXXIV New York—Thursday, January 27, 1916—Chicago No. 4

The AUTOMOBILE

Chicago Draws the Curtain

33⅓% Gain in Attendance Over 1915 at Opening of Sixteenth Show—Decorations a Great Success—80 Gasoline Car Exhibitors—7 Electrics—52 Stripped Chassis

An example of the Japanese decorations

CHICAGO, ILL., Jan 22—Chicago's sixteenth annual automobile show opened this afternoon promptly at 2 o'clock with the usual crowds waiting at the doors of the Coliseum and the armory as in former years, and within one-half hour the entire lower floors were filled, setting at rest any thoughts as to a possibility of waning interest in the automobile in the Windy City and in the great Mississippi valley that have for a couple of years been enjoying unparalleled prosperity due to bumper crops and war-time prices. To-day's and to-night's attendance has not brought a symptom of indication of waning interest; rather, the curve is shot upwards in keeping with automobile production, the price of materials, the price of gasoline and the price of tires. Official figures to-night show a paid attendance almost 33 1/3 per cent in excess of last year, with a much larger attendance of out-of-town dealers, many of whom have arrived days ahead of last year, the only reason for which is found in the present shortage of freight cars to ship automobiles from the factories to the dealer.

50% More Dealers

The freight car problem in itself is enough to warrant dealers hurrying up, but there is a little nervousness due to the difficulty of getting deliveries, the rising price of materials slowing this up. The prospects are that before the end of the week the registration of dealers will be fully 50 per cent ahead of last year. Those arriving early hope to get the early-worm percentage of deliveries.

A Japanese Garden

Chicago's four-building show, always renowned for its decorative effect, is up to standard, all four buildings having walls and roofs entirely covered, giving a Japanese garden effect, with pagodas, Japanese tea girls, and Japanese scenes forming the roof draperies, the gallery fronts and, in short, concealing every bit of the walls. The entire interior of the Coliseum, the Coliseum annex, the Armory and the Greer building are in reality scenes snatched from the Mikado's realm, with more realism added by Japanese lettering on all signs, excepting the miniature electric ones that hang above the accessory exhibits. There are huge Japanese pillars filled with electric lights forming the major effect on the main floors; myriads of bright-colored Japanese flowers on the mural draperies; Japanese arches, Japanese

INTERIOR view of Coliseum taken from one corner of the gallery, showing the sea of lights and the general scheme of decorations, huge illuminated Japanese lanterns, typical Japanese arches with the enormous circle, and Japanese screens on which the name of the exhibit is carried out in miniature Japanese letters.

One side of the First Regiment Armory, showing every detail of the decoration. The hanging round the gallery gives a good idea of the richness of the effect

va[illegible] a typical Mikado scene, as typical as if tak[illegible] the famous Gilbert and Sullivan opera.

A T[illegible]

It[illegible] show with all of the old-time Chicago sho[illegible] Pneumonia Alley connecting the Coli-se[illegible] long lines of demonstrating cars on Wa[illegible] the Coliseum, more long lines on Mic[illegible] of the Armory; demonstrating mot[illegible]tic makers filling the streets and carr[illegible] signs; hotels filled with exhibitors who[illegible] any of the buildings; and vacant stor[illegible] Avenue are covered with improvised elec[illegible] new accessories or car makers who coul[illegible] within any of the four buildings.

T[illegible] Chicago hotel accommodation was tak[illegible] before the show started, theaters are near[illegible] railroads are running beyond capacity, in [illegible] West is stirred up with the automobile's great[illegible] year.

This year's show is unique in the long list of sixteen annual exhibitions staged in the historic Coliseum, the scene of so many national political conventions and historic in many other regards. For the first time in its career the Chicago show has few additional cars over the New York show. For years Chicago has come forward with a score or more of new exhibitors not seen in New York; there have also been numerous late body ideas that were not ready for the Gotham exposition; there were always many new motors, and a host of other new components and accessories. This year there is only one brand new car uncovered, this honor going to the Champion from Wabash, Ind., a conventional block type four-cylinder chassis at $750. There are, however, a few makes such as Glide, Farmack, Sun, a new Detroiter body and a new Halladay, details of all of which have already appeared in these columns.

But One Miniature Type

For the first time Chicago is practically free of anything in the complete automobile partaking of the cyclecar, or motor buggy idea, the Gadabout being the only miniature type seen. In former years Chicago distinguished itself by the first and largest exhibit of motor buggies, then came other days when the cyclecar held the novelty stage, but to-day it is as conventional a show as ever staged, conventional cars, and conventional accessories.

Last year there was a crop of new eight-cylinder motors not seen at New York; this year there is not a new motor with the possible exception of Continental showing one of its recent six-cylinder models which is seen for the first time at a show this year, as Continental did not exhibit at New York. There are no new eights, no new twelves; in fact, this feature is in strong contrast with a year ago, when there was a veritable landslide of premature eights, which were not ready for New York but were hurried into readiness for Chicago. For the first time in its career, the Chicago show is more of a duplicate of the New York show than ever before, with the possible exception of some body styles not shown at the Grand Central Palace.

More Car Exhibitors Than at New York

When the show is compared numerically with the recent New York exhibition, it is discovered that there is one more gasoline car manufacturer exhibiting at Chicago, the total for the Windy City being eighty, as compared with seventy-nine at the Gotham display. There are also two more electrics at Chicago than at New York, the respective totals being seven and five. New York, however, leads in the total number of gasoline cars and chassis on display, having 307 to Chicago's 294. Last year Chicago had 254 gasoline cars and chassis on exhibition.

Electrics in Armory

Chicago is the greatest electric city in the country; it is known as the home of the electric and, as usual, has the center of the armory set aside as an exclusive electric exhibit. This exhibit is smaller than usual with seven different makes, showing in all twenty-two different cars and a couple of chassis. Contrasted with former years, this electric display is unique by reason of an entire absence of gaudy colors and interiors, it being tradition to work all the colors of the rainbow into some of the cars and the upholstery.

This year dark colors dominate, with gray-striped interiors. Waverley has the sole exception, being a brougham with broad-striped upholstery. The body colors are generally dark with the possible exceptions of the green Milburn roadster, a blue Ohio brougham and a Baker with dark-gray body and panels and light-colored wire wheels.

Wire Wheels and Cord Tires Popular

There is a preponderance of wire wheel equipment on the electrics, Detroit showing four out of five with wire wheels, Milburn two out of three, Baker and R. & L. two out of four, and Ohio, Woods and Chicago not showing any. The seven electric makers exhibiting are Baker-R. & L., Detroit, Ohio, Milburn, Chicago, Waverley and Woods. There is a preponderance of pneumatic tires, seventeen out of the twenty-four vehicles and chassis using them. Practically all of them are cord types.

Eights Gain 400%

Reverting to gasoline cars, this show serves well to demonstrate the rapid growth of the eight-cylinder car during the past year and also to show the progress made in twelve-cylinder types. There are forty-two eight-cylinder cars and chassis as compared with eleven a year ago, a 400-per-cent increase. The twelves not represented a year ago are now represented by eleven cars and chassis, the exact representation that the eight had a year ago. This coincidence suggests what the relative figures will be a year hence. Six-cylinder cars and chassis have increased from 109 last year

Accessory exhibit on the upper floor of the Coliseum Annex showing illumined Stewart-Warner exhibit in the foreground

The Japanese decorations of the Chicago show are carried out with extreme thoroughness and the effect is as handsome as could well be desired. Besides using many pieces of Japanese handicraft of many kinds, there is lavish employment of special paintings on a very large scale. These, combined with hangings and with garlands and sprays of artificial flowers, give the decoration a completeness seldom equalled.

to 135; and four-cylinder types have dropped from 133 a year ago to 106 at present. So is the trend of events outlined by THE AUTOMOBILE for Dec. 30, a dropping in the number of different makes of fours and the increase going to sixes, eights, and twelves, all gainers.

More Polished Chassis Shown

The present show demonstrates that the use of polished chassis as show attractions is on the increase, and that more of these can be used to advantage is indicated by the crowds constantly found around these exhibits, and particularly those where the demonstrator gives periodical lectures on the job. There are fifty-two chassis this year, as compared with forty-four last year and as compared with fifty-six at the New York show this year. The Studebaker gold-plated chassis now making the complete circuit is attracting many, as are such cutaway exhibits as Overland, Cadillac, Hupmobile, Reo, Saxon, Chalmers, Marmon, Stearns, Buick, Chandler and others. A tabulation contrasting the car exhibits of the present show with those of former years shows those concerns that rely on chassis exhibits.

Five-Passenger Bodies Lead

The Chicago show offers interesting contrasts with New York in body exhibits, and, while there are scores of bodies seen at New York and also at Chicago, there are always many different styles seen at the Coliseum. In the high-priced field New York invariably leads Chicago, many of the Chicago jobs savoring more of the utilitarian type. The open five-passenger type is still a leader, with sixty-four different styles shown. It is closely followed by fifty-seven styles of six- and seven-passenger designs. There has been a big gain during the year in the closed types, such as detachable winter tops, touring sedans, etc.

Eighteen Demountable Tops

There are eighteen demountable winter top styles as compared with one a year ago, when Kissel, the pioneer in this design, held sole sway. The West is appreciating this type of body, the demand being so great that nearly a dozen Chicago dealers and distributors have added body-building departments for the production of these winter types. The sedan type has increased but little, from seven a year ago to ten this season, these figures, however, not truly representing the increase in these types, as several dealers are exhibiting sedans in their salesrooms, due to lack of space in the exhibit space at the show.

Town Cars Gain

The town car following has increased very perceptibly during the year; in fact, Chicago has made rapid strides during the past year as a closed-car town. This closed-car demand is not local to Greater Chicago, but visiting dealers speak generally of the increased use of the automobile throughout the winter and the natural increase in demand for closed types. Limousines are not making gains; in fact, they are a little behind a year ago. Coupés have made little progress. Thirty-two different makes show wire wheels on all or some of their show cars, this being over 40 per cent. Cord tires are on sixteen different makes. In other words,

How the Japanese effect was worked into the accessory section

20 per cent of the exhibitors are showing cords on some or all of their cars and chassis exhibited.

Commendable Variety in Colors

From a body color viewpoint the present Chicago show is the brightest in the long line of sixteen annual exhibitions. Manufacturers are displaying commendable judgment in not making the show too much like a morgue by having everything in black. During the past fall THE AUTOMOBILE has carried on a consistent campaign for more color in car bodies, on the ground that black is one of the poorest body colors, being the easiest to dirty and the hardest to keep clean.

Color Options Increasing

THE AUTOMOBILE has made a canvass of car manufacturers on this question of car color, and the figures show that color options are rapidly increasing, not only with the high-priced makers, but many medium-priced car manufacturers are realizing that it is often possible to sell a car with a color option that would not be sold without it. Some dealers selling cars listing at under $1,000 have during the past fall instituted the plan of repainting bodies on new cars, giving the buyer several options, together with such additionals as slip covers and tire covers to match at an additional cost of $100 or thereabouts. Many sales have thus been made that otherwise would have gone to higher-priced cars giving some color options.

Brightness Without Gaudiness

Standing in the gallery of the Coliseum and looking over the couple of hundred cars on the main floor, the scene is much more brilliant than in former years, and, while more brilliant, it is not that useless gaudiness of former shows, but, with a few exceptions, the colors are practical colors and the interior finish and upholstery are feasible for general use.

Large-production manufacturers, such as Overland, Buick, Studebaker, Maxwell, Dodge and Reo, almost invariably have dark colors exclusively. Black dominates, but there are examples of dark greens and a few dark blues.

In the galaxy of color at the show Velie leads in novelty with three special show cars—one in red, one in white, and one in blue—a publicity scheme that is immediately apparent yet effective as a show exhibit. Among the other exhibits, the grays predominate. These are of all shades from gunmetal tints to battleship hues and to others much lighter. The broad striping usually found on them is absent this year.

In the brighter colors, reds, oranges, yellows and creams are popular. There are many maroons, many wine-colored bodies, and several combinations of cream and chocolate tints. Mercer has a bright yellow, while Scripps-Booth, Stutz and Case have orange-yellows. There are a few whites that are more for show purposes, such as Paige, Inter-State and Hudson, these generally having the broad black-and-white-striped upholstery.

Many Have Color Options

Looking next at color options given by makers, it is seen that the option policy is making good headway. There are nearly ten concerns that offer a wide range of colors, these including Packard, Winton, Locomobile, Mercer, White, Fiat, Pierce-Arrow and Mitchell on its closed cars.

Stutz shows bright colors on all models—two reds, a yellow, and a blue. This company gives six color options at a slight extra cost, these colors including maroon, gray, ultra-marine blue, white, and battleship gray in addition to those on exhibit.

National is a believer in colors, and for an extra price gives a choice of five, including gray, blue, cream, white and maroon. Scripps-Booth offers four colors: Black, gray, royal blue and English biscuit.

There are many concerns offering two or three color combinations. Thus, Oakland has green, gray and blue; while Chevrolet, Oldsmobile, Saxon, Buick and Westcott, have two each, at extras ranging from $25 to $50.

Other Standard Colors

Among some of the standard colors other than black being offered at present are: Chandler, blue; Marmon, blue; Kissel, blue; Studebaker, blue; Cadillac, Reo and Haynes, green; Willys-Knight, blue, and Paige, blue. These concerns offer other color combinations at extras that extend from $30 to $100.

Some color schemes seen at the show which tend to show the effort to get away from black are: Marion, four maroon cars; Cole, two greens, a red and a light yellow; Auburn, one dark green; Pathfinder, one yellow, one red, and two dark types; Lexington, a gray, a green, and a red; Hollier, a dark red and a black; McFarlan, a dark maroon; Premier, two grays and a green; Briscoe, a green, a cream, a red, and a light brown; Apperson, a blue, a gray, and a maroon; Moon, a gunmetal, a gray and a black; Chalmers, two wine-colored styles; Hupmobile, a gray, a dark brown, and two blacks; Marmon, grays; and those showing dark types, some blacks and others very dark greens are Elcar, Austin, Paterson, Allen, Detroiter, Glide, Grant, Metz, etc.

Taking first the gasoline cars it is found that eighty makers of this class of cars are represented as compared with seventy-nine at the New York show. Two hundred and ninety-four chassis are on display at the Chicago show as against 307 at New York, these being divided in such a way that the six-cylinder types lead with 135, the four-cylinders ranking second with 106 and the eights and twelves numbering forty-two and eleven respectively. New York had 136 sixes, 108 fours, thirty-nine eights and thirteen twelves. Of the 209 chassis shown at the Chicago show, fifty-two are stripped.

Two hundred and forty-two body types are shown. Of these 187 are open cars, sixty-five being five-passenger, fifty-seven six- and seven-passenger; thirty-three two-passenger; twenty-three three-passenger and ten four-passenger. In the closed car group fifty-five models are exhibited, seven being coupés, ten sedans, eighteen demountable tops—these include two-, three-, four-, five- and seven-passenger capacities—ten limousines, one landaulet, five town cars and two berlines. Putting these figures in the balance with New York, Chicago leads in the touring car class of exhibits by four, in demountable tops by three, in coupés by one, and in berlines by one. New York was ahead of Chicago in roadster types, having seventy-seven as against Chicago's sixty-six. In the cabriolets New York had five—a lead of three—in limousines, eleven—a lead of one; in landaulets, three—a lead of two. In the town car types they were even, each having five.

There are forty more gasoline cars on display to-day than there were at the 1915 show. One hundred and thirty-three fours were shown last year, as against 106 this year. Six-cylinder models show a material gain over last year, when only 110 were exhibited, compared with 135 this year. As an evidence of the gain in popularity of the eight it may be said that there are forty-two chassis being shown, whereas, only eleven were at the 1915 show. Of course, the twelves, being a 1916 development, no comparison is possible with other years.

More touring cars were displayed at the 1915 show than are to be found on the floors of the Coliseum, Greer Building and Armory to-day, although the difference is but one. Of the roadsters there were only forty-two last year, compared with sixty-six this year, but this is accounted for largely perhaps by the fact that three- and four-passenger bodies come under roadsters this season. In the other body types little difference is to be found in numbers as between the 1916 and 1915 Chicago shows.

The use of wire wheels seems to be on the increase, since thirty-two makers out of the eighty represented here are showing some, if not all, models so equipped. Of this thirty-two, twenty-three are Houks, four Rudge-Whitworths, two Freyers, or F. & W.'s, two Universals and one is Spanger. This shows that 40 per cent of the makers now are using wire wheels as stock equipment, or offer the purchaser an option, sometimes at a slight increase in price.

Cord tires are found on some of the models of 20 per cent of the manufacturers showing at Chicago. These are not stock on all models of all the makers exhibiting them, but are found predominating among sixteen separate exhibitions at the Chicago show. Of these sixteen, ten are Goodrich Silvertowns and six Goodyear cords.

NUMBER OF EXHIBITS

Number of manufacturers exhibiting	80
Total number of chassis exhibited	294
Number of four-cylinder motors	106
Number of six-cylinder motors	135
Number of eight-cylinder motors	42
Number of twelve-cylinder motors	11
BODY TYPES (OPEN CARS)	
Five-passenger	64
Six and seven-passenger	57
Two-passenger	33
Three-passenger	23
Four-passenger	10
Total	187
BODY TYPES (CLOSED CARS)	
Coupes	7
Sedans	10
Demountable tops	18
Cabriolets	2
Limousines	10
Landaulets	1
Town cars	5
Berlines	2
Total	55
Number of stripped chassis	52
Makers using wire wheels	32

Houk	23	Universal	2
R.-W.	4	Spanger	1
F. & H.	2		

Makers using cord tires	16

Goodrich	10	Goodyear	6

Chicago Has Salon Show For First Time

CHICAGO, ILL., Jan. 24—A new thing in Chicago motor car circles is the Salon which opened Jan. 24 at the Auditorium Hotel. Although such an exhibition has been held for several years in New York at the Astor during show week, this is the first year that a similar affair has been staged in Chicago. The promoters are confident of the success of the venture, and seemed well pleased with the number of visitors during the opening hour.

Though naturally on a smaller scale, the Salon is similar in its scope to that held in New York this year. It includes several American cars as well as the foreign types. Those exhibiting are White, Simplex, Brewster, Peugeot and Lancia. The Salon has always been regarded as a high class body show, and the thought in exhibiting in Chicago is to get such an event started, because it is very certain that there is a place for it in Chicago.

Therefore most of the bodies on view at the auditorium are special designs that reflect the skill of the body makers. One of the White chassis carries an especially attractive Sedan upholstered in tapestry and having the new V fronted windshield that lends an unmistakable touch of class. One of the Lancias is also a closed type of Sedan design which is built with a very low roof to give a rakish appearance, this effect being accentuated by the slanting windshield.

A. C. H. Test Perfection Heater

A CERTIFICATE has just been issued by the Automobile Club of America covering a test made on the Perfection heater manufactured by the Perfection Spring Service Co., Cleveland, Ohio. The object of the test was to determine the effect of the heater on the power, fuel consumption and back pressure of the motor and to note the temperature of different points of the radiator surface.

The Perfection heater consists of a heat radiating element having six copper tubes connected to cast iron headers at each end. A casting which is clamped around the exhaust pipe between the motor and muffler and which contains means for by-passing a portion of the gases through the copper tube radiator is connected to the radiator by a flexible tube. In the casting is a butterfly valve which serves the double purpose of catching some of the exhaust gases and of shutting off the heater when its use is not desired.

Five runs were made on the motor with the heater on, off, with valve open and valve closed and a check run with the heater off again. The conclusions showed that the power output and the gasoline consumption of the motor were not adversely effected by the use of the heater; the back pressure was reduced when the heater was attached and its control valve opened; the back pressure remained the same as it was without the heater when the control valve was closed; the temperature was substantially the same in the center and outer tubes of the radiator.

Only One Quite New Car at Chicago

Ten Cars Shown for the First Time Contain Only One Surprise—Several Modifications in Design Noted on a Few Others

AS it was anticipated, there has never been a Chicago automobile show that differed so little in its exhibits from the New York exhibition. Not a single well-known manufacturer had a surprise to spring and there was not even an additional eight or twelve, to be found in motor form alone. Thus a review of the new cars at Chicago is mainly a list of the features of those few which have been altered in some small particular since their announcement in the summer or fall of 1915 when they were mostly described fully in THE AUTOMOBILE.

Of course, on the occasion of the Chicago show a number of cars are expected which on account of the lack of space or for other reasons did not appear at the season's opening in New York. Consequently it is not surprising to find at the Coliseum this week ten productions which have not been unveiled to the public gaze previously. These include the Monitor, Paterson, Detroiter, Glide, Dort, Halladay, Elcar, Farmack, Elgin and Gadabout. All of these have been made known to the public through descriptions in the trade papers and some of them are makes that have been on the market for a long time, such as the Monitor, Paterson, Detroiter, Glide, Halladay, while the Dort is a year old, and the Elcar is the product of a concern which has been delivering motor cars for many years, though the name is new. The Farmack and Elgin are making their initial appearance at the Chicago show.

In addition there is one car which has come unheralded to the Chicago exhibition, this being the Champion, produced by the Champion Auto Equipment Co., Wabash, Ind. The car is of the conventional small four type in most respects, but is featured by a special tire inflating arrangement such that any two of the tires can be pumped up at the same time while the car is on the road.

Though we are getting our first actual view of these cars, several of them have been described and illustrated in the Dec. 30 and Jan. 6 issues of THE AUTOMOBILE, among these are the Paterson, which is unchanged from its original announcement, the Glide, the Dort, Farmack and the Sun.

Champion Has Unique Tire Pump

Offering the most unusual feature of any car at the show is the new Champion, a small four which has an arrangement designed to pump the tires while the car is under way on the road. This arrangement consists of a diaphragm type of pump, mounted on the motor and driven from the front-end timing drive. From the pump air is carried to a distributing box on the dash, and thence to each of the four wheels. The air is led through metallic hose and the connection to the tire is through a stationary collar on each. The collar is fitted with hydraulic packing between the stationary portion and a rotating drum upon the wheel. A metal hose from the rotating drum to the tire valve completes the connection.

The distributing valve on the dash is so arranged that any one or any two tires may be inflated. It also is fitted with an automatic blow-off valve which whistles when the pressure reaches a designed amount, and prevents any more air being forced into the tire. The pump is thrown into operation by pulling a lever on the dash.

So far as the car itself is concerned it is a conventional small four, having a 3¾ by 4¼ in. block engine as a part of the unit power plant, a single plate clutch and three-speed gearset completing this unit. Carburetion is provided by a Schebler instrument and ignition by a Dixie magneto. A two-unit starting and lighting system is supplied, the drive is of the Hotchkiss type through cantilever rear springs and a floating rear axle. The axle is a Peru make and the motor is a G. B. & S. build. Roadster and five-passenger touring cars are offered at $750, the wheelbase being 110 in., and tires are 32 by 3½. The car is the product of the Champion Auto Equipment Co., whose factory is at Wabash, Ind. Present plans are for the production of 5000 cars during the coming season. One feature of the car is the fact that the tires are manufactured by this concern. They are called Perfection tires and use an asbestos fabric instead of the conventional cotton fabric.

Brief Details of Other New Cars

The Sun is a production of the Sun Motor Car Co., Buffalo, N. Y., and is a new light six with the popular 3 by 5-in. cylinder dimensions. It has Remy electric equipment, a dry-plate clutch, and Hotchkiss drive. Fuel is fed by the vacuum system, and the wheelbase is 116 in.

The Elcar is a conventional type of four-cylinder car with a five-passenger roadster body, selling at $775. It is made by the Elcar Carriage & Motor Car Co., Elkhart, Ind. It has a 3½ by 5, four-cylinder motor in which the intake valves are in the head with the exhaust valves on the side. The gearbox is in unit with the motor and the Gemco axle is employed.

The Paterson is a six-cylinder appearing in five- and seven-passenger bodies, selling at $985 in five-passenger form. The parts are standard, being a Continental motor, Warner gearset, and a Weston-Mott axle. The wheelbase is 117 in. and the tires 32 by 4.

The Farmack likewise has been described previously. This is a four, selling at $865, in five-passenger touring or roadster form. The 3½ by 5 in. motor is distinctive in that it uses an overhead camshaft as well as overhead valves. The Elgin is a six at $845 as a five-passenger touring car or a Clover leaf roadster. The Falls motor is 3 by 4½ in. block cast, the wheelbase is 114 in. and the tires 32 by 3½.

The Dort is a four, using a 3¼ by 5 in. block motor, unit power plant, cone clutch, cantilever rear springs. It lists at $650 as a touring car and $540 as a roadster. The electrical equipment is Westinghouse.

The Glide is a six at $1,095, with a demountable sedan top at $200 additional. It uses a 3 by 5-in. block Rutenber motor, Westinghouse electrical equipment, and Hotchkiss drive

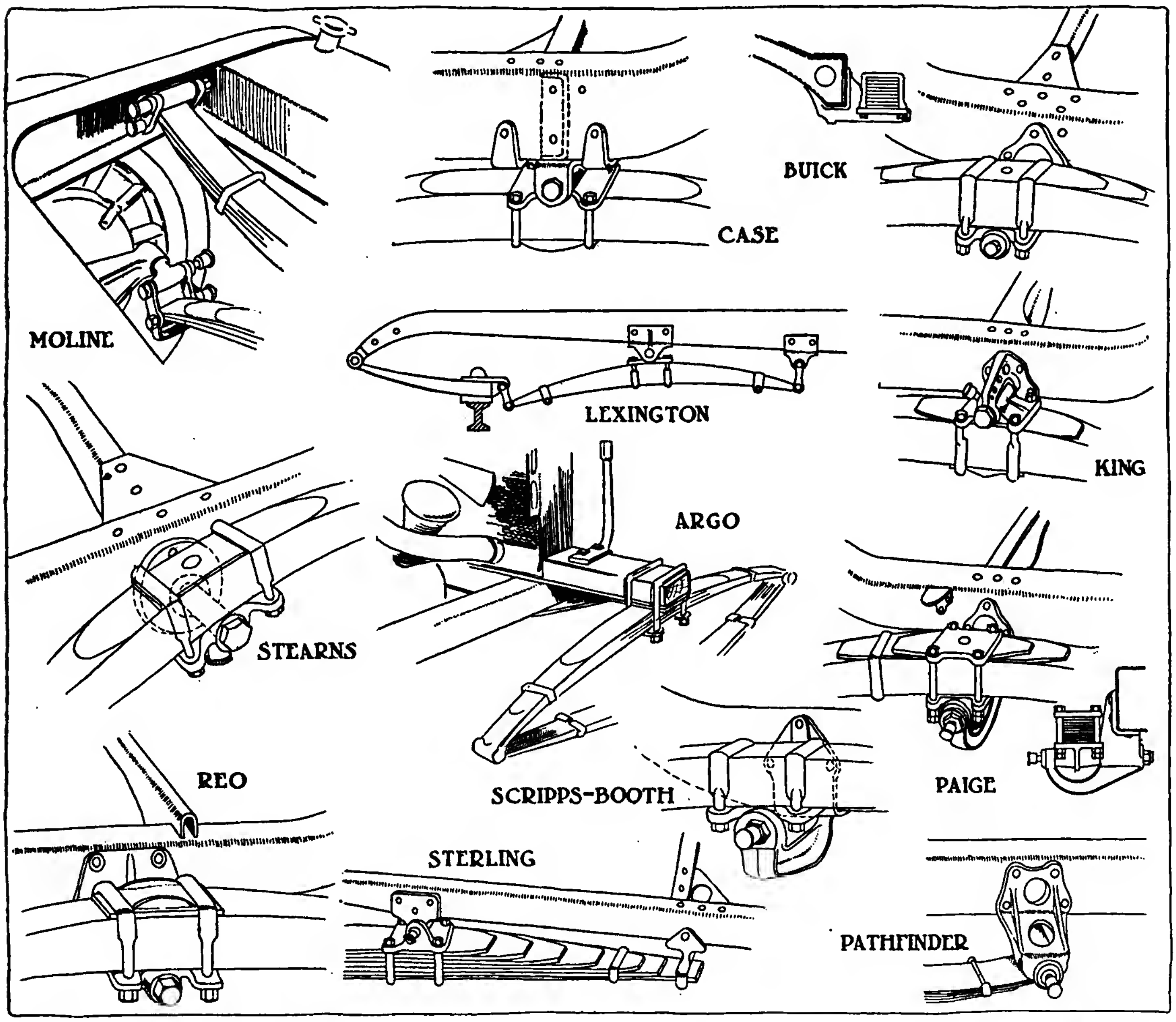
A new model of the Halladay has been produced within the past few weeks. This is a small six less in size and price than the model R which was the single model scheduled previous to the first of the year. The motor is practically the same as the 3 by 5 in. Rutenber employed in the large model, but the wheelbase is less, being 118 instead of 122 in. and tires are 33 by 4 instead of 34 by 4. In general desig the new model is the same as the model R, employing Stewart vacuum fuel feed and a Stromberg carbureter, floatin axles, pump cooling, and so on. This is made by the Barle Mfg. Co., Streator, Ill.

The Detroiter has produced a new six, which is known a the 6-45 and has a six-cylinder Continental-Detroiter moto of 3¼ by 4½ in. dimensions. It sells at $1,098, with a very modern double-cowl touring body. A long, sloping hood, slanted windshield, hooded radiator and other features of up-to-dateness are incorporated. Some of the major specifications are: wheelbase, 118 in.; tires, 33 by 4; 18-gal. gasoline tank feeding through a Stewart vacuum-gravity system; Auto-Lite, two-unit cranking and lighting system; Hotchkiss drive through semi-elliptic underslung rear springs; and floating, ball-bearing axle. In addition to a very full list of stock equipment, special equipment is offered in tonneau windshield, Moto-Meter, and wire wheels.

There has been a slight change in the size of the Monitor six since it was announced earlier in the winter. This consists in the increase of the bore of the motor ¼-in., so that it now is 3¼ in. The stroke remains at 5 in. This six of the Cummins-Monitor Co., Columbus, O., is known as the model N and sells at $895 as a five-passenger tourist. A roadster is offered on this chassis and there also is a four-cylinder model Monitor, known as the model R, which sells at $795.

The Gadabout is one of the very smallest of the cars on exhibition, and it also is one of the lowest in price, listing at $385 without electric lighting and cranking, or $485 with such additional fitting as electric equipment speedometer, clock and work light. It is made by the Gadabout Corp., Detroit, Mich.

Points made in favor of the Gadabout are the low weight, economy of first cost and operation and ease of handling and the mechanical design is carried out on these ideas. The motor is a Sterling four, 2⅞ by 4 in., with Atwater Kent ignition. The axle is a semi-floating type with gearless differential. An open, leather-faced cone clutch is used and the service brake is interconnected with the clutch pedal, the emergency brake being operated by a second pedal. The wheelbase is 104 in. and the tires are 28 by 3 in. The stock body is a two-passenger, though three-passenger bodies are made to order. An option of wire wheels is offered.



FEW parts of detail automobile construction vary more than the spring mountings, and the above sketches, made from cars at the Chicago show, illustrate these variations. Some engineers think it necessary to brace a frame very strongly by a cross rail at the point where the spring bracket is attached while others make no such provision. There is a slightly growing trend towards the use of a very wide frame so that the rear springs may go beneath it instead of to one side. Cantilever springs may have the middle pivot pin either above or below the spring, the two methods being used about equally. The eight cantilever sketches show all typical mountings of both varieties.

Accessory Section Features Component Parts

Motors, Axles, Transmission Parts and Springs Better Displayed at Chicago than in New York

CHICAGO, Jan. 22—Each of the two big automobile shows invariably claims a number of accessory and parts makers that the other does not list among those present. Some of these with a more specialized distribution of their product figure that either one or the other show best meets their field, and do not go into the one which they believe does not help them materially. There are still others which are somewhat local to the show in which they exhibit, such as, for instance, a concern in Chicago that might be the western distributor for a product. Instead of the factory, which we will assume is in the East, exhibiting, this representative takes care of Chicago.

Thus when we come to the Chicago show we find that there are this year about forty names in the accessory division that were not to be found at New York, although some of the faces that were to be found on the upper floors of the Grand Central Palace in the Metropolis are missing here. These range anywhere from the miscellaneous accessory exhibitor to the maker of castings, and heavy component parts such as motors, axles and gearsets.

Chicago has always been recognized as a great rendevous for dealers from all parts of the country at show time, and this may have some bearing on the fact that so many chose the Windy City in preference to New York. Chicago is more centrally located and is easier to reach from all sections, and so here you will find men from the Far West, from the South and from the North as well as the East. Accessory makers seeking distribution points are therefore especially alert to the advantages of being housed in the show buildings here this week.

It is interesting to note some of the big accessory names that are here for the show, and which did not appear at New York. Among them are the Remy Electric Co., the Warner Gear Co., the Continental Motor Mfg. Co., the Waukesha Motor Co., the Tuthill Spring Co., the Hess Spring & Axle Co., and many others.

Following are presented some of the accessories which visitors at the eastern exhibition were not privileged to see on display.

Two Good Motor Exhibits

There are two good exhibits of motors which were absent from New York. Although it is not exactly a new engine, having been in production for some time, the Continental little six known as model 7W, made by the Continental Motor Mfg. Co., Detroit, makes its premier appearance at any show. It is a clean-cut design with dimensions of 3¼ by 4½ in. The displacement is 223.95 cu. in., and in general the engine follows out recognized Continental six-cylinder practice with the cylinders and upper part of the crankcase in one piece and the head detachable. The valves are on the right, and of course completely housed in. On this side are also the centrifugal water pump and provision for either generator or magneto drive on the extension of the pump shaft. On the left rear side are bosses intended for the attachment of an electric starting motor to drive through gearing with the flywheel, and this unit together with the carbureter, which bolts directly to the cylinder block, are the only accessories on the left, although the breather and oil gage have been placed here in convenient positions.

The front of the motor is arranged to be hung from a forged cross piece, and the rear supports are a part of the housing of the flywheel, the crankcase bolting to this housing direct.

Another motor exhibit was that of the Waukesha Motor Co., Waukesha, Wis., who have several models of truck and tractor motors including a 3½ by 5¼ in. four of very compact design, a 4 by 5¾ in. four type with cylinders in pairs, a 4¼ by 5¾ in., a 4½ by 6¾ in., and a 4¾ by 6¾ in., these all being fours similar in design and adapted to certain truck requirements. The 3½ by 5¼ in. type is a good example of modern truck design, and is especially recommended for commercial cars ranging from 1 to 1½ ton capacity. It is a block-cast type with cylinders and upper crankcase a unit and the head detachable. Practically complete enclosure of all parts is a feature. Valves are on the right and the carbureter on the left, bolting direct to the cylinders, so that the distribution to the cylinders is through cored passages within the casting.

Several Component Exhibits

Apart from motors, there were a few other component parts well displayed, among them being sundry Warner products made by the Warner Gear Co., Muncie, Ind. A novelty among them is a new two-pinion differential designed especially for lighter types of cars. Instead of the usual four differential pinions, this gets along very nicely with two, and thus simplifies the construction as well as making it lighter. The Warner company also manufactures a line of steering gears designed to meet the requirements of different types and weights of cars. Model S 37 F is particularly adapted to many of the lighter types of cars on the market, and possesses the features of adjustability of rake, full worm wheel, quadrant above the steering wheel, and horn button in the center.

Another of the Warner products is a complete series of gearsets to meet any requirements. These are made adaptable to unit power plant constructions, cars in which the gearbox is located amidships, and types in which it is coupled up to the rear axle. A new example of the latter form is the model T 43, which is a very compact three-speed construction intended for cars from 20 to 25 N. A. C. C. horsepower. Similar to this but designed to bolt to the motor is the model T 46 intended for cars ranging from 20 to 30 hp. Warner also specializes in both multiple-disk and cone-clutch construction, particularly where they are intended for unit power plant installation.

Tuthill springs made by the Tuthill Spring Co., Chicago, are well displayed and in the construction of these springs the main feature of design is the absence of a center bolt to keep the spring leaves in position. Instead a bump is given the leaves and between the bottom leaf and the spring pad of the axle a wedge shaped plate is interposed; thus the combination with the spring bolts at either side of the bump prevent any movement of the wheels with respect to each other, and make a strong construction to relieve them from any possibility of center bolts shearing or weakening of the spring leaves due to drilling for such bolts. The Tuthill company has published a booklet listing all standard makes of cars and indicating the style and model of its springs adapted to each model of each make of car. For instance, for the model D 44 Buick, the price is $8.25.

Hess Has Axle Exhibit

Hess axle products are advantageously displayed at the show. These are made by the Hess Spring & Axle Co., Cincinnati, Ohio, and include designs incorporating both the spiral bevel gearing and straight bevels. They all have pressed steel housings, most of them ridged outwardly by webs in the top and bottom of the housing. A good example is the model 214, which is intended for the car weighing from 2800 to 3600 lb. It has spiral gears and the differential is arranged for convenient adjustment to the large opening at the rear. With these axles double-internal expanding cam-brakes are used, with the brake operating rods and equalizers incorporated in the unit.

Front axles of various sizes and shapes are also manufactured as well as any design of spring. The front axles are all of the I-beam drop-forged type, while the rear designs are made either in semi-floating, three-quarter, or floating construction, and are equipped with both ball and roller bearings.

A somewhat unusual exhibit is that of the Advance Felt & Cutting Co., Chicago, who make a big line of felt products for the use of motor cars, besides marketing a machine for the use of dealers and jobbers which cuts felt washers to the proper size for any car. It consists essentially of a regular hand-punched press and comes complete with a full set of dies, being adaptable to cutting leather, rubber or asbestos as well.

Die Castings Displayed

Die cast parts of all descriptions, some of them being exceedingly complicated, are displayed by the S. H. Franklin Mfg. Co., Syracuse, N. Y. This concern concludes that die castings are no longer an unknown quantity, now taking their place with stampings, screw machine parts, forgings and so forth in the construction of many well known instruments. The Franklin concern makes them of various white metal alloys which are forced into steel molds under pressure. The work is so accurate, a finished article results which eliminates practically all machine work. One of the specialties in this line is die-cast bearings, which present an entirely finished appearance without any subsequent machining.

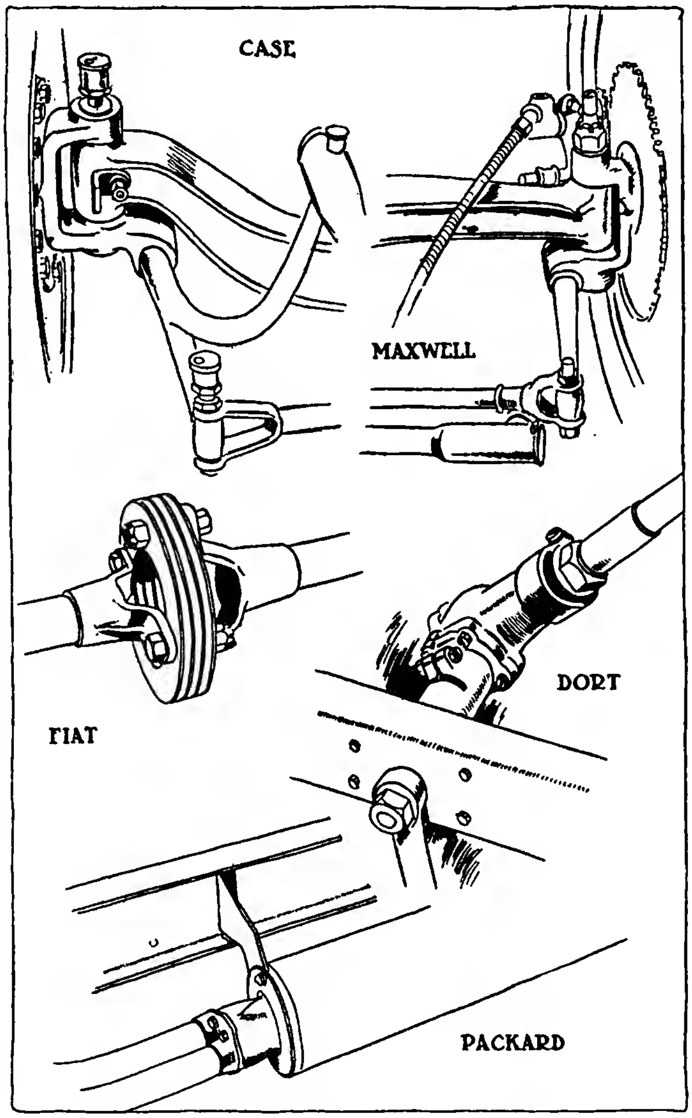
A large variety of automobile castings are to be found in the educational exhibit of the William Cramp & Sons, Ship & Engine Building Co., Philadelphia, Pa. These range anywhere from bearings made from Carson's white brass or Cramp special bearing bronze, to crankcases, rear axle worm driving gears and steering gears.

The Benjamin Electric Mfg. Co., Chicago, is featuring among other electric specialties a line of horns, both of the vibrator type, and of motor driven construction. The vibrator horns have been on the market for several seasons and the motor-driven horn is new this year. The motor operates on five to six dry cells and the principle is that of a rotating member striking the diaphragm to make an especially loud warning. This horn is made either for mounting outside or under the hood, and sells for $7.50, finished in all black enamel and 50 cents more when it is black and nickel.

The vibrator types are in several shapes for both under hood and outside attachments and range in price from $4 to $6, depending on the size and finish. In their construction the vibrating electromagnets strike the diaphragm to make the signal. A magnetic horn designed for Fords is also produced, intended for installation so that it can utilize some of the excess current furnished by the Ford magneto. It costs $3.

The American Bronze Co., Berwyn, Pa., is showing various examples of its bearing materials and castings made from from Non-Gran bronze. The special feature of Non-Gran aside from the composition of the material is that it is sold in assortments of different sizes of bars to meet the requirements of the garage.

The F. A. Ames Co., Owensboro, Ky., have some new detachable tops for Ford roadsters and touring cars. These are of the cloth material construction, arranged so that the doors not only hinge nicely but the attachment of the body is very rigid and there is a good fit between body and top and windshield, preventing any air or water from leaking in. The roadster type weighs about 100 lb. net and sells for $60, while the touring car type weighs 150 lb., and sells for $97.50.



THESE few sketches of cars at the Chicago show illustrate some neat points of design. Two examples of the European form of front axle with the yoke on the wheel spindle instead of on the I-beam are the Case and the Maxwell. Besides being simple these are both extremely strong designs. A novel universal coupling is used on the Fiat between the clutch and the amidships gearbox, this combining both leather and thin spring steel. Each piece of leather is separated from the next by a steel lamination, so adding to the rigidity of the coupling. The Dort has a steering gear that can be set for rake when assembling the car by means of a simple split housing with a pinch screw lock. On the Packard twin-six there is a single muffler, and a very neat and simple piece is used on the muffler end to receive the two pipes.

Italy Developing Aeroplane Engines

New Model Cars Also Being Built—Experimental Work Unaffected By War*

By W. F. Bradley

Chivibirri 16 Fixed Cylinder Aviation Motor

ALTHOUGH the tendency is to decrease the time spent on road tests by more complete dynamometer tests, manufacturers being pushed by the special chassis test tax, it would be impossible to convince a Turin automobile engineer that road tests are unnecessary. He would point to the mountains surrounding his town, the tops of which are capped with snow in the month of August, to the Mt. Cenis pass, more than 10,000 ft. high, he would remind you that the Stelvio, the highest mountain road in the world, is only a few hours run from Turin, and he would smile at the idea of any indoor test replacing this natural testing ground. In addition to the ordinary factory test service, the English branch of the Fiat Company maintains its own tester at the Turin factory, who must test every chassis on the road before it is shipped abroad.

Milan Has Several Factories

Apart from Turin, the only Italian town having automobile interest is Milan, where there are about 5000 people directly employed in the automobile industry. The most important factories are Bianchi and Isotta-Fraschini. Smaller firms are Zust, Otav, Junior and Alfa, this last mentioned being the old Darracq concern, but having now no connection with the French and English Darracq companies. Alexander Darracq, the founder of the Darracq Company, but now totally disconnected with that concern, is in Milan running a couple of ammunition factories supplying the Italian government. The Bianchi establishment is particularly interesting and complete. The output comprises bicycles, most of which are absorbed by the army, motorbicycles, light cars, trucks and armored cars.

Each of the European countries has its own "school" of automobile design as distinctive as the art schools of the different nations. A typical Italian car, for instance, with all nameplates removed, could not be confused with a typical French, English, Belgian or German machine. The standard Italian machine is a four-cylinder of 100 by 140 mm. (3.9 by 5.5 in.) bore and stroke. Sixes, eights and twelves may be considered as non-existent, at any rate at the present moment. Cylinders are a block casting with all external piping abolished. The biggest Fiat ever built—7.48 by 10.5 in. bore and stroke—is as clean a block casting as the smallest standard motor made. There are no detachable cylinder heads; indeed the tendency is to make the water header on the top of the cylinders an integral part of the casting. This is done by Scat and also by Newton, an English firm with an Italian factory. It is admitted that the casting is more difficult, but the advantages claimed are a neater looking job and the abolition of a joint.

In most cases the exhaust manifold is cast integrally, a conspicuous example being the Nazzaro. L-head is standard, naturally with enclosed valve stems. Intake manifold is an integral part of the casting. In many cases the throttle and the jets are within the casting, only the float chamber being external. Water pumps are also combined in the cylinder casting, a good example being the Spa. Thermo-syphon cooling is not used. The crankcase breather is cast in the cylinders to avoid an external pipe. Lubrication is forced feed to all bearings with no external pipes other than the lead to pressure indicator.

Unit construction is generally employed, the motor being mounted direct to frame members, without a sub-frame and without a mud-pan. Gearbox is aluminum casting with arms encircling and forming a well for the clutch, generally multiple disk type; cone clutches are not in use. Four speeds are invariably employed. Hotchkiss drive is not used, the typical Italian car having one-piece axle housing and torque tube with forked end. This is a two-piece stamping bolted or welded together. Axles are full floating; wheels are detachable but not of any definite type—wood, wire spoke, steel spoked and steel disk all being used. Springs, semi-elliptic; brakes, water-cooled when cars are for Italian service; dashboard invariably of cast aluminum. Electric lighting and starting very commonly employed, the two-unit system being preferred.

New Models Are Being Produced

The war having had no adverse influence on the experimental departments of Italian factories, new models have been produced and tendencies are observable. There is not going to be any serious breakaway from the four, but one very important firm has a twin six almost ready and will put it on the market in 1916. It is more than probable that other firms having carried out experiments with twin-six aviation motors will also produce twelve cylinders as a model de luxe. Bore will be rather less than 3 in., and stroke about 5 in. The feeling is that the mass of motorists will be satisfied with fours and that the twin-six can only be considered as a superfine car. There are no indications of the appearance of eight-cylinder motors in Italy.

A more general move is toward the adoption of small, light two- and four-seater cars, to be put on the market at a popular price, fully equipped with electric lighting and starting. This is an adoption of American ideas, but emphasis is laid on the fact that the cars will have the high-grade finish which always has characterized Italian cars. Bianchi has led in this direction with a small four-cylinder model of 2.4 by 4.3 in. bore and stroke. The car is really a reduction of the bigger models made by this firm, with three instead of four

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*This is the last of a series of articles by the Paris correspondent of The Automobile, who has just concluded a careful examination of the Italian industry.

speeds, the gearbox being on the front end of the torque tube. The car is sold as a two- and a four-seater, with electric lighting and starting. As a two-seater it has been very extensively adopted by the Italian army, officers making use of it as a runabout.

Another important Italian firm has two new small car models ready and will doubtless put them on the market early in 1916. These are important, both on account of the standing of the concern and the changes in design which have been adopted. The two models have respectively four-cylinder motors of 2.44 by 3.9 and 2.75 by 5.1 in. bore and stroke. In each case cylinders and crankcase are one casting, but cylinder heads are not detachable; base chamber is an aluminum casting. Motor is L-head type, with enclosed valve stems, adjustable single-chain drive for camshaft and magneto shaft, and thermo-syphon cooling.

Thermo Syphon Cooling Grows

The change from pump to thermo-syphon is important, for it is likely that it will be extended to a larger model of 3.3 by 5.9 in. bore and stroke, and its sponsors are a firm always maintaining that a pump was an essential part of a motor equipment. It is admitted that it is a difficult task to produce a thermo-syphon cooled motor which will be satisfactory in the hot plains of Italy and on the Alpine passes, but the firm claims that with careful design and such good foundry work as they can produce in Italy the pump can be abolished. The change has evoked a lot of discussion and an important bet has been made that no standard car, of any make or any horsepower, with thermo-syphon cooled motor, can get over the Stelvio pass, in the Alps, under its own power. The bet has been taken up by the maker of this car and will be decided during the hot weather next year.

These two new cars have unit construction, four speeds, bevel gear drive and double internal brakes on rear wheels; there is no brake on the mechanism. Electric lighting is fitted for both cars, the larger of the two having electric starter. The generator is mounted over the flywheel housing and partly projects through the aluminum dash, the projecting end being covered by a detachable plate. The starting unit is alongside the motor, just below the crankcase hanger, and engages with a gear cut in the face of the flywheel. The smaller model has a lever starter, with rack and pinion in the gearbox. This type of starter is already in use on the Newton 2.7 by 5.5 in. four-cylinder light car and is very successful. There is no additional external mechanism, for the change speed lever is made use of, with an additional notch on the change speed quadrant, and the vertical rack is mounted in one corner of the gearbox. Only a quarter turn of the motor is obtained at each stroke of the lever, but owing to the ratio between the rack and the pinion on the lay shaft, the motor is turned over at a much higher speed than it is possible to spin it by hand.

The general specification of these cars is practically that of some of the popular American cars. The differences are in the use of a smaller high-speed motor and a better finish—sand blasted castings, polished aluminum dash, burnished bolts, parts machined all over. This adoption of American ideas is not likely to be confined to one or two Italian firms. Some leading members of the industry in Europe are in favor of closely copying the cheaper American cars, with no more finish than is usually given the $500 car. On these lines it is claimed that they could manufacture and sell cheaper than American cars could be imported. Others, as in the case described above, are willing to adopt the general idea, but refuse to sacrifice the detail finish they have been accustomed to give their high grade cars.

Apart from the small car and the twin-six motors, tendencies are toward detail refinements. Pointed radiators are coming more into use, with the top rounded off so as to harmonize better with the hood. Lancia is now making use of a wood fan made by an aeroplane propeller specialist; it is claimed that a propeller of this type is much more efficient than the average cast aluminum fan.

A greater use than ever is being made of aluminum dashboards, but the latest type is a hollow dash within which all the instruments and wires are carried, leaving both faces perfectly neat. With the general adoption of electric lighting and starting sets the wiring of a car is increased, and an untidy appearance is given to what would otherwise be a perfectly clean-line chassis.

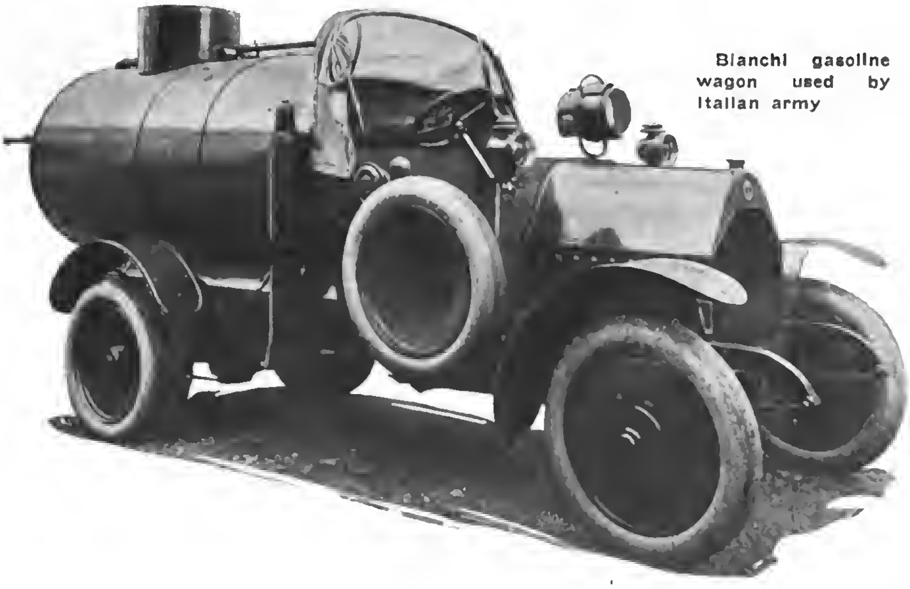
Nazzaro has a very fine example of the hollow aluminum dash with all wiring encased, the only uncovered parts being about an inch of the end of each ignition wire as it connects up to the plug. The Italians have held back on chain drive, but are now coming to it more strongly, the most popular type being a triangular drive across crankshaft, camshaft and magneto shaft, the adjustment being on the magneto pinion.

There are no worm driven cars in Italy, practically every maker having straight bevel. Fiat has recently taken up the Gleason spiral bevel gear and appears to be thoroughly satisfied with it; it is understood that this type of gear will be used for all their pleasure cars.

Few Aluminum Pistons

There is comparatively little use of aluminum pistons by Italian makers. Yet the Italian industry is not at all a stranger to this metal. Aquila-Italiana started using aluminum alloy pistons on all their cars as far back as 1911. They were used on all models up to 3½-in. bore, with hollow connecting-rods having walls only 0.85 mm. thick. Aquila-Italiana has adhered to aluminum pistons up to the present. Fiat has carried out a lot of experimental work with aluminum alloy pistons and is at present making use of them on all their six-cylinder aviation motors, which have a bore of 4.7 in., and on all racing motors. Aluminum alloy pistons were used in the set of Fiat cars run in the last French Grand Prix, when no trouble whatever developed with the pistons. At the Chiribirri factory, one of the small Italian firms doing much experimental work, I was shown a 40-hp. aviation motor with aluminum cylinders and cast-iron liners, built in

Italian Bersaglieri on Bianchi Truck



Bianchi gasoline wagon used by Italian army

1912, and flown in that year. This firm makes aviation engines and an original light car with cylinder dimensions 2.5 by 3.8 in. bore and stroke, the pistons of which are aluminum alloy. In other factories it was stated that experiments had been carried out with steel, cast iron and aluminum alloy pistons, with the final retention of cast iron. In several cases it was stated that it had been impossible to overcome piston slap, even with a scraper ring fitted. As the result of these experiments one firm grinds its cast-iron pistons slightly oval. The head is cylindrical, the ovalization increasing as the skirt is reached.

Aeroplane Motors in Demand

Italian factories have only been interested in aviation motors since the war broke out. Previous to hostilities there was no encouragement to make aviation motors; supplies were allowed to come in from France, Gnome securing the greater portion of the business. At the present time the Gnome Company has an important factory in Turin and is working exclusively for the government on rotary cylinder and fixed eight-cylinder all-aluminum water-cooled motors. All the factories, however, are now making aeroplane engines and a number of V-types are being produced. Fiat is at present interested in the six-cylinder vertical water-cooled type, with inclined overhead valves and a single overhead camshaft. Cylinders are of steel, and of course separate, with a sheet steel waterjacket, common to each pair of cylinders. This motor is of the same general type as that built in France by Renault and Lorraine-Dietrich.

Lancia is building twin sixes with horizontal valves, giving a combustion chamber of the type used for a number of years on Delage racers, and on the car which won at Indianapolis in 1914. Spa has built eight-cylinder V-motors, eight horizontal opposed with two crankshafts and only four combustion chambers, 10 cylinder Anzani motors, and six-cylinder vertical type with steel cylinders, sheet metal jackets and overhead valves. The Diatto Co. has taken up the Bugatti aviation motor, which has six separate steel cylinders welded together and surrounded by a copper water jacket. There are four vertical valves per cylinder, with a patented mechanism by which a single cam operates direct on a pair of valves. Isotta-Fraschini is interested in both six- and eight-cylinder aviation motors of the vertical water-cooled type. Nazzaro is building Anzani type motors. As in France, the aviation motor work will tend to bring the twin six motor into greater prominence and it is expected this will cause its adoption for car work.

Cars For Egypt Must Have Special Carbureters

ACCORDING to articles published in the Egyptian *Gazette*, the climate is an important factor to be taken into consideration in connection with the market for automobiles in that country, carburetion, lubrication and cooling being affected by the atmospheric conditions. Facilities for long distance touring being lacking in Egypt, the type of vehicle most in demand is that best suited for town traffic work.

Higher mileage per gallon of fuel may be obtained than in other countries due to the higher temperature and greater humidity, the latter condition frequently receiving inadequate attention in determining carbureter adjustments. It has been noted that in a large percentage of the cars imported it has been necessary to cut down the fuel supply to a considerable extent before satisfactory working results were obtainable, marked economy accompanying this change. This weakening of the mixture, however, frequently causes trouble with radiation due to the same climatic conditions which make the carbureter adjustment necessary.

The essentials of a perfect carbureter for use in Egypt are: It must deliver a fairly rich mixture with the control lever set at the nearly shut position to insure easy starting; the strength of the mixture should be maintained during the process of getting under way and as this progresses, gradually weakens, until the weakest possible mixture on which the engine will pull well at 20 to 25 m.p.h. is being delivered, at which point the control lever and throttle should be about half through their distance of travel. It is stated that it is impossible to secure these results from the original carbureter owing to the use of automatic control of the air supply which prevents attaining the exact conditions required. Mechanical control of the air supply in proportion to the fuel supply is therefore necessary.

Since engine temperatures in Egypt are far higher than in the countries where the principal motor oils are made and tested, an oil that gives perfect results in other countries quickly becomes far too thin, with the result that abnormal quantities must be used and even then such thin oil does not coat the cylinder walls sufficiently to give perfect compression. Hence it gets past the rings and is burned, giving an unnecessary carbon deposit with resultant loss of power. The obvious remedy is to use a far heavier grade of oil and by so doing to increase compression with a corresponding increase of efficiency and economy and the considerable abatement of smoke and carbon. The same applies to gearbox and differential greases which soon become little better than oil, after a little running.

Special attention must be paid to the efficient protection of all working parts against the sandy dust which prevails. Universal joints should be carefully covered and frequently examined and an especially well-fitting undershield to the engine should be insisted upon, as should that type of spring shackle which is drilled for lubrication and fitted with a screw-down grease cup.

As regards springs the usual standard types do not seem to be a success and a very long and light suspension combined with shock absorbers seems to give the best result.

Working Out the Rolls Royce Brake

Experiments Showing Many Unexpected Effects with Different Materials Led to Adoption of Compressed Asbestos on Special Type Shoe

By Chas. J. Booth
(Engineer, Rolls Royce, Ltd., Derby, England.)

I RECENTLY carried out a series of comparative tests of various brake materials which I think should prove of general interest. The purpose of these tests was to obtain reliable and impartial data *re* the many fiber brake lining materials now on the market and to make a comparison between them and the older metal-to-metal types.

It may perhaps be as well to state at this point that these tests were made and this article written without the cognizance of the manufacturers of any of the materials mentioned and that personally I have no financial interest in any of these concerns; the statements I shall make are therefore quite unprejudiced and may possibly be not endorsed by the makers in their entirety, but are the results of my own experience and tests.

Cast Iron for Brakes

The old standard practice of using a brake having cast-iron liners working on steel drums, for many years reigned supreme in the motor car world as the best combination that it was possible to use, although such a brake it must be admitted has several minor drawbacks or faults. One of these is the noise emitted when the brake is applied, which varies from a low grating noise to a high pitched scream, and another being the tendency of the brake to suddenly seize instead of allowing itself to be gradually applied.

I tackled this problem very seriously some years ago and made a number of tests with varying grades of cast iron, which only seemed to prove that the best I could do was a compromise between two evils. The screaming and the seizing seemed to go together and were always associated with a hard and close grained cast iron, which, however, had excellent wearing qualities.

By using a softer iron the screeching and seizing disappeared, but so did the wearing qualities; I used numerous grades of iron till I got to a point where all tendency to seize was eliminated and the noise reduced to an almost unnoticeable low grating sound, but the iron was now so soft that the liners appeared to powder up and wear so rapidly that they could be completely worn through in a week's severe testing.

Experiments with Steel

I also tried varying the steel brake drums, comparing case-hardened drums with others not hardened, and others cooled out at various temperatures, but I got exactly similar results, that is, noise with hard drums and wear with soft ones, but the seriousness of brake drums needing replacement leaves the designer no choice but to make these as desirable as he knows how.

The policy therefore dictated by these tests was to use a liner made of a medium grade of cast iron as a compromise between rapid wear or noisy and screamy brakes.

I should also add that I found that an excessively hard liner also had a tendency to wear ineffective through taking a very high polish and becoming glazed, and it was also obvious of course, that the harder the liner the greater would be the wear taking place on the drum, which I repeat is a serious point to be avoided as the very reason for the existence of a brake liner is of course, to have the wearing part of a brake easily and cheaply removable.

Lubricated Brakes

Seeing that the noise referred to above is simply the natural result of rubbing the rough surface of the cast iron without a lubricant, the next point that occurred to me was that if the brake were lubricated then it might be possible to use the hardest liners without the attendant disadvantage, but tests in this direction did not tend to impress me very favorably. It is well known that a little thick oil applied to a harsh brake will temporarily make the brake beautifully smooth in action and silent, but the effect almost immediately wears off if the brake is applied hard.

If on the other hand a liberal supply of oil is applied in the first place in order to last longer, one finds the brake practically useless when first applied, with perhaps, dangerous results in an emergency.

The position therefore forces us to consider brakes which are automatically lubricated; this, however, is a complication which like all other complications must in my opinion justify its existence by very definite benefits, which in my experience they do not.

One method is to use a number of oil grooves on the brake which are connected to an oil well, or sometimes to a drip feed lubricator, these each have their disadvantage, the principal one being that if the brake is not used for a lengthy period it is flooded and useless when next required, hence the designer is driven to elaborate the scheme so that the amount of oil used is controlled by the number of times the brake is used. The most usual type employed is one in which an oil-way is uncovered or a valve opened every time the brake pedal or lever is operated, thus insuring a supply of oil simultaneous with each brake application, but I have not yet myself tested a system which was free from unexpected floods of oil occasionally; for instance in negotiating congested traffic one is constantly depressing the brake pedal without actually applying the brake, and consequently the brake is swamped with oil and inefficient when it may be urgently needed.

Another serious objection to lubricated brakes is that, with prolonged application the oil is liable to be burnt entirely away and, unless the pull on the brakes is reduced proportionally (which is too much to expect a driver to do) the brake suddenly seizes.

It is a most desirable thing to have the efficiency of the brake absolutely constant, and this can be most readily obtained by using an unlubricated brake, and my own experience compels me to indorse the policy of those manufacturers who go to some trouble in their brake designs to prevent the possibility of any oil leaking or being thrown on their brake drums.

Using Phosphor Bronze

Having apparently exhausted the possibilities of cast iron, my next move was therefore to look out for some other material that might combine in a greater measure the desirable features of efficiency, silence and durability, and phosphor bronze struck me as being possibly a suitable material. I therefore made several tests with this and similar alloys, but I was not very favorably impressed by the results, the action of this material appeared to vary, not with its hardness, but with the speed of the revolving drums; at very slow speeds for instance the efficiency of the brakes is good, but accompanied by much screaming noise, and at fast speeds the brakes are much less efficient, but are more silent: at very high speeds they were ineffective. They appear to wear well, but develop a rough surface after much use; they also roughened up the surface of the drum.

This material cannot be used successfully with a lubricated brake as the co-efficient of friction is reduced to a point which makes the brake valueless.

Copper for Liners

I also tried brake liners made from hard copper, these in contradistinction to phosphor bronze appear to work better when lubricated, but were rather uncertain in their action although they were very silent and smooth when oiled. Like phosphor bronze their surface appeared to roughen up after use, when used dry; in this condition they also screamed very badly and seized.

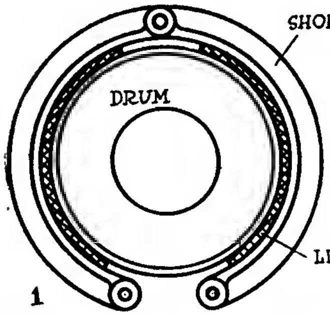
Woven Asbestos Materials

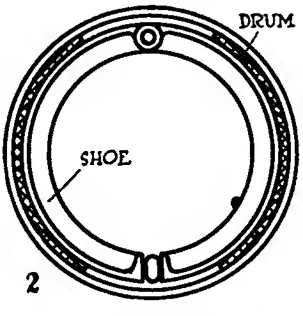
My only hope seemed to lie in trying some of the many brands of woven asbestos brake linings. I made up some brakes using liners having sections of both cast iron and asbestos, but the latter appeared to compress in use, leaving the cast iron to take all the load.

I was greatly disappointed at these results and discontinued the tests, concluding that there was nothing to better the use of cast iron brake liners, and for a time I left the subject of brakes entirely alone. Fairly recently, however, I became impressed by the very rapid rise to popularity and universal use of these asbestos fabrics and decided to give the matter further consideration.

The first thing I then discovered was that the wearing qualities of these fabrics had been greatly improved so that they had better durability. Here then was one great objection removed, leaving only the trouble of over-heating which I previously found in my tests and which I now proposed to tackle in earnest, feeling confident that it only had to be understood to be overcome, seeing the general use to which this material is now being put not only on passenger cars such as I am interested in, but also on heavy lorries, omnibuses, street cars, electric underground railways, etc., in London and Paris.

I used exactly the same model of brakes as for my previous tests and was quickly able to confirm the excellence of the wearing qualities and also the silence and smoothness of the material in action, but the heat trouble was still there, the brake drums getting so excessively hot as to cause them to run right out of truth, and to be discolored all over.



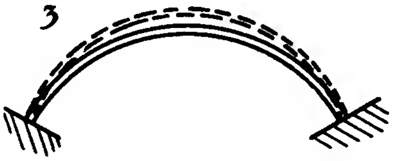


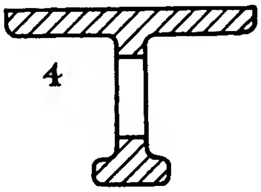
Asbestos of course is an excellent non-conductor of heat, and consequently the heat generated in the brake is concentrated on the drum, whereas in a metal-to-metal brake the heat is distributed to both the shoes and the drum and the temperature of the two members remains fairly constant, which will be seen later is an important point.

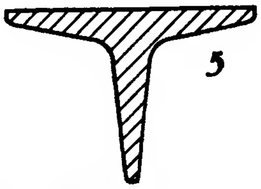
The brake used in my first experiments was of the external type shown diagrammatically in Fig. 1 and on considering the problem it will be seen at once that the asbestos insulates the drum, compelling it to retain all the heat generated, whereas with metal liners most of the heat is quickly dispatched through the shoes to the atmosphere, thus explaining why the drums should get so excessively hot when used with asbestos liners, and not otherwise.

I therefore began to realize that in order to be able to utilize asbestos liners to their full value, I must necessarily re-design my brakes accordingly, and this also explained to me the very contradictory accounts I had heard from various sources of the efficacy of these liners, and I saw that their success or otherwise depended entirely on the type of brake to which they are fitted. I therefore abandoned the external type of brake, as unsatisfactory for a heavy touring car unless a water cooled drum or other complication be introduced, and I consequently turned my attention to experimenting with an internal type of brake (See Fig. 2). In this type the heat is still, of course, concentrated on the drum, but the latter, being on the outside, has a better chance of cooling, and I was quickly able to demonstrate that in this case the drum did not get so hot, but the brake was by no means perfection.

The next trouble that demanded attention was the fact that the brake, although very efficient when first applied, gradually became less efficient if used continuously; one naturally followed this up by further pressure from the foot or hand as the case might be, until the maximum movement had been reached, whereas the brake would continue to grow less effective till it went completely off. On releasing the brake and allowing it to cool it quickly regained its former state, but would again repeat the performance if continuously applied long enough. This was exactly the reverse to the action of the other type of brake, which tended to jamb on with continuous application.







Figs. 1 and 2—Two designs of brake experimented with. Fig. 3—Distorting tendency of shoe when heated. Figs. 4 and 5—Sections of shoe used to eliminate distortion trouble.

This is only what we should expect after considering the two diagrams; in each case the drum expands due to heating up, and in Fig. 1 this has the effect of getting closer to the shoes whereas in Fig. 2 it expands away from them. If metal liners are used with either type this trouble does not accrue, as the heat being transmitted to the shoes, these expand with the drums.

The drums obviously required still further cooling, so I had some made with cooling ribs turned on the outside. These were a great improvement, considerably lengthening the amount of time the brakes could be kept on continuously. The added weight of these ribs is partially compensated for by enabling one to use thinner drums. It is signficant how the use of these cooling ribs have come into general use, coincident with the extensive adoption of asbestos liners.

I was however by no means out of the wood, there was still the same tendency for the drums to expand away from the shoes although it took longer to accomplish, and the reason this does not happen with metal liners is, as previously explained, that the shoes also expand and follow up the movement of the drum. I therefore endeavored to find a way of transmitting some of the heat to the shoes. This I did by using a large number of rivets and having the tops of these flush with the asbestos linings, which successfully lengthened the amount of time the brakes could be run continuously.

But yet another trouble arose; curing one trouble had created a second. I now discovered that after the shoes had been heated up they not only distorted, but they took a permanent set.

After carefully considering the matter I reasoned it out in the following way. Referring to Fig. 3, let us suppose the brake shoe be represented by a simple arc of metal, rigidly held at each end, which if it expanded through being heated up, one would expect to take the form shown by dotted lines, but, if in addition to being fixed at each end the drum also prevents any movement in the way indicated by the dotted lines, then the only way left is for the tendency to expand to take the form of compressing the lower face of the metal, tending to bulge out the bottom face.

If the brake is now released, cooling sets in and if the shoe cooled evenly all over it should re-assume its former shape, as permanent set under such circumstances can only be the result of unequal cooling; I therefore turned my attention to the section of the shoe which was the one most commonly used and shown in Fig. 4. It was then obvious to me that the bottom flange furthest away from the source of the heat, with its large surface and bulk of metal, would certainly cool very rapidly; mainly due, of course, to the tendency of the drilled out thin web to impede the flow of heat from the large flange. This bottom flange being under compression but the pressure at the extremities being relaxed, it therefore straightened out slightly, forcing the upper flange to form a larger radius and thus causing the trouble referred to above.

I therefore set about designing a shoe which would cool more evenly and consequently after several attempts I evolved a shoe having the section shown in Fig. 5. This I found minimized my troubles to negligible quantities, the only remaining fly in the ointment being a squeaking noise which came into existence simultaneously with the employment of a larger number of flush headed rivets in the liners.

I made a comparative test between iron, steel, copper and aluminum rivets and found the latter to give the least trouble from noise and I therefore adopted them.

I was able to satisfactorily accomplish what I set out to do, namely to produce a brake combining the qualities of silence, efficiency, absence of tendency to seize prematurely, long life, smoothness of action and reliability with prolonged application, and I feel sure my experiences should prove very useful to others desiring the same ends.

There will be some of course who will doubtless say that I went to a lot of needless trouble, their brakes being quite satisfactory although they ignore many of the points I have suggested as being necessary. To these I can only reply that the car I was working on was an exceedingly heavy and powerful touring model, and many of these points are not so essential on a light car. Or again, some people may be satisfied with a lower standard than I am, also many wait till a trouble loses them orders before they consider it important. I can only state that our old brakes gave satisfaction to most, it being only the most fastidious customers who ever complained to us about them, but now all our customers are loud in their praise of the excellence of our brakes, and I know that in a few cases they have proved a turning point which brought us the order.

In selecting a suitable fabric I have been very successful with a die-pressed, bonded asbestos for my heavy cars. The die-pressed variety will outlive the best cast-iron liners and it has a very high co-efficient of friction, being .32, which factor seems to remain almost constant under all normal conditions, being not appreciably affected by either pressure, speed or temperature. With a good fabric all three of these factors can be raised to higher values than are likely to be met with in actual practice, without destroying the material.

Aluminum Cylinders Without Iron Liners

IN our British contemporary *The Autocar*, of Jan. 8, there are two suggestions for using plain aluminum for cylinders without cast-iron liners by means of special piston design. The idea is as follows:

"The first idea consists in the use of an aluminum alloy cylinder with a thin steel piston. The piston has no rings on it, but special contractile rings are let into the cylinder walls, the piston being sufficiently long so that it does not uncover the rings either at the top or bottom of the stroke. These contractile rings are used in order to obviate the wear of the cylinder walls due to the scraping of the usual piston rings. The steel piston is long and has the advantage of reducing the specific pressure on the walls, besides omitting the weight of the rings and their containing grooves.

"The co-efficient of expansion of aluminum is considerably greater than that of steel, and therefore if an aluminum piston be used in a steel cylinder there is a tendency for the piston, in expanding at a quicker rate than the cylinder, to bind, this being avoided by the allowance of considerable piston clearance.

"If the procedure be reversed, however, as is suggested by Mr. Funck, the aluminum cylinder expands quicker than the steel piston, so that no great clearance is necessary, and the faster the engine runs and the hotter the cylinder gets the less is the tendency toward binding.

"So far as the wearing qualities are concerned, it seems reasonable to expect that the new arrangement will prove satisfactory. Aluminum pistons in cast iron or steel cylinders seem to wear quite well, and in this case the smaller surface is the aluminum piston, whereas when aluminum cylinders are used the smaller surface is of steel. There is an analogy in the white metal-lined bearing in daily use which in many cases is superior to a bearing made with a harder metal.

"The second arrangement designed by Mr. Funck consists of a plain aluminum cylinder without rings, and in this case the piston is provided with a series of grooves to act on the principle of the labyrinth packing used extensively on steam turbines. Briefly, labyrinth packing consists of a series of grooves without rings, the initial pressure being reduced step by step as the medium expands successively in the various grooves, so that before the last groove is passed atmospheric pressure obtains. In a steam turbine there is, of course, no possibility of carbon forming in the grooves, and Mr. Funck claims that there would be no fear of these grooves carbonizing up an internal combustion engine arranged according to his design, as the cooling of the engine would be very effective owing to the high heat conductivity of the aluminum alloy cylinder.

"It is thought that these aluminum cylinders should be specially suitable for air-cooled engines, with the radiator fins cast on the cylinder, and if necessary machined all over. In both cases the valve seats are shown as fixed into the cylinders separately, so that cast iron may be used."

Sterling Has Simple Chassis

New $595 Car Uses Double Expanding Brakes and Cantilever Rear Springs—Two Unit Electrical Equipment

THE Sterling, a new roadster made by the Sterling Automobile Mfg. Co., New York City, is a new entrant into the low-priced car classifications. The car is marketed under the name of Sterling-New York and although selling for $595 fully equipped, it is thoroughly up-to-date in design and incorporates many meritorious features. Among the special points of interest about the car are the Lanchester cantilever spring suspension, ample body room and low center of gravity secured by flat spring suspension and drop frame construction.

The power plant is a unit type including a four-cylinder block motor, cone clutch and three-speed gearset. The motor dimensions are 3 by 4.25 in. giving an S. A. E. rating of 14.40 hp. The piston displacement is 120.2 in. The 1¼ in. valves are in the head and are operated by rocker arms which are controlled by means of external pushrods operating from the internal camshaft. The valves are all on the left side of the motor head and the horizontal rocker arm shaft carries eight rockers, an independent one for each valve.

Carburetion is taken care of by a Zenith instrument which is carried on the right side of the motor. The intake gases flow across the top of the head of the cylinder to the valve openings which are on the opposite side of the head from the intake port. Ignition is by the Wagner battery system in which the current is furnished from the storage battery and the balance of the system is made up of the Wagner distributer mechanism and a high-tension coil. The distributer drive is from the forward end of the timing gears which provides an accessible location. The high-tension coil is mounted on the side of the motor, giving very short connections between the breaker distributer mechanism and the coil.

Splash lubrication is employed, the oil being carried in the bottom half of the crankcase.

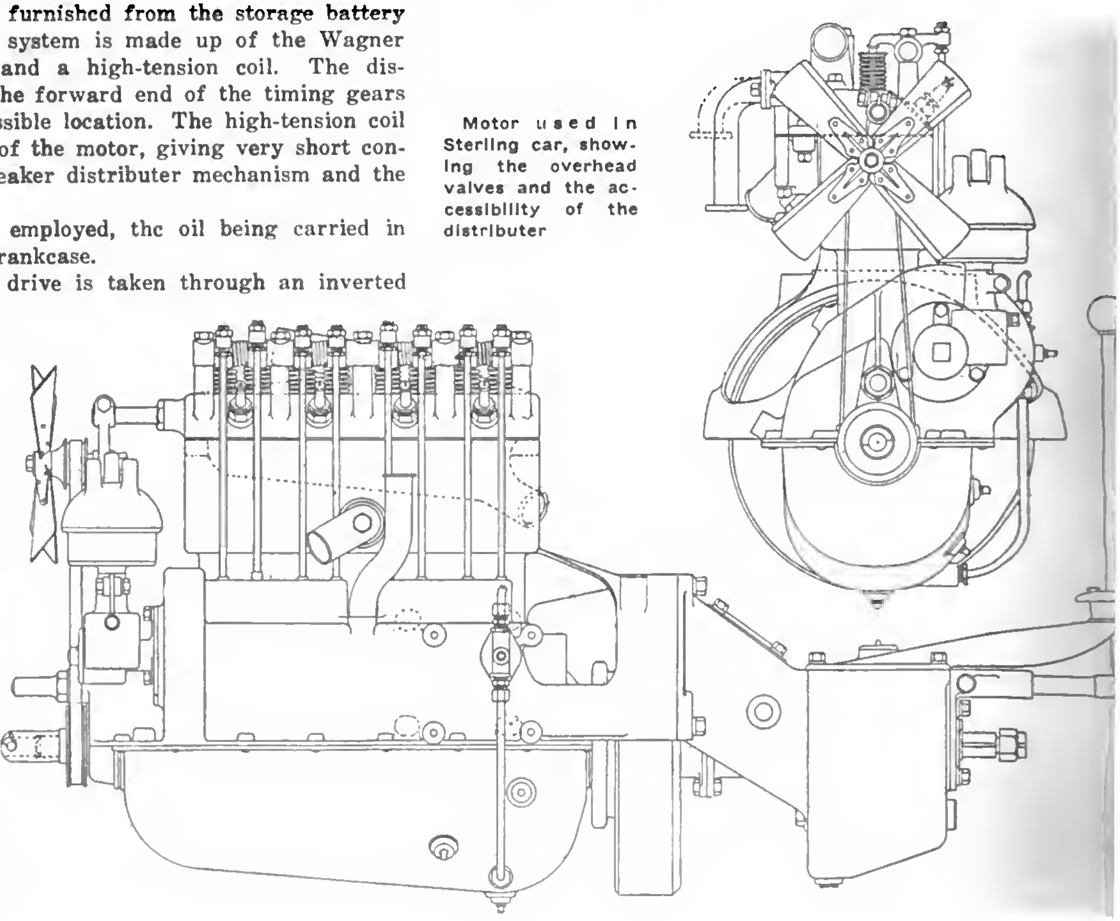
From the motor, the drive is taken through an inverted leather-faced cone clutch to the three-speed sliding selective gearset. The housing of the flywheel and gearset has been kept light by reducing the amount of metal necessary here to a minimum. The assembly is also compact, the distance between bearings is short providing rigid shaft construction. The gearshifter lever and the hand brake lever are mounted on an extension of the gearbox cover plate. This is done to bring the position of the levers to a convenient location for the driver. At the same time, the rigidity of a cover plate mounting is maintained. The entire power plant is self-contained with very few external parts outside of the valve mechanism. Since the motor is water cooled, there is no water pump and the neat block casting and self-contained working parts combine to render the assembly quite clean.

Lighting and starting are by the electric Auto-Lite system which is made up in two units, the generator is driven by silent chain and the starting motor has the Bendix gear attachment for meshing with the flywheel.

Bearing Provision Ample

Anti-friction bearings are used throughout the entire power transmission mechanism, the gearset being mounted on ball bearings and employs chrome-nickel steel gears. The semi-floating rear axle is also made up of chrome-nickel steel units carried on ball and roller bearings. The parts made of chrome-nickel steel are the bevel gears, pinion and driveshafts.

Two sets of brakes are on the rear wheels. These are lined with Raybestos. The wheels are wood-artillery type made from hickory and given a natural wood finish. They are equipped with quick-demountable rims and the standard equipment includes an extra rim. The standard tires are



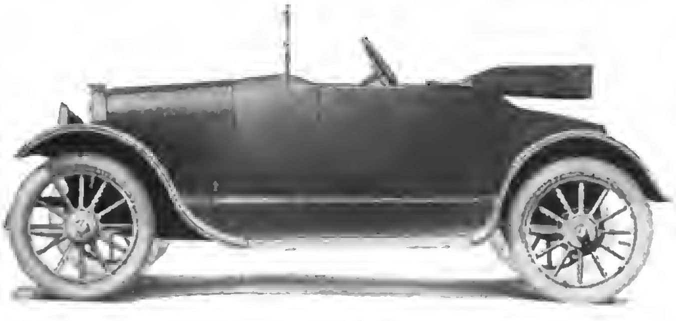
Motor used in Sterling car, showing the overhead valves and the accessibility of the distributer

30 by 3½ Swineharts. The wheelbase dimension is 102 in.

In exterior appearance and equipment, the car is a straight streamline design with no perceptible break in the body line between the cowl and the bonnet. The fenders are crowned and are made of heavy-gage steel with full skirts and dust shield. The running boards are covered with linoleum.

Equipment Is Complete

The price mentioned includes full equipment which is specifically mentioned as a full set of lamps, the headlights being 10½ in. adjustable focused type with Mazda bulbs, electric tail light with license bracket, rain vision ventilating windshield, mohair one-man top, extra rim, tire irons, tools and tire pump. The standard finish is blue, black or gray with either natural or painted wheels.



The Sterling Roadster

Economy of performance has been made a feature of the design. The car is light in weight and the construction is unified so as to maintain the number of parts at a minimum. The seating space has not been slighted and in accordance with the latest dictates in body design, the doors are large and have concealed joint lines and hinges.

Dust-proof Envelope

The top is held in a dust-proof envelope which is so arranged as to provide a firm support for the top and at the same time to conform to the lines of the body without sagging. It does not interfere with the rear deck, beneath which baggage may be carried if desired.

Low price attained by efficiency of design and by simplicity is the keynote and each detail from the ground up has been worked out to go suitably with the rest.

George Automatic Roller Bearing

Compensates for Variations in Roller Diameters

A ROLLER bearing which has been described as automatic has been placed on the market by the George Automatic Roller Bearing Co., Cincinnati, Ohio. This bearing was first shown the automobile engineers on the last summer's excursion of the Society of Automobile Engineers on the Great Lakes. It may be described roughly as a roller bearing in which the rollers are held in suspension on balls. It combines the functions of a radial and thrust bearing and has as an important feature of merit that it automatically compensates for commercial variations in actual roller diameter.

Balls Adjust Rollers

A general view of the bearing which will bring out the fundamental principles of its construction is shown in Fig. 1. By the construction of this bearing the rollers are separated by two rows of balls which, while decreasing frictional resistance, produce an automatic adjustment for the rollers. Furthermore the construction is such that concentricity is maintained without compelling expensively close limits in machining. An ingenious method of mounting and dismounting the bearing has been provided and the entire assembly can be taken apart for inspection and cleaning without the use of tools or distortion of the parts.

Briefly, the bearing is conical; this being so the rollers are tapered to compensate for the conical race and the tapered rollers have lateral freedom controlled by the contact of the balls at *A* Fig. 1, on the conical ends of the rolls *B*. When the bearings are mounted and tightened in place there is a certain wedging action on the rollers, but as soon as the bearing has made a half turn the large rollers are forced to creep owing to the pressure upon them, thus forcing the balls in contact further apart. This pressure is equalized all around the outer and inner rings because the balls are

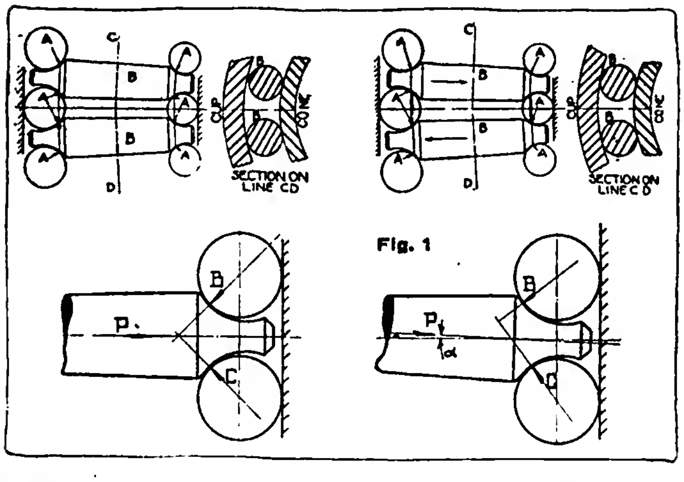


Fig. 1

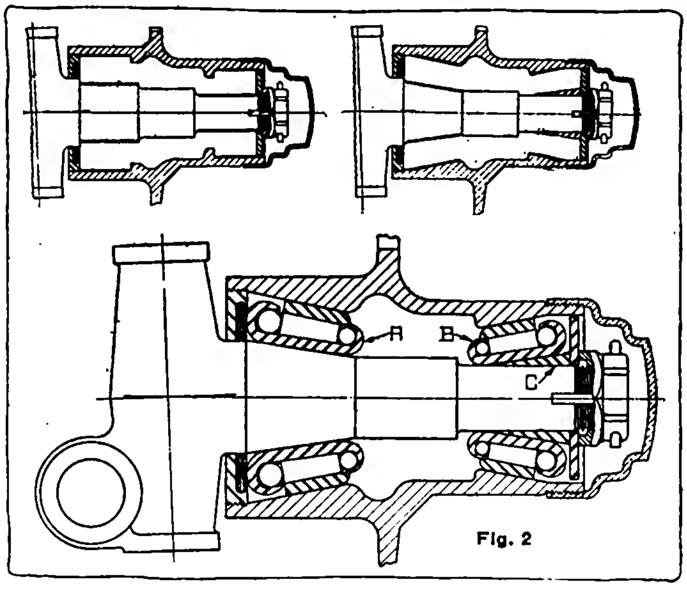


Fig. 2

Diagrams and assembly sections showing the construction of the George automatic roller bearing and the action of the balls and rollers under the stresses due to load. The compensating action of the balls and rollers on the conical race is the novel feature. The upper diagram on the right shows in comparative form the amount of accurate machining required on the hub with the George and with the parallel type of bearing pressed into their proper running positions automatically. The large and small rollers thus automatically take their places, being forced either forward or backward until the same working diameter between the cap and cone is produced all around the bearing.

Suppose one of the rollers is a trifle thick and another a trifle thin, then the thick one will receive more than its share of the load, and directly the bearing begins to turn it will slide outwards till it takes no more than the load on the others. This outward sliding, however, puts pressure on the outer ring of balls and lets it off the inner ring, so the effect of a thick roller sliding outwards is to press any small roller inwards, so effecting compensation.

All roller bearings need a separating medium for the rollers. In this particular bearing the balls at the inner and outer ends of the rollers are used as separators. This design provides rolling contact between the balls and rollers thus eliminating the frictional resistance which would come from a sliding action. Also, the conical ends of the rollers acting in conjunction with the balls form a true concentric rolling action and overcome tendency to skew out of the true rolling axis.

Referring to the lower part of Fig. 1 if there is *P* pounds end thrust on each roller there will be a reaction through the balls along the normal lines *B* and *C*. Owing to the shape of the end of the roller the angle made by *P B* must be the same as the angle made by *P C*. consequently the forces *B* and *C* are of the same magnitude and the axis of rotation must remain true. To the right of Fig. 1 at the lower corner is shown the alternative condition where the angles are not equal. This would provide an unbalanced force, with the result that the bearing would tend to slide away from its true rotative axis.

Simplifies Machine Work

One of the claims for the bearing is that in mounting, it is unnecessary to have great accuracy in machining. Both the inside and outside surfaces of the bearing are taper and hence concentricity is obtained by tightening the bearing in position.

At the same time any small variation in diameter of the housing or seat in mounting is taken up by a very slight lateral movement of the whole bearing. Fig. 2 shows a typical installation of a front hub fitted for George automatic roller bearings. As will be noted, the tapered surfaces render unimportant close limits in machining for the bearing mounting.

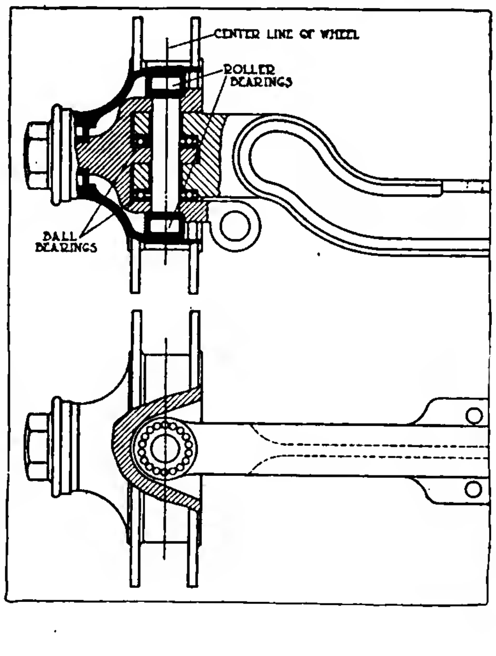
In the typical George mounting shown, the bearing *A* does not touch any part of the spindle until it rests on its tapered seat. The hub is then mounted by moving it laterally until it rests upon its tapered seat and bearing *B* is then put into position and it in turn must come to rest on its tapered seat. The split tapered collar *C* is then slipped over the spindle and that again must rest on its tapered seat after which, the splined washer, lock adjusting nut and cotter pin are put into position in the usual manner. The entire assembly is then concentric with the axis of rotation of the wheel and this has been accomplished without the use of special tools or any force.

In dissassembling the bearing the first ball is dropped out of a little opening in the periphery of the larger race. After this is removed another ball can be dropped out and then the rollers can be pulled out by canting them sideways and lifting them from place. The other balls then drop out. The reassembling work is easily accomplished by simply reversing the procedure. There is no danger of the bearings falling apart when packed in position as it requires manual separation of the rollers to allow the first ball to drop out of the opening.

The mounting illustrated, of course, needs a special hub or housing to take the George bearing, but the manufacturers are now prepared to supply bearings with an integral outside part that will enable them to be interchanged with other bearings of the long series type.

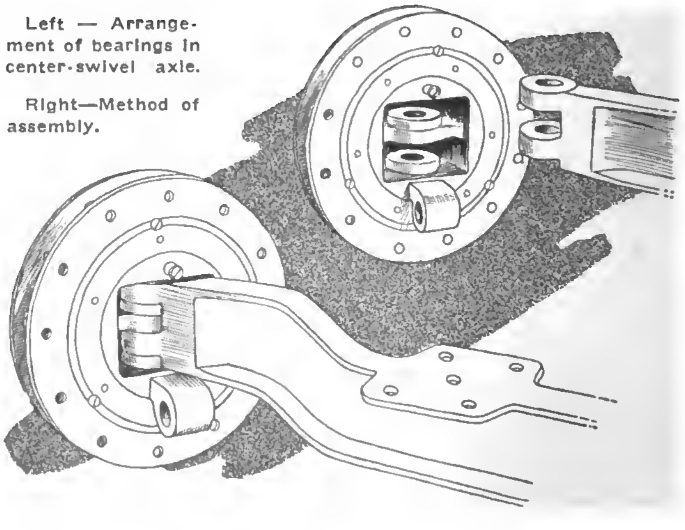
A Design of Swivel Giving Centrally Pivoted Steering

With reference to a recent article in THE AUTOMOBILE on the layout of steering gear Elmer E. McIntyre, ball and roller bearing manufacturer, Pittsburgh, Pa., calls attention to his center swivel front axle, which provides the ideal front wheel mounting without clumsy parts. The illustrations are completely self-explanatory except for the large diameter roller bearing which surrounds the swivel. The weight is taken on two ball thrust races, and the roller wheel bearing is located centrally in the plane of the wheel which is mounted vertically instead of being dished. No road shock barring a glancing blow can deflect the steering.



A feature of the device which is uncommon among centrally placed swivels is that it does not need an ugly or cumbersome wheel hub to accommodate it, and it has the further advantage of being reasonably inexpensive to make. It would be difficult to imagine any sort of axle end easier to forge than this.

Having due regard to its undoubted advantages, it would be interesting to know how many American manufacturers have actually tried out a center pivot axle. In Europe the experiments have been few and far between.



Left — Arrangement of bearings in center-swivel axle.

Right—Method of assembly.

The Rostrum

Minervas In Isle of Man Races

EDITOR THE AUTOMOBILE:—How did the three Minerva-Knights perform in the Isle of Man races a year ago? How did these cars differ from the stock models?

2—Does not an Argyll single sleeve valve motor hold some records on Brooklands track? What are the differences from a stock car of this make?

3—Please publish a horsepower chart of the 1913 Stearns-Knight.

Mesa, Ariz. H. G. A.

—The three Minerva-Knight cars performed excellently in the Isle of Man races. They did remarkably well considering they were the first racing cars made by the Minerva company. They suffered extensively from broken connecting-rods. The motor did not in the least resemble a stock Knight motor as it had large exhaust ports at the bottom of the cylinder, the opening of which was also controlled by the sleeves. At the top of the cylinder the intake and exhaust ports were much larger than usual.

2—An Argyll sleeve motor in 1914 took the world's record for 12 to 14 hr. continuous running on the Brooklands track. This car was a stock car with a single-seated body slightly different gear ratio and special carbureter. Please note the Argyll is no longer manufactured and the single sleeve valve had nothing to do with Knight, very much on the contrary.

3—A horsepower curve of the Stearns-Knight six-cylinder 1913 motor is published in Fig. 1.

Circuit Breaker Cam is Worn

Editor THE AUTOMOBILE:—I have a Great Western four-cylinder car and for some time it has been missing on No. 1 and No. 4 cylinders and I am unable to remedy this. The plugs are all right and the compression is good. I have put new platinum points in the magneto breaker, which is a Remy, have cleaned the carbon from the cylinders, adjusted and readjusted the spark plug points. Have tried new plugs, changed them from 2 and 3 to 1 and 4; have adjusted the carbureter, but still, numbers 1 and 4 miss. Some times they miss and then again they do not. This occurs at both low and high speeds, with and without load. I have also ground the valves. Please advise me just what the trouble can be in this case.

Bastrop, La. A. G. McB.

—The circuit breaker cam in the magneto is probably worn so that the circuits are not broken on cylinders No. 1 and 4, or the distributer gaps for these cylinders might be too wide. Leaky valves or manifold connections might also account for the missing cylinders.

Repair Business Should Be Success

Editor THE AUTOMOBILE:—Is there much profit to be made repairing automobiles?

2—What salary does the average repairman get?

3—Can one become an expert in ten weeks at an automobile school?

4—Which is the quickest and most thorough way to learn the business, in a repair shop or in a school?

Honea Path, S. C. B. S. M.

—This seems to be largely dependent upon the methods of doing business, as there are a large number of successful concerns and also a large number who do not survive. Putting the matter on a broad basis, however, there is no reason why a properly conducted automobile repair business in a proper locality should not prosper.

2—This varies through quite a range but probably $18 a week would be an average.

3—No.

4—A combination of both makes the ideal repairman. He should have a knowledge of the theory as well as the practice.

Installing an Ammeter on Chalmers

Editor THE AUTOMOBILE:—Kindly send me a sketch showing how to install a charging and re-charging ammeter on model 24· Chalmers; also let me know the highest reading that this ammeter will require?

New York City. E. O. H. C.

—The method of procedure in both cases is identical and the ammeter should be cut in off the battery lead as shown in the diagram Fig. 2. The reading of the ammeter should show on charge from 0 to 25 and on discharge 0 to 150.

12-Volt Generator on 6-Volt Battery

Editor THE AUTOMOBILE:—Approximately how much and what size of fine wire would be used in making a cutout relay to work on a 6-volt generator?

2—How can a 12-volt generator be used with a 6-volt storage battery and 6-volt lamps?

3—When pistons are found to fit too loosely in cylinders and cause piston slap, can anything be done with them except fit larger pistons? Have heard they could be enlarged by heating. What is your opinion?

Manitoba, Canada. J. S. C.

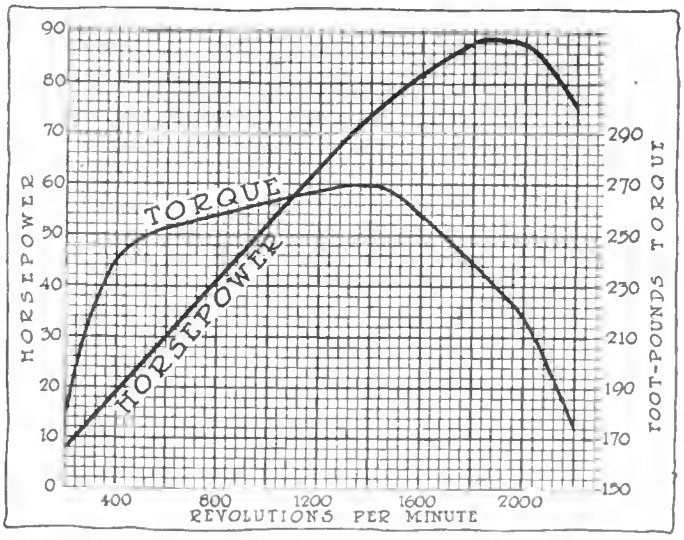


Fig. 1—Horsepower and torque curves of the Stearns-Knight six-cylinder motor of 1913

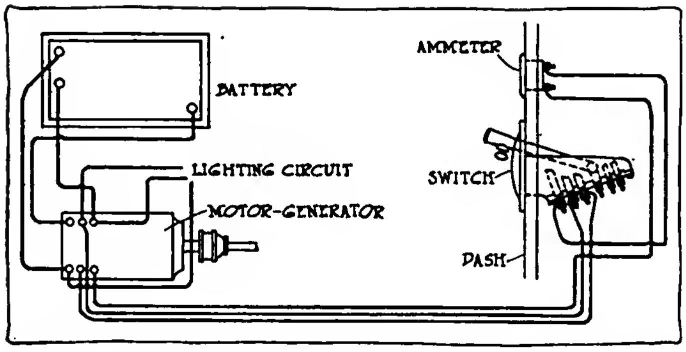


Fig. 2—Wiring diagram showing connections of ammeter on model 24 Chalmers

—The amount of wire and size will vary with the design of the cutout, but it will approximate in general the ordinary bell buzzer winding designed for that voltage.

2—It is a rather difficult proposition to use a 12-volt generator with a 6-volt battery. A 12-volt generator, if its fields are connected in series, can sometimes be changed to a 6-volt by connecting the field in parallel. The generator can also be made to develop 6 volts by cutting the speed in two. When this is done the generator, battery and lamp will work together, although the capacity of the generator will be limited to a considerable extent.

3—The only safe method is to fit larger pistons.

Finding Horsepower by Formula

Editor THE AUTOMOBILE:—Will you please tell me how to find the horsepower of automobiles?

2—What is the horsepower of a car that is 3¼ by 5 in.?

Jamestown, N. Y. K. B.

—Multiply the bore of the motor by itself, then by the number of cylinders and divide by 2½.

Many Factors Determine Car Speed

Editor THE AUTOMOBILE:—Please give me some information regarding two Overland cars. One is a 1914 model 79 F and the other is a 1915 model 81. The 1914 has a 35 hp. motor and 4 to 1 gear ratio and the 1915 a 30 hp. motor with 4 to 1 ratio. Please give the actual speed of these two motors in miles per hour; that is when the momentum of the car is not pushing the engine. Both cars use 33 by 4 tires.

Anna, Ohio. O. E. H.

—It is impossible to give a definite figure in speed in miles per hour for these cars, as they vary considerably with the condition of the motor, the tightness of the bearings, the atmospheric conditions, adjustment of the carbureter and many other factors. In fact, two cars taken out of stock will not make the same speed due to variations in adjustments, etc. It is impossible to give more than an approximate speed, therefore, and in each case this is about 50 m.p.h.

Using an Alcohol Hydrometer

Editor THE AUTOMOBILE:—Kindly advise me how to use an alcohol hydrometer. I wish to test the strength of the alcohol solution in the radiator of my car so I can determine whether I have a safe margin to allow for the various temperatures. I have purchased an hydrometer which is marked as follows: "U. S. C. H. Hydrometer for Spirits with Tralles Scale for Alcohol temperature 60 deg. Fahr."

New York City. W. S. J.

—The way to use a hydrometer in order to test freezing solution is to first make the mixture in your radiator that you desire to use. A reading on the hydrometer is then taken and as the alcohol evaporates readings are taken on the hydrometer and sufficient alcohol added to bring back the reading to the original.

Valve Spring Pressure of Racers

Editor THE AUTOMOBILE:—What is the relation of valve diameter and width of valve seat to valve spring pressure?

2—What are the valve spring pressures of the Chalmers 6-40, Mercer 22-70, Duesenberg motors, Peugeot, Mercedes or other racing cars with overhead valves and camshaft?

3—Where can I obtain some two- or three-ply wood veneer similar to that used in building bodies before metal came into use?

4—How is skin friction, or the friction caused by a body moving swiftly through the air, computed?

5—In a magazine which is no longer published, I read an article in which the author, wishing to show the importance of wind resistance, gave the following example and law, "The wind resistance of a moving body increases as the cube of its speed." He then cited that the wind resistance of a body moving 60 m.p.h. would be twenty-seven times as great as at 20 m.p.h. He obtained this by dividing 60 by 20 and cubing the resulting quotient. This computation of wind resistance and the curve of wind resistance published in THE AUTOMOBILE for Sept. 2, on page 428 do not quite agree. Will you please tell me which is correct?

Akron, Ohio. R. T. O'B.

—The relation between valve diameter to valve spring tension is simply empirical. There is no definite rule which designers follow in this respect. In general, it may be said that the speed of the motor affects the stiffness of the spring more than the points you mention as at high speeds it is necessary to have a spring which will close the valve sufficiently rapidly to prevent the cam from running away from the follower. It must be remembered that the spring acts with the gas pressure against the cam action so that in lifting the valve, the cam must lift the load of the spring plus the load due to the area of the valve upon the pressure is acting. In closing, the gas pressure is immaterial as at that time it has generally reached close to atmospheric.

2—Some of the concerns which you mention object to the publication of details such as the valve spring pressure. On the Duesenberg motor, for the eight-valve type an 80-lb. spring is used on the intake and a 90 on the exhaust. For the sixteen-valve Duesenberg the intake valve spring is 60 lb. and the exhaust 70. The eight valves are 2 3/16 in. diameter and the sixteen valves are 1 13/16 for intake and 1⅞ for exhaust. Owing to the heavier valve on the eight-valve type it will be noted that slightly heavier springs are used. On the Chalmers 6-40 model 32 the valve spring pressure is 49 lb.

3—The nearest concern to you of which we have record is the Empire Panel & Veneer Co., 940 Seneca St., Buffalo, N. Y.

4—This subject takes up more space than is available here but if you will secure any standard work treating on Froude's laws of friction you will find therein the information you desire.

5—The wind resistance curve published in THE AUTOMOBILE for Sept. 2 is based on the well-recognized Smeaton's table, which is largely used in building calculations. There are various other formulas which give wind resistance results which vary from Smeaton's calculations, but the latter are generally accepted.

Use Dull Paint Under Varnish

Editor THE AUTOMOBILE:—I have a Ford roadster and want to repaint it. I want the running gear a bright red, the fenders black and the body blue. In painting it would it be advisable to use a paint with a glossy finish over the old paint or to use a dull finish paint and varnish it afterwards?

Laceyville, Pa. B. W. F.

—It would be better to use a dull colored paint rubbed down and finished with varnish. You can obtain the materials required at any paint store.

Wheel Warmers Consume Little Current

Editor THE AUTOMOBILE:—I am contemplating the use of electrically operated hand warmers on the steering wheel of my Dodge car. Do devices of this sort consume a very great amount of current? Inasmuch as I keep my car in an unheated garage and it requires considerable spinning to start the motor on cold mornings, I do not want to run any risk of having my battery fail me. What can you advise?

Bedford, N. Y. G. A.

—These devices consume very little current and should not prove to be a serious drain on your battery. Entire steering wheels embodying this feature may also be purchased very reasonably.

Franklin's Thermal Efficiency is High

Editor THE AUTOMOBILE:—What is the average operating temperature of the Franklin air-cooled motor? What advantages do the manufacturers claim for it and what is the effect of the higher temperature on the thermal efficiency?

Lawrence, Kan. B. B.

—The average operating temperature of the Franklin car is a little higher than that of a water-cooled car. The possibilities of going considerably higher can be seen by a study of the cooling system.

Just as it is difficult to say what is the average temperature of water-cooled cars, so it is difficult to say what it is with the Franklin. The maximum temperature at which a water-cooled motor can operate is naturally the boiling point of water, or normally 212 deg. The maximum temperature used in this motor is 350 deg.

The oil recommended by the Franklin company has a flash point of 435 deg. and a fire of 490 deg. Naturally the higher the temperature, and providing the lubrication is satisfactory, the greater the thermal efficiency.

Information on the 1914 Cadillac

Editor THE AUTOMOBILE:—What is the actual horsepower of a 1914 Cadillac?

2—What is the bore and stroke of this car?

3—As I understand, this car has a double axle and has four speeds forward. What is the maximum speed that this car can make on third speed and what is the maximum speed it will make on its high-speed axle or its fourth speed?

4—What does this car weigh?

5—When the pressure of this car is pumped to 1½ lb., it drops to about ½ lb. pressure in about 6 min. What is the cause of this?

Brooklyn, N. Y. B. U.

—The actual horsepower of this motor is between 40 and 50.

2—The bore and stroke are 4½ and 5¾, respectively.

3—The rear axle of the 1914 Cadillac is fitted with two direct drives. The transmission was supplied with three speeds. It was intended that the transmission and axle be operated in the folowing manner:

Start the car on low gear, shift into second, then into high in the transmission. Then when the speed of the car increases to 19 m.p.h. or higher, shift the axle into the high direct, providing, of course, that the car is being driven at the time over fairly good roads and in reasonably level country.

4—The shipping weight of the five-passenger 1914 Cadillac was 4095 lb.

5—If the air pressure drops from 1½ lb. to 1 lb. when the engine is running it indicates either that the pump is not properly lubricated or that the pump cylinders or pistons are worn somewhat.

Single Electric Lighting for Ford

Editor THE AUTOMOBILE:—Please tell me how I may wire a Ford car for electric lights and have two independent systems; the storage battery to be wired in parallel and the magneto in either series or parallel.

It must have a foolproof switch so that only one system can be turned on at a time.

Modesto, Ill. K. L. N.

—It is not practicable to attempt to operate the headlights by two different systems, and if you use a storage battery it will be necessary to disconnect the present lighting wires to the magneto. The lights cannot be operated by both the storage battery and the magneto at the same time with satisfactory results. By attempting to do so you would undoubtedly demagnetize your magnets and cause ignition trouble. A storage battery cannot be recharged by the Ford magneto.

Wants Information on 1910 Thomas

Editor THE AUTOMOBILE:—Will you kindly answer the following questions pertaining to a 1910 model M Thomas car?

1—What is the cause of poor compression in two of the cylinders after the valves are properly ground in?

2—Would you advise putting in patent piston rings?

3—Is there any arrangement to advance the timing of the valves without touching the timing gears?

4—How do you time an engine of this make?

5—What are the functions of the ⅝-in. set screw and lock nut set between the pairs of tappet bushings?

6—What causes a grinding noise in the transmission on level ground and when going up hill the noise ceases?

7—What are the adjustments on the Stromberg carbureter on this model?

8—Could you tell me of any 1914 body which I could put on this car without many alterations?

Lynn, Mass. C. C. S.

—This is probably caused by the cylinders being worn out of true, or perhaps a scored cylinder or poor rings.

2—Unless the cylinders are round new rings will not do any good. If they have been worn oval it will be necessary to have them reground. If oversize pistons are fitted any reliable ring will do.

3—No, except by changing the adjustment of the push rods.

4—The two important things in timing the motor are the closing of the exhaust and the opening of the intake. On this motor the exhaust valve should start to close on the exhaust stroke 1/32 in. over center and the intake valve should start to open 1/16 in. in all. If this is carefully done and the push rods are given 6/1000 to 7/1000 in. clearance on the exhaust side and 4/1000 to 5/1000 on the intake side the timing will be correct.

5—The set screw and lock nut between the cylinders are to hold the camshaft bearings in place.

6—It is possible that the trouble is in the trunnion or it may be in the differential. This would have to be determined by a mechanic.

7—The adjustments on the Stromberg carbureter are made through the adjusting screw on the air spring at the bottom of the air intake for low speed and the adjusting nut on the top of the intake for high speed. It is also necessary to see that all joints are right and the proper spray nozzles are used.

8—I would be almost impossible to fit a 1914 body.

The FORVM

ADVANTAGES OF OVER-SIZE TIRES WITH LOW AIR PRESSURES IN GIVING FREEDOM FROM BLOWOUTS—HISTORY OF ALUMINUM PISTON

First Aluminum Alloy Pistons Made in France

LONDON, ENG.—Editor THE AUTOMOBILE:—With reference to the letter of Joseph Leopold regarding aluminum alloy pistons in your issue for Nov. 25, we know nothing about American aluminum alloy pistons as we have not had the good fortune to be able to test them, but we have no doubt that they are satisfactory.

Our reason really for writing to you is in the interests of historical accuracy, since we see that Mr. Leopold claims that a German alloy was used almost exclusively for aluminum alloy piston construction in Europe. To be quite correct, this is in no way the case since the first aluminum alloy pistons ever manufactured and fitted to motor car engines were produced by Messrs. Maxime Corbin et Cie. in France eight years ago. These pistons have been fitted as standard by Messrs. Chenard et Walcker for the last five years and by Messrs. Doriot, Flandrin & Parant for the last two years. We believe that neither of these firms has ever had to replace an aluminum piston during this time and we know that large numbers of Chenard et Walcker cars are in use in different parts of the world without their owners being aware that they are fitted with aluminum pistons.

The article by Mr. Sherbondy struck us as being very close to the truth and we do not see why Mr. Leopold should state that the European aluminum pistons were only worthy of superficial consideration, unless, of course, he is referring to the German ones, since he admits that his company has been able to improve on these.

This letter is simply written with a view to informing your readers of the situation as we could not hope to sell European pistons in America and have nothing to gain in this connection.—THE ALUMINUM PISTON CO.

Oversize Tire Advantages

By Charles E. Manierre

EDITOR THE AUTOMOBILE:—Up to date the tire manufacturers seem to have made no special effort to set forth the virtues of the over-size tires. It therefore seems proper occasionally to refer to the subject in your paper and to emphasize the fact that such tires when used should not be inflated to a pressure equal to the regular sized tire and much less than the pressure sometimes stamped upon the casing.

Referring to your issue of Nov. 25 last, at page 956, we are reminded that the standard sizes recommended by the S. A. E. are limited to the following: 30 by 3, 30 and 32 by 3½, 32 and 34 by 4, 34 and 36 by 4½, 36 by 5, 38 by 5½. That is to say, only nine regular sizes for the use of manufacturers, all of them an even number of inches in diameter, and for each of these regular sizes an over-size 1 in. larger in diameter by ½ in. larger in cross section.

It is to be hoped that automobile makers will keep to the even sizes so that individuals may always have the option of increasing their insurance against blowouts by purchasing the over-size tires.

Your issue of Oct. 22, 1914, contained an interesting letter from Mr. Parsons of the Palmer Tire Ltd., including a table showing the diminishing pressure in pounds per square inch for any given load for each ½-in. increase in the size of the tire. For example: a load which requires a 60-lb. pressure on a 3½-in. tire requires only a 48-lb. pressure on a 4-in. tire, or 42 lb. for 5 in. Also a heavier load, requiring 80 lb. for 3½-in. requires 62 for 4-in., 56 for 5 in., 40 only for 6 in. This diminishing inflation is in accordance with common sense.

So far as the cost is concerned, a set of six regular sized tires costs about the same as five over-size tires. But the five over-size tires will outlast the six regular tires, and at the same time give much less trouble, together with more comfort in driving. I have seen from time to time a number of letters warmly praising the use of the over-size and none whatever discouraging such use.

My own experience in three years' driving, using the over-size (35 by 4½), gives but a total of three inner tube punctures on the road, and I think that each of these was more or less my own fault. Prior to the change from the regular tires the punctures had been quite a common incident.

For a time after putting on the over-size I faithfully inflated them to the pressure of 90 lb. stamped upon the casings, and hard riding was the immediate result. Later on the pressure not infrequently fell as low as 35 lb., both front and rear, and I have no idea how much driving I did on those under-inflated tires. I believe that it was a great many miles at or near that pressure. The fact that they were under-inflated did not appear when the car was standing without passengers. It would seem that instead of 90 lb., 60 lb. for the front wheels and 70 for the rear wheels is the outside that would be necessary. By this I do not mean that those are the pressures that should always be found in the casings, but the pressures to which they should be inflated with the expectation that they will run down somewhat below those figures in the course of driving. This over-size and the pressures mentioned should take care of a 3000-lb. car with five passengers.

May I suggest that in addition to increased comfort there is more satisfaction in driving with tires which scarcely ever bring one to a halt by the wayside and in not having (even with two extra casings inflated and ready for substitution) the lurking fear that two blow-outs may not be the sum total for the day. One extra over-size casing is an almost absolute insurance against any tire repairing at inconvenient points on the highway.

I confidently urge upon the prospective purchasers of tires the favorable consideration of the over-size question, particularly as the regular size tubes can be used in the over-size casings so that the expense of the change is only for the actual casings themselves.

The History of the American Automobile Industry—14

Activity in France Began Mainly After 1870—Bollee, De Dion and Serpollet Amongst the Pioneers—Internal Combustion Engine Soon Replaced Steam

By David Beecroft

IN 1861 the government of Britain passed a uniform tolls act and added to the difficulties of the situation by regulating the engine sizes, the weight on each wheel and limiting the speed to 10 miles in the country and 5 miles per hour in the cities. Also requiring at least two men with each vehicle. Seeing that the power vehicle was not wholly killed by such treatment an amendment was passed in 1865 limiting the speeds to 4 and 2 miles respectively and requiring an attendant sixty yards ahead with a red flag to warn riders and drivers. Naturally the business could not continue much less grow and the hardy pioneers were whipped, not by the problem, but by the vested interests speaking through the law makers.

France Starts in 1870

In France very little was done prior to about 1870. The firm of Lotz, of Nantes, were traction engine builders and their engines were frequently used to haul omnibuses, but they built a sort of steam carriage in 1865. With civil war and an immense new country to develop in America, with foolish restrictive laws in England, France became the logical development ground for the yet-to-be vehicle. The velocipede had gained considerable favor both in Europe and America and while largely out of fashion in America had left its imprint on British and French mechanical minds.

The next 20 years was to impress three names in particular on the minds of American students, viz., Bollee, De Dion-Bouton and Serpollet. Amidee Bollee seems to have begun his work as early as 1872 and built a number of steam automobiles, one of which was exhibited at the Paris exposition in 1878. This vehicle, or a mate to it, was also shown in Berlin and Vienna and driven over much of central Europe. It had the engine inclosed at the front of the vehicle, much like modern gasoline cars. It was the pioneer in this design.

The boiler was vertical and at the rear with coal bins each side, and the vehicle could travel 18 to 22 m.p.h., using for that distance 8½ to 11 lb. of coke. In many ways it marked a very considerable advance from the cruder and heavier structures that preceded it, if we except the several light steam buggies that had been used in America.

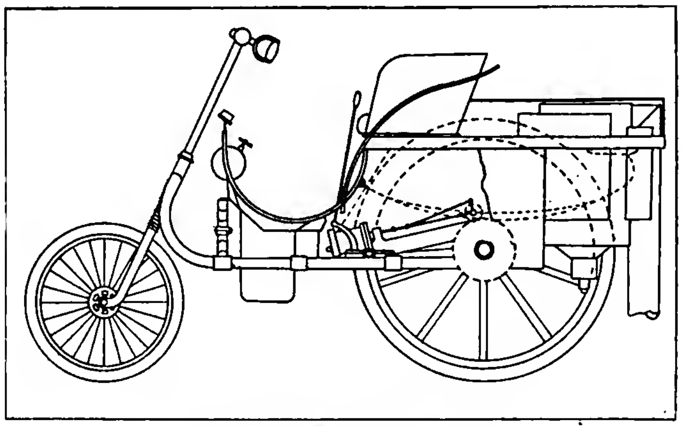
Another small vehicle turned out by Bollee about 1885 had a wheelbase of 75 in. and a gage of 33 in. Its frame was of steel, as were the wheels of which the fronts were 30 in. in diameter and the rears 39. The boiler was located in front with a water capacity of 7½ gal. The total weight was but 1430 lb. and the speed from 21 to 24 m.p.h. maximum.

De Dion Starts with Steam

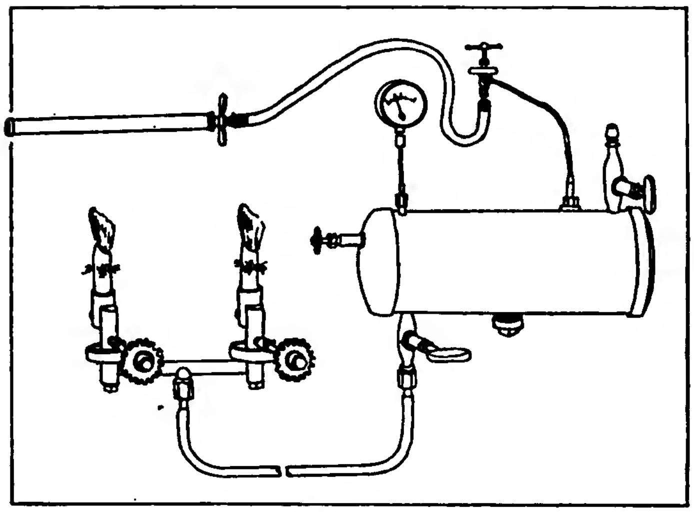
Count de Dion and his partners in manufacturing took up the automobile problem in 1883, and began with that best known motor, the steam engine. With them as with all others, the biggest obstacle to producing a light vehicle was found in the boiler and it was not till 1884 that they appeared with a tandem tricycle having the boiler and engine in the place of the second seat. This attempt was quite light, its motor had about 1 hp. and could run up to 18 m.p.h. on perfect roads.

In 1885 they brought out another tricycle in which the steam generator was carried between the steering wheels and the seat over the rear wheel, which was driven by a tandem compound steam engine directly connected. This machine was driven by Bouton as fast as one kilometer per minute.

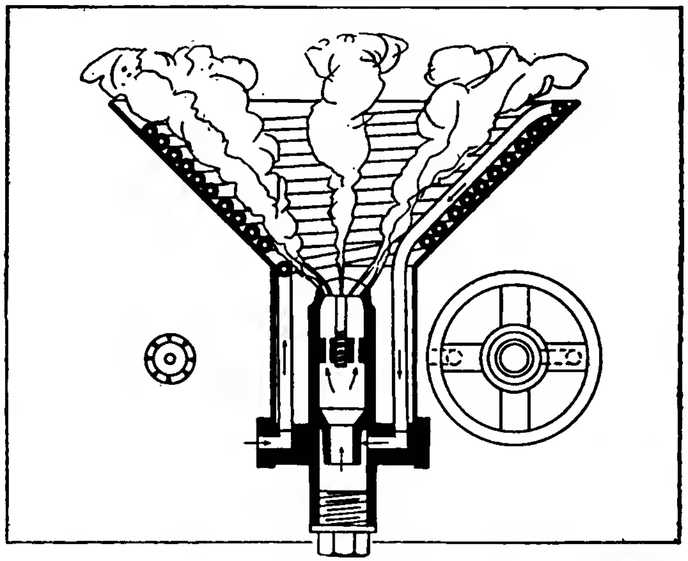
In the next 8 years they made a number more of these vehicles of different types, including a small carriage carrying its entire mechanism at the front but with the connecting-rods of the two tandem compound engines extending to and driving the rear wheels. The seat was wide enough for four people, and the weight about 1300 lb.



One of the first Serpollet steam cars



The principal parts of the Longuemare burner for a flash boiler of the Serpollet type, including fuel tank and air pressure pump to spray the gasoline.



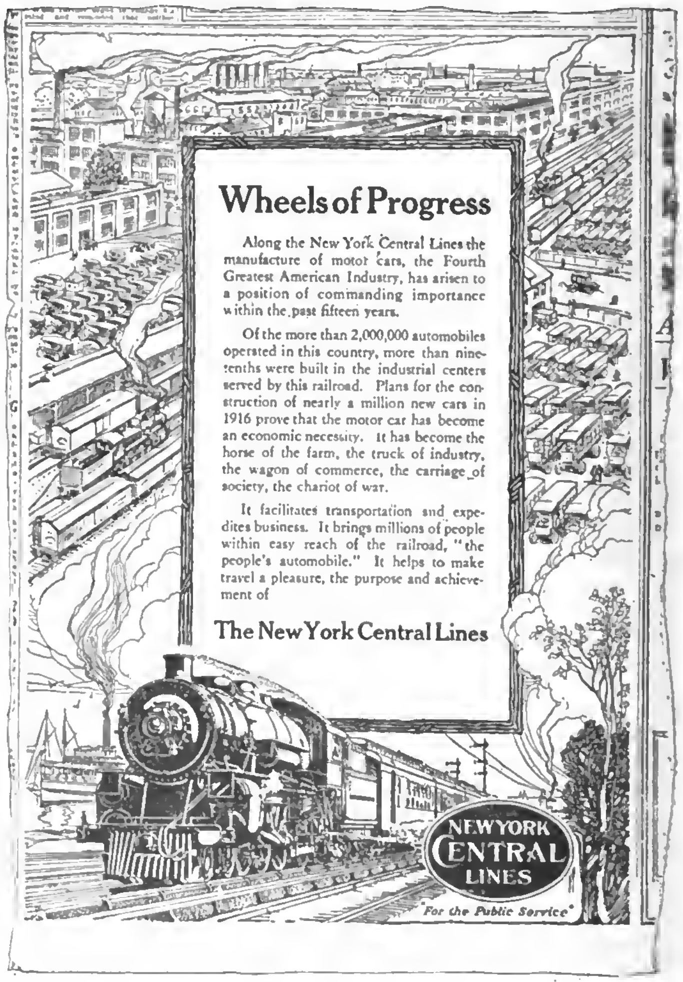
Details, in a diagrammatic form, of a Longuemare burner intended to burn kerosene

They next turned their attention toward steam tractors and won the Paris-Rouen contest of 189 with one of these. Its front wheels were rub tired, but the rears were shod with iron. It weighed 3500 lb. empty, and 5000 lb. loaded and charged with water for 20 miles, and fuel for 60. Its construction embodied a form of full floating rear axle.

Serpollet's Flash Generator

Both Bollee and De Dion soon took up the gas engine and so the best known French advocate of the steam vehicle is Serpollet. Confronted as was De Dion and every other builder for road use, with the fact that the demands for steam varied almost constantly and over much range he took up the problem of the steam generator and produced one having flattened tubes which exposed a very large surface to a small amount of water. These flat tubes opened up and so defeated his intent, which objection he met by making them curved in cross-section. He also used very thick walls and attempted to store the heat in these walls so that when a sudden demand for steam came the walls themselves would largely meet it. His first vehicle, built about 1886, was a very crude tricycle design with boiler at the rear. His next tricycle had rubber tires and was a noticeable improvement. The next year, 1889, he built a seven-passenger tricycle weighing 2500 lb. empty, and about 4000 lb. loaded. The rear wheels were driven by chains from the shaft of a horizontal two-cylinder engine. Fuel for 40 and water for 20 miles were carried. The inventor relates that he drove this vehicle 144 miles from Paris to Douai on less than 12 francs' worth of coke. He averaged 17 m.p.h. over some stretches and thought a maximum of 25 miles was reached at times. Later an American named Gardner joined him, and the Gardner-Serpollet steamers became well known in the early years of the modern industry.

In 1833 a highly ornate coach was brought out by a Dr. Church. This used spring wheels 8.5 ft. in diameter with tires 18 in. wide, and a single smaller wheel in front for steering. Its passenger load was fifty people and it employed a set of full elliptic springs on the front, a distinction from Hancock's carriages which seems to give preference to semi-elliptic. Church seems to have continued his experiments for about 5 years.



Wheels of Progress

Along the New York Central Lines the manufacture of motor cars, the Fourth Greatest American Industry, has arisen to a position of commanding importance within the past fifteen years.

Of the more than 2,000,000 automobiles operated in this country, more than nine-tenths were built in the industrial centers served by this railroad. Plans for the construction of nearly a million new cars in 1916 prove that the motor car has become an economic necessity. It has become the horse of the farm, the truck of industry, the wagon of commerce, the carriage of society, the chariot of war.

It facilitates transportation and expedites business. It brings millions of people within easy reach of the railroad, "the people's automobile." It helps to make travel a pleasure, the purpose and achievement of

The New York Central Lines

The advertisement of which this is a reproduction, recently appeared as a full page in various prominent daily newspapers. It is particularly noteworthy because it shows how greatly the attitude of the railroad companies has changed toward the automobile. A few years ago such an advertisement would have been deemed utterly impossible.

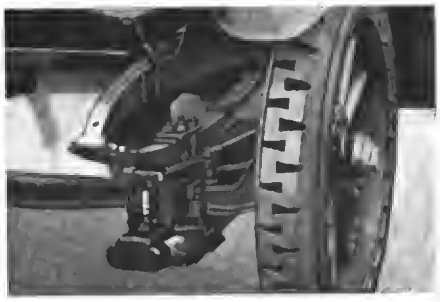
ACCESSORIES

Jones Pneumatic Spring

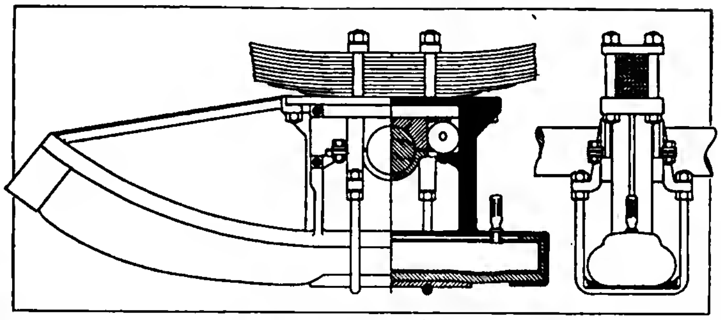
How to secure pneumatic tire action with solid tires is a question which has been the subject of a number of inventions during the last few years. A very ingenious method of solving the question is suggested by the Jones Pneumatic Tire Spring Co., which, as the name implies, incorporates the pneumatic action with the spring, although the car itself is equipped with solid rubber tires.

In other words, the Jones pneumatic tire spring utilizes the principle of the pneumatic tire as a cushion but takes it away from the road, thus eliminating wear on the pneumatic unit from riding friction, blowouts, rim cuts, punctures and other familiar tire troubles. The device can be atached to any car without mechanical changes and as suggested by the illustration, this is done by simply removing the spring clips and installing the Jones axle clips.

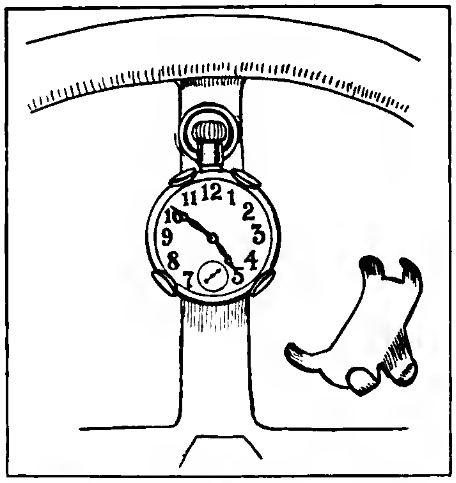
As shown by the illustration, the pneumatic cushion is slung beneath the axle in such a way that the upward or downward thrusts on the spring are communicated to it by the pneumatic medium, while the car itself is equipped with solid tires. The pneumatic units are not subjected to any wear except that due to cushioning shocks and they can be kept to any desired pressure by inflating through the valves with which they are equipped. The Jones pneumatic springs are $150 a set, except for Fords for which car they sell for $50 per set.—Jones Pneumatic Tire Spring Co., New York City.



Jones Pneumatic Spring



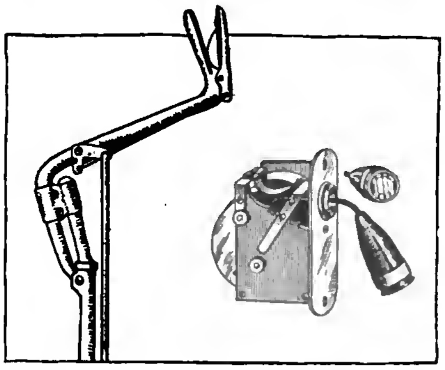
Section of Jones Spring



Jay & Dee watch and holder on wheel

Jay & Dee Watch Holder

This watch holder is a felt-lined one-piece steel clamp, down-turned fingers of which grip one arm of the steering wheel, while four upturned fingers clasp the watch. The clip holds the watch firmly in place, but not so tightly that it cannot be easily detached by a pull when leaving the car. It can then be carried in the pocket, being a standard timepiece with special dial and hands. The watch and clip are not sold separately, the combination listing at $1 each.—Jay & Dee Specialty Co., Inc., New York City.



Left—Grout's lever extension. Right—Electric cigar lighter

Grout's Lever Extension

This is an offset extension for the Ford brake lever which brings the handle 7 in. closer to the driver and makes it considerably easier to manipulate the brake. The latch handle is carried along with the extension so that the brake is used in the same way as with the straight handle. Attachment is made by a clip and a single bolt and the work can be done in a few minutes without fitting or machine work. The device is of steel, finished in black enamel. Price, $3.50.—B. F. Grout, Derby, Vt.

Weaver Bucket Grease Pump

This device consists of a heavy valveless grease pump; is detachably mounted in a large bucket so that it can be used in three ways; grease can be pumped from the bucket into a gearbox or rear axle housing; it can be pumped from a case or housing into the bucket; and it can be pumped from its original can or barrel into the housing, without using the bucket. Valves are eliminated by using ports which are covered and uncovered by a slight turn of the pump barrel. The barrel holds exactly 1 lb. of grease or heavy oil and is 2 in. in diameter, made of heavy brass tubing. The bucket of sheet steel, has a two-part cover, one section sliding within the other, and holds 25 lb. of grease. The hose used is of flexible steel and is ⅝-in. in diameter. The illustrations below show the handiness of the bucket pump. Not only is time saved by using it, but much waste of lubricant. Price, $12.—Weaver Mfg. Co., Springfield, Ill.

Weaver bucket grease pump, showing two methods of using

Detroit Gears for Fords

These special gears are designed to permit an increase of speed where conditions are favorable or to lower the gear ratio of Ford cars for very hilly country, being supplied in one ratio lower than the standard, 3.63 to 1, and three higher. The low ratio is 4 to 1, and the higher ratios 2¾ to 1, 2 4/7 to 1 and 3 to 1, the highest, or 2 4/7 to 1, gear being for racing purposes, the 2¾ to 1 for fast roadsters, and the 3 to 1 for general driving. Gears are nickel steel, hardened and sand blasted, all except the racing type being interchangeable with the regular Ford gears. A little machining is necessary for the installation of the racing gears, instruction for which is furnished. The gears offer a very simple means for saving gasoline as well as for gaining speed, as the use of a slightly higher ratio in flat country, will reduce the fuel consumption in practically the same proportion as the gear has been raised. The gears sell for $15.—Detroit Radiator & Specialty Co., Detroit, Mich.

Cutler-Hammer Grounding Switch

This switch is designed to ground the magneto circuit and so prevent the operation of the car until the ground is removed. The ground is established by pulling out a plug, which is small and may be carried on a key-ring when not in the switch. The switch may be installed in any convenient place. It sells for 76 cents.—Cutler-Hammer Mfg. Co., Milwaukee, Wis.

Dover Offset Funnel

The Dover funnel is designed for filling tanks which cannot be conveniently reached with a straight funnel, its offset spout giving a horizontal reach of 10 in. The spout outlet is ⅞-in. diameter and the top of the funnel 10¾, the capacity of the funnel bowl being 1 gal. The material used is copper-plated steel. The spout is removable for compactness. Price, $2.—Dover Stamping & Mfg. Co., Cambridge, Mass.

Polson's Blow-Out Patch

This blow-out patch is of heavy white friction fabric with red rubber ends, the entire patch being vulcanized over a mold. A flap prevents pinching, the fastening being a self-adjusting strap. When air pressure is applied the patch expands at the ends and tightens in the middle, preventing pouching at the blow-out. The 3-in. size sells for 80 cents; 3½-in., 90 cents; 4-in, $1; 4½-in. $1.20, and 5-in., $1.40. All the patches are 10-in. in length.—Polson Rubber Co., Kansas City, Mo.

Trescot Pocket Testers

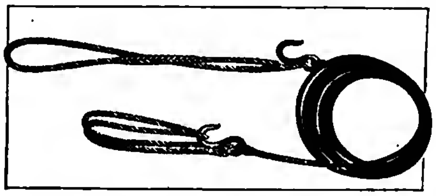
The Trescot pocket meters for battery testing are somewhat smaller than the standard Sterling pocket instruments, and, while possessing the same constructional features, are little more than ½ in. thick and 1¾ in. in diameter. They consist of: Ammeter, 40 amp. in 5-amp. divisions; voltmeter, 10 volts in ½-volt divisions; voltammeter, 40 amp. in 5-amp. divisions and 10 volts in ½-volt divisions. The ammeter sells for $1, the voltmeter $1.10 and the voltammeter $1.35.—Sterling Mfg. Co., Cleveland, Ohio.

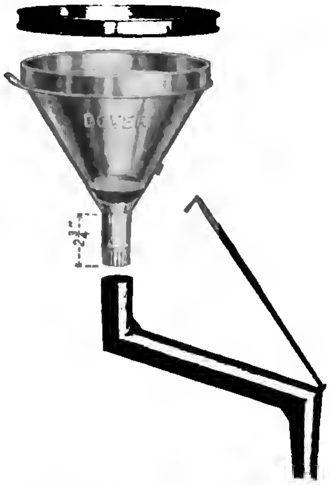
Ekern's Garage Grease Gun

A new model Ekern's grease gun has been brought out having a heavy seamless steel cylinder 6-20 in. and holding 20 lb. of grease or 2½ gal. of liquid oil. The tank is mounted on wheels. The hose is 5 ft. long and has a special nozzle and shut-off at the end. A scale at the top measures grease accurately and checks the amount used. A new feature is an extra set of gears which makes it possible to bring the piston from the bottom of the cylinder to the top, when the container is empty, at three times the descending speed. The piston is lifted out and swung to one side to fill with grease or oil. The gun sells for $30.—Ekern Bros., Flandreau, S. D.

U. W. Pull-Out Line

This is a steel wire cable for towing work, the hook spliced on each end being fitted with two manila rope slings for making fast to axles to give flexibility in towing and to prevent marring of the finish. The line is 25 ft. long, including the slings in towing position. It sells for $2.—Upson-Walton Co., Cleveland, Ohio.

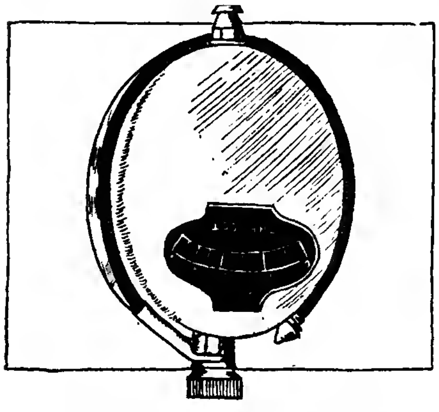

U. W. steel towing line and slings



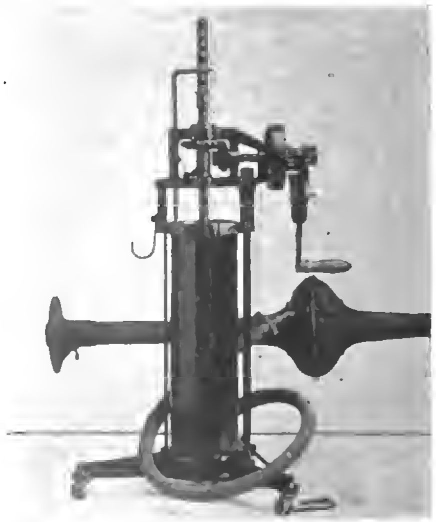
Dover funnel with offset spout


Polson's rubber-ended blow-out patch


Gears for changing Ford ratio


Trescot thin model pocket meter


Cutler-Hammer magneto grounding switch


Ekerns new model garage grease gun

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Materials and Makers

"STAND by us and we will stand by you." This is the attitude that some of the large parts manufacturers seem to be taking toward the makers of raw materials. The concerns which furnish the makers of automobile parts with raw materials know that this shortage is but a temporary one, and it would be indeed foolish and short-sighted for them to raise the price to a prohibitive degree to customers whom they know to be steady and good for business for an unlimited number of years.

This attitude toward the parts manufacturer, who buys in such large quantities that his business is cherished, is the only possible fact that can explain the large number of recruits to the passenger car manufacturing business. These new concerns are all in the assembling rather than in the manufacturing business, and this means that they must be able to purchase parts at prices which will enable them to compete with cars which are built complete in the home factory.

The fact is that the price of materials has not so seriously hampered the parts makers that they cannot continue to sell parts to new concerns. The feeling of fear against serious shortage that was noted a few months back seems to be passing over, and the small manufacturer does not seem in the least worried at the present time.

Chicago Meets Expectations

AS was anticipated on all hands the Chicago exhibition proved to hold few surprises of a mechanical nature. It is practically a repetition of the New York exhibition with hardly a difference in the cars. Reports of the first few days prove that it is a great success, the attendance being good and the scheme of decoration, on which so much trouble has been lavished, voted remarkably effective.

That color in connection with automobiles is beginning again to be considered was indicated in New York, and emphasized at Chicago. The effect of so large a display of bodies with carefully chosen paintwork and upholstery is bound to be great. At both shows it was easy to see that the neatly colored car, not the gaudy eye-stunning creation, but the quiet red or blue or gray, attracted much favorable comment. This means that the public taste is being educated away from the unsuitable black toward a more serviceable and more attractive scheme.

It is unquestionably a fact that dealers find the offer of a choice of color a great advantage, even if the color cost a little more than standard black. Probably this is because it allows a customer to impress his own individuality upon his automobile to some extent, giving him a car that is recognizable from his neighbor's without a critical inspection.

Detail Refinements

IT was pointed out at the recent meeting of the Metropolitan Section of the Society of Automobile Engineers that no radical changes in automobile design had been made during the past year, and that all the changes are in the nature of detail refinements. This is an interesting viewpoint, and at once brings the observer back to the question of what is, and what is not, a radical change. Certain it is that the introduction of the spiral bevel drive, for instance, into the lower-price cars must mean that somewhere someone has found a process which radically cut the price of manufacture of these parts.

So on throughout the entire gamut of changes made during the year. On the car they appear as minor refinements, but each one of them stands for something more than that in the plant of the manufacturer.

The reflection that detail changes have on the whole make-up of the car is a point not to be overlooked. Apparently it makes little difference to the car user if the cylinders are cast in block or singly, but when he stops to consider that the block-cast motor shortens the hood and gives more room throughout the entire body for a given amount of wheelbase it begins to be evident that the change does affect him. Vacuum feed, apparently, is not connected with baggage space, and yet the fact that the tank is removed to the rear allows for much greater carrying capacity under the seat. Each alteration has effected some other part of the car besides that with which it is intimately connected, and while improvements in themselves may be classed as minor, yet the *tout ensemble* has been definitely improved.

Jordan Motor Car Co. Organized

Capitalization $800,000—Company Is Based on Co-operative Plan

CHICAGO, ILL., Jan. 25—The work of organizing the Jordan Motor Car Co. was practically completed at a meeting of the stockholders held here to-day. Two-thirds of the preferred stock issue of $300,000 was subscribed and reservations made for at least one-half of the remainder by persons desiring to distribute it among their friends and business associates.

The company is based on the co-operative idea in which E. S. Jordan, president, has associated with him on a stockholding basis practically all of the dealers who have to date arranged to handle the product; and besides several men interested in the manufacture and sale of components and accessories. To this list have been added the names of several well known advertising and newspaper men. A portion of the unsubscribed stock is being held for prospective dealers who have expressed an interest in the new organization.

The organization prospectus calls for a total capitalization of $800,000, including $500,000 preferred and $300,000 common. Of the preferred $200,000 is being held in the treasury. The common stock is given as a bonus with the preferred on the basis of one-half share to every share of preferred. The preferred pays 7 per cent cumulative and is redeemable at the company's option of two years at 110.

Already all the specifications of the Jordan car have been decided upon and parts for 2000 machines contracted for with the most reliable parts makers, these including such names as Continental, Timken and Brown-Lipe.

The car is a six-cylinder design, the chassis assembled from components as indicated and with particular attention devoted to body design, the lines of which incorporate the latest tendencies in custom body work. Appearance, comfort, power and durability have been aimed at.

New Tire Pump Ready

NEW YORK CITY, Jan. 20—The Edward A. Cassidy Co., Inc., this city, is introducing an engine-driven tire pump under the name of the Cassco. This pump, a single-cylinder device, is listed at $8. It is claimed that the device contains new constructional features, covered by Cassidy patents, which eliminate all piston difficulties. At present fittings are furnished for Buick, Studebaker, Chandler, Chevrolet, Dodge, Reo, Saxon, Overland and Hudson cars. Fittings for other cars are being prepared. The pumps will be ready for delivery Mar. 15.

Three new men have been added within the past week by the company. They are R. G. Ames, G. B. Gosman, and C. P. Brewster. Mr. Ames will cover the Western territory for the company and will make his headquarters in Chicago. Mr. Gosman, formerly assistant general manager of the automobile accessories division of the H. W. Johns-Manville Co., has been elected secretary. Mr. Brewster will cover Pennsylvania and the South for the company.

Burr Leaves Woods Electric

CHICAGO, ILL., Jan. 25—Information has just became public that Louis E. Burr for many years at the head of the Woods Motor Vehicle Co. has severed his connection with that concern.

Mr. Burr resigned early last November. "I left the Woods Co., selling out my interest nearly three months ago," said Mr. Burr to-day. "But it was a part of my agreement not to make the matter public. The company was planning a new car and it was thought best not to announce my retirement from the organization." Mr. Burr now is engaged in the bond business in Chicago.

A. A. A. Assigns Race Dates

NEW YORK CITY, Jan. 22—The following dates have been assigned for automobile contests during the coming season. Those marked * have been assigned official sanction numbers and the other dates are tentatively assigned pending completion of the preliminary requirements under the contest rules:

Date	Event and Promoter
Feb. 22	Speedway—Los Angeles Ascot Speedway Assoc.
May 6	Speedway—Sioux City Sioux City Speedway Assoc.
May 13	Speedway—New York Sheepshead Bay Speedway Co.
May	Speedway—Chicago (Amateurs) Speedway Park Assoc.
*May 30	Speedway—Indianapolis Indianapolis Motor Speedway.
June 10	Speedway—Chicago Speedway Park Assoc.
June 28	Speedway—Des Moines Prince Speedway Co.
July 4	Speedway—Minneapolis Twin-City Motor Speedway Co.
July 4	Track—Coeur D'Alene, Idaho Hiller-Riegel.
July 4	Speedway—Sioux City Sioux City Speedway Assoc.
July 15	Speedway—Omaha Omaha Auto Speedway.
Aug. 5	Speedway—Tacoma. Tacoma Speedway Assoc.
Aug. 18-19	Elgin Road Races Chicago Auto Club.
Sept. 4	Speedway—Indianapolis Indianapolis Motor Speedway.
Sept. 4	Speedway—Des Moines Prince Speedway Co.
Sept. 16	Speedway—Providence Narragansett Park Speedway.
Sept. 29	Track—Trenton, N. J. Inter-State Fair (H. P. Murphy, Racing Sec.)
Sept. 30	Speedway—New York. Sheepshead Bay Speedway Co.
Oct. 7	Speedway—Omaha Omaha Auto Speedway.
Oct. 14	Speedway—Chicago Speedway Park Assoc.
Oct. 19	Speedway—Indianapalis Indianapolis Motor Speedway.

Harding Twelve Announced

New Car to Be Made in Cleveland—Experimental Work Completed

CLEVELAND, OHIO, Jan. 24—The Harding Twelve is Cleveland's newest car. It will be placed on exhibition at 1824 Euclid Avenue within a few days.

F. I. Harding, formerly treasurer of the Peerless Motor Car Co., and W. C. Spaulding, formerly president of a large knitting company, are the founders of the Harding Motor Car Co., which will manufacture and market the Harding car. A number of other prominent business men of this city will be interested in it. At present the offices are on the fifth floor of the Cuyahoga Building, but factory space will be secured at an early date and the company will begin to build cars for the trade.

Has Good Body

In appearance this car is rather foreign. Instead of the straight lines of the streamline car, curves have been used, blending into each other from the radiator through the hood, cowl and body to the rear. This renders the car distinctive, but not freakish. It sets low and is furnished with crowned fenders, cowled back to the front seat and is generally graceful in contour.

The motor of the new car is of the twin-six type. The cylinders, 2¾ by 5, are cast in blocks of six each and the heads are removable. The crankshaft may also be easily removed without disturbing the cylinders, this rendering it very convenient for making repairs and reducing the upkeep.

The carbureter is located on the left side and the starting and lighting units on the right, the V being left clear. The first car is a seven-passenger and it is probable that no other type of body will be built, not this year at least. Later on a roadster may be offered the public if it is seen that there is a call for it after the other car is out.

To Reorganize United Motor Truck

GRAND RAPIDS, MICH., Jan. 21—Prospects are said to be bright for rejuvenating the United Motor Truck Co., which has been in a financially embarrassed state for several months. A committee appointed by creditors to decide upon a feasible plan for overcoming the difficulties has reported that $100,000 of the $150,000 merchandise creditors have replied to letters and that the total will reach $131,000. This figure does not include the $80,000 held by banks and Frank T. Hulswit.

Metropolitan S.A.E. Discusses Show

New York Engineers Debate Developments of 1916 Cars

NEW YORK CITY, Jan. 21—At the meeting of the Metropolitan Section of the Society of Automobile Engineers, held at the Automobile Club of America, the nominations of officers for the coming fiscal year were announced by the nominating committee. The new nominees are Leonard Kebler, president Ward Leonard Electric Co., for chairman; Harry Tipper, advertising manager of the Texas Co., secretary; and H. G. McComb, engineer of the General Vehicle Co., treasurer. The officers held over from this year who will serve on the governing committee for the next fiscal year are R. McA. Lloyd, consulting engineer, present chairman and J. Edward Schipper, technical editor THE AUTOMOBILE, present secretary. Elections will take place at the next meeting which will be held Feb. 17.

The paper discussed at the meeting was entitled "Some Engineering Features of the 1916 New York Show," by H. H. Brown. It dwelt on the detail improvements which have been made during the year, especially in the refinement of parts of the car which have made it more efficient from the owner's standpoint. One of the points commented upon by Mr. Brown is the attention which has been given to the lubrication of the slower moving parts such as the springs, steering knuckles, spring bolts, etc.

Referring to the question of the multicylinder motor, Mr. Brown said:

"While there is little doubt but that the demand for the polycylinder motors over that for the four is largely a matter of style yet it is probably founded on the sound basis of a demand for a flexible car.

"While many of the manufacturers have sought to satisfy this demand by supplying six-, eight- and twelve-cylinder motors for their cars, yet there are others that have realized that flexibility in a car depends primarily on the number of impulses imparted to the drive wheel in a revolution rather than to the crankshaft of the motor.

"These manufacturers have therefore sought to give the public flexible cars by providing the car with a light, well built, well balanced, high-speed motor geared comparatively low on high rather than with one of many cylinders or large cylinder displacement geared comparatively high.

"There is no doubt but that the six-cylinder motor is a better naturally-balanced motor than the four, hence to rival the absence of vibration in the six the advocates of the light high-speed fours have sought to obtain as good balance as possible by refining the details of design and by lessening the weight of reciprocating parts."

The discussion consisted chiefly of comments by the members on the interesting features of development as seen at the show. The more extended use of spiral bevel drive, thermo-syphon cooling, block casting, better brake arrangements and unit power plants excited particular interest. The absence of the transmission brake was also commented upon.

Gloetzner Vice-President Bour-Davis

DETROIT, MICH., Jan. 25—A. A. Gloetzner, assistant chief engineer of the Chalmers Motor Co., has joined the Bour-Davis Motor Car Co., Detroit, where he will have full charge of the purchasing and engineering departments. He is also vice-president of this new company.

Mr. Gloetzner has been actively connected with the production and engineering end of the automobile industry for about thirteen years. He was at one time assistant production manager of the Olds Motor Works. He also was factory manager of the Krit Motor Car Co. and also of the Owen Motor Car Co.

Bradfield Velie Sales Manager

MOLINE, ILL., Jan. 22—F. E. Bradfield, who has been associated with the Velie sales department almost since the inception of the Velie Motor Vehicle Co., has been appointed to the position of sales manager and will hereafter have jurisdiction over the entire sales organization. He will be assisted in his work by G. H. Lloyd, long connected with that company's sales, which to date, are over 400 per cent greater than those of a year ago.

Dunlap Chandler Sales Manager

DETROIT, MICH., Jan. 25—J. M. Dunlap will becomes sales manager of the Chandler Motor Car Co., Cleveland, Ohio, on Feb. 1. Mr. Dunlap was the organizer of the Dunlap-Ward advertising agency here, which had charge of the Chandler advertising campaign during the last two years.

Studebaker to Retire $2,308,500 of Serial Notes

DETROIT, MICH., Jan. 22—The Studebaker Corp. has called for payment on March 1 of the remaining $2,308,500 of its 5 per cent serial notes. This wipes out the last of the $8,000,000 note issue sold March, 1912.

Grant Increases to $4,000,000

Originally Capitalized at $100,000 and Raised to $200,000

CLEVELAND, OHIO, Jan. 25—The Grant Motor Car Co., Findlay, Ohio, is to increase its capital stock from $200,000 to $4,000,000, of which $3,000,000 will be common stock, the shares having a value of $10, while $1,000,000 will be 7 per cent cumulative convertible preferred stock, of $100 value per share. Of the common stock $1,000,000 is reserved for the conversion of the preferred stock and the total authorized outstanding stock is thus $3,000,000.

The preferred stock is now offered to the public by Andrews & Co., investment brokers in Chicago and Detroit, at $105 with a bonus of 20 per cent in common stock. The 7 per cent preferred stock is convertible into an equal amount in par value of common stock, that is ten shares of common for one share of preferred, at the option of the holder at any time prior to Jan. 1, 1919. It is preferred over the common stock as to dividends and in the event of dissolution and liquidation, is entitled, in priority to the common stock to repayment in cash at 120 per cent and accrued dividends.

According to a statement of President D. A. Shaw, of the Grant Motor Car Co., the earnings of the company during 1915 were about $165,000. The number of cars shipped was 4,006 while in 1914 the total shipped was 2164. The production for 1916 calls for 12,000 cars and the net earnings are estimated at $720,000 for the year. Beginning July 1, 1916, it is expected that production will be increased on a basis of 15,000 cars annually.

The investment of the company in plant, machinery, tools, etc., is reported to be only $79,239.66, which small amount enables the assets to be current and liquid at all times, and makes rather large earnings possible on a small capital investment. The company started in business in 1913, with a capital stock of $100,000 which was doubled later.

Ray Harroun Leaves Maxwell

DETROIT, MICH., Jan. 24—Ray Harroun, of the Maxwell Motor Co., who built the Maxwell racing cars and was especially interested in the racing end of the engineering work, has resigned, and will, it is said, devote his attention to the Maxwell racing cars now owned by Carl G. Fisher and himself. No successor has been appointed as yet.

Baltimore Territory Needs 40 Per Cent More Automobiles for 1916

Tenth Annual Show Is Highly Successful—Closed Cars in Strong Demand—Registrations in District Have Increased Over 66 Per Cent

BALTIMORE, MD., Jan. 24—Statistics gathered at the show staged in the Fifth Regiment Armory, Jan. 18 to 22, by the Baltimore Automobile Dealers' Association and the Automobile Club of Maryland reveal that the territory controlled by Baltimore dealers will absorb between 25 and 40 per cent more cars during 1916 than were absorbed in 1915. In actual figures, the State of Maryland registered in 1915, 27,858 pleasure cars, 3189 commercial vehicles and 1341 dealers. The total registration up to date shows that already there have been registered some 10,460 pleasure cars, 2124 commercial vehicles and 913 dealers. These figures include both the State of Maryland and the District of Columbia, and represent an increase of nearly 66 2/3 per cent for the same period last year.

Is Retailers' Show

The show was the tenth annual event to be staged in the city, and from a monetary point of view it was by far the most successful. All told, some 60 dealers of pleasure cars and commercial vehicles had exhibits, and as an indication of the size of the show suffice it to state that there were on view 157 pleasure cars and 71 trucks. Wednesday was the big day, the attendance figures totaling more than 9000, and even on Thursday, which was Society day and for which the admission charge was 50 cents instead of 25 cents, more than 6000 persons passed the ticket takers. The attendance figures for the week were approximately 20 per cent ahead of those for any previous year.

The show is essentially a retail function. Some few dealers and subdealers are appointed by some of the larger distributers who have space, though for the most part it is the Baltimore city dealer who has the exhibit. Accurate figures regarding the number of sales made at any show always are difficult to obtain, though from the reports of exhibitors it appears that sales were quite satisfactory and in many instances greatly exceeded expectations.

Not the least significant feature of the show was the great demand for closed cars and particularly for open cars which are fitted with detachable tops. That the advent of these detachable top cars has had a noticeable effect in bolstering up the sales curve during a time when it ordinarily drops considerably, cannot be gainsaid. In some cases dealers who have not been able to get detachable top jobs from their factories have shifted their representation to be able to offer them.

Another noteworthy feature is the great interest which Baltimore is taking in the commercial vehicle. Up to comparatively recently Baltimore pavements have not been what might be termed excellent, and this has had a depressing effect on the commercial vehicle industry. Now, however, Baltimore is probably one of the best paved cities in the country and this undoubtedly has had some effect in helping sales of trucks. There are at present 11,046 one-horse vehicles in Baltimore and 5025 that are drawn by two horses. These figures are practically the same as for the year 1913. Just how the motor vehicle is supplanting these is

Value of Baltimore's Industries

	No. of Establishments Engaged in	Total Employees	Value of Manufactures	Local Sales	Shipments
BREWING AND DISTILLING					
Malt liquors	12	933	$5,820,841	$5,529,799	$291,042
Spirituous liquors	14	441	2,951,867	837,532	2,114,335
CEMENT, CLAY AND PRODUCTS					
Builders' materials	19	408	452,831	323,819	129,012
Brick	9	1,407	1,252,134	935,655	316,479
Crockery and pottery	3	70	204,000	134,000	70,000
Paving and roofing materials	7	796	4,062,766	3,994,080	68,686
CHEMICALS, OILS, ACIDS, ETC.					
Acids, fertilizer, etc	23	2,257	15,976,306	2,229,783	13,746,523
Paints, varnishes and dyes	11	300	1,933,084	323,550	1,609,534
Soaps and perfumery	11	150	441,519	190,211	251,308
Miscellaneous chemicals and oil	15	1,442	11,965,946	2,253,500	9,712,446
DRUGS AND PREPARATIONS	65	1,702	6,673,355	987,346	5,686,009
FOOD PRODUCTS					
Bakery products and flour	381	2,442	6,740,474	4,221,528	2,518,946
Cereals and spices	5	172	2,068,581	417,699	1,650,882
Preserved and canned foods	52	6,693	12,971,721	1,028,317	11,943,404
Slaughtering and meat packing	49	1,352	18,533,317	8,451,605	10,081,712
Candy and confectionery	50	2,448	5,680,978	1,317,578	4,363,400
Miscellaneous	12	361	2,199,167	374,755	1,824,412
FOUNDRY AND MACHINE SHOP					
Bridge and structural iron	11	682	1,344,388	548,780	795,608
Electrical equipment	7	194	478,870	299,225	179,645
Machinery	51	4,190	6,730,245	1,664,261	5,065,984
Railway cars and construction	6	5,211	11,422,110	1,990,000	9,432,110
Miscellaneous	39	6,520	11,833,751	1,209,348	10,624,403
GLASS AND PRODUCTS					
Bottles and glassware	5	1,322	1,681,521	490,915	1,190,606
Mirrors and stained glass	6	91	158,494	92,912	65,582
JEWELRY AND SILVERWARE					
Jewelry	14	116	322,100	187,780	134,320
Silverware	10	389	974,000	458,500	515,500
Miscellaneous	8	45	64,000	31,500	32,500
LEATHER AND MANUFACTURES					
Belting	7	481	1,690,452	159,500	1,530,952
Shoes	7	673	1,885,000	511,750	1,373,250
Harness and saddlery	14	320	783,399	148,637	634,762
Finishing of leather	4	57	128,500	39,000	89,500
Miscellaneous	5	93	165,000	100,300	64,700
LUMBER AND MANUFACTURES					
Baskets, willow ware, etc	23	137	235,834	150,307	85,527
Boxes, barrels, etc	29	2,017	3,940,232	2,415,084	1,525,148
Furniture	35	2,158	4,754,330	1,165,296	3,589,034
Millwork	22	1,270	2,470,841	1,251,050	1,219,791
Miscellaneous	22	1,615	5,388,300	753,920	4,634,380
PAPER AND PRINTING					
Boxes and bags	20	1,208	1,935,930	981,810	954,120
Printing and publishing	204	4,897	8,763,817	5,208,463	3,555,354
Printers' supplies	17	225	434,288	283,489	150,799
Paper and stationery	5	157	232,695	76,928	155,767
TEXTILES					
Awnings, tents and sails	9	93	203,500	137,363	66,137
Cotton and burlap bags	4	203	1,621,769	622,634	999,135
Carpets and rugs	2	44	63,000	20,000	43,000
Cottons and prints	5	3,856	5,890,000	372,700	5,517,300
Clothing: men's and boys'	82	14,991	30,091,441	1,796,695	28,294,746
Men's furnishings	53	9,788	14,259,068	1,135,273	13,123,795
Hats and caps: except straw	12	339	480,232	103,250	376,982
Ladies' apparel	55	3,450	7,415,884	1,334,859	6,081,025
Miscellaneous	8	812	576,235	240,577	335,658
TOBACCO	208	4,267	10,585,048	3,192,261	7,392,787
TOOLS AND HARDWARE					
Builders' hardware	7	188	304,500	79,500	225,000
Miscellaneous	7	138	567,632	68,543	499,089
VEHICLES					
Horse-drawn	36	510	651,200	584,750	66,450
Motor and vehicle parts	12	181	479,162	242,587	236,575
MISCELLANEOUS					
Brass and bronze products	19	597	872,800	284,110	588,690
Brooms and brushes	18	579	776,055	215,500	560,555
Tin and sheet iron products	61	6,410	24,858,425	3,426,678	21,431,747
Flags, banners and regalia	6	120	141,525	51,250	90,275
Fur goods	15	47	240,000	167,500	72,500
Ice and cream products	42	1,186	2,433,200	2,138,510	294,690
Mattresses and spring beds	15	804	2,877,000	922,600	1,954,400
Millinery and lace goods	9	438	426,127	112,166	313,961
Shipbuilding	17	2,747	6,530,931	409,431	6,121,500
Stone and monument work	54	913	1,896,422	1,133,136	763,286
Umbrellas and canes	9	895	2,274,500	130,800	2,143,700
Straw hats	6	1,970	4,991,238	391,313	4,599,925
Miscellaneous	148	2,759	64,065,208	896,586	63,168,622
	2,228	115,767	353,319,086	73,980,084	279,339,002

revealed by the truck registrations, which for 1915 were 3189, whereas up to date, for 1916, the number is 2124 and gives evidence of eventually showing an increase of considerably better than 66 2/3 per cent.

Covers Seven Counties

The average territory controlled by the Baltimore dealer embraces seven counties—Anne Arundel, Baltimore, Carroll, Cecil, Harford, Montgomery and Howard—with a total population of 295,755; some dealers have more territory, a few of the large distributers having the whole State of Maryland, and some have a little less. And throughout the whole of this territory business prospects are bright, for, as a trade center, Baltimore is growing rapidly. For example, the bank clearings last week totaled $44,418,957, as against $37,120,124 for the corresponding week last year. The increase has been consistent, and, if continued, will show a large gain for the year.

The population of Baltimore, according to the last census figures, is given as 558,485, though there is a project afoot at present to increase the size of the metropolitan district to give a total population of more than a million. Maryland is essentially a farming State, more than 82 per cent of the land area being included in farms, and of this about 68 per cent is improved. It may not be generally known that the State stands second in the canning industry and is led only by California. More than 40 per cent of the tomato pack of the United States comes from Maryland. The single industry of second rank is men's clothing, and this centers largely in Baltimore.

Baltimore Is Prosperous

At the present time, Baltimore is enjoying the wave of prosperity that is sweeping over the Southern States. In the opinion of dealers at the show, this section of the country is entering on a period of unprecedented prosperity, and as an indication of the possibilities of the territory the figures which are given herewith and which cover Baltimore's diversified trade interests are illuminating. These are taken from an industrial survey of the city which was brought to a close in December, 1914. Since that time a number of large industrial interests have located in Baltimore, though no figures are available as to their trade importance.

Jobbing Trade, $250,000,000

Baltimore's jobbing trade, not including the commission business, reaches $250,000,000 yearly. The leading items are dry goods and notions, millinery, clothing, boots and shoes, hats and caps, drugs, groceries and food products, all of which show large increases over the figures given in the United States Census report for 1910. In addition, there are grain and shipping figures of over $100,000,000 and a commission business of a like figure. As an indication of the grain trade, it is pointed out that Baltimore received in 1914 60,770,082 bushels of grain and 1,808,672 barrels of flour. Baltimore's imports for the calendar year were $35,533,814 and the exports were $117,269,378.

Following are figures which give the extent of the motor car industry in the State of Maryland and the city of Baltimore at present, from figures compiled by the Automobile Trade Directory:

	Maryland	Baltimore
Dealers	166	60
Repair shops	34	24
Garages	67	50
Supply dealers	31	30

Mason Tire & Rubber Co. to Be $1,000,000 Corporation

KENT, OHIO, Jan. 22—At a meeting of the board of directors of the Mason Tire & Rubber Company this week, a resolution was adopted to increase the capital stock to $1,000,000, and a meeting of the stockholders will be called within a short time to approve this step. According to a statement made after the meeting, building contracts have already been awarded.

Stutz Doubles Plant

INDIANAPOLIS, IND., Jan. 24—Work has commenced on a new four-story building, 80 by 208, of the Stutz Motor Car Co., which will give it double its present manufacturing capacity. The new building is being erected immediately north of the present plant and the contracts call for completion of the building, which will be a duplicate of the present factory, by June 15. President Harry Stutz says that this new building will make it possible for the company to manufacture more of the parts entering into the car which are at present purchased outside. The new factory will be an insurance against any possible tie-up due to shortage of certain parts.

Harry Bill Vice-President of Springfield Body Co.

NEW YORK CITY, Jan. 24—Harry Bill has become vice-president and general manager of the Springfield Body Co. and will have charge of production. Mr. Bill has been connected with the Hayes Mfg. Co., Detroit, in charge of production.

Elliott Leaves United Motor Truck

GRAND RAPIDS, MICH., Jan. 24—E. M. Elliott has resigned as vice-president and general manager of United Motor Truck Co., Grand Rapids, Mich. His future plans have not been announced.

John A. Hill Dies Suddenly

Famous Publisher Did Much to Develop Technical Journalism

John A. Hill, president of the Hill Publishing Co., died suddenly from heart disease on Monday morning, Jan. 24, while traveling in his automobile from his residence in East Orange, N. J., to his place of business.

Mr. Hill was fifty-seven years of age, having been born on Feb. 22, 1858, in the town of Sandgate, near Bennington, Vt. While a young lad his parents emigrated to central Wisconsin and he was educated in the public schools there. He had a liking for mechanics, however, and after some years in a printing office he became half owner of a machine shop, where he carried on repairs to a variety of local machinery. In 1878 he removed to Colorado and ran a locomotive on the Denver & Rio Grande R. R. for a time.

His bent toward journalism and the printing office was shown by his founding in 1885 the "Daily Press" of Pueblo, Col., which journal he edited for some time.

A number of his articles were contributed to a modest sheet called "Locomotive Engineering," which was published in New York by a company which also published the "American Machinist." In 1888 Mr. Hill was invited to come to New York and take charge of "Locomotive Engineering." Under his charge the journal rapidly increased in importance. Seeing the possibilities in the enterprise, Mr. Hill associated himself with Angus Sinclair, purchased the journal from its owners and undertook to carry it on as a separate publication. In this venture Mr. Hill was both editor and publisher, and his genius was well proved by the phenomenal success of the publication. Its subscription list grew by leaps and bounds, and it rapidly assumed the leading position in its field.

In 1896 Mr. Hill sold his interest in "Locomotive Engineering" to his partner, Mr. Sinclair, purchased the "American Machinist" and laid the foundation for one of the largest enterprises in the field of technical publication ever established.

At that time practically all class publications had their printing done by contract and were limited by such facilities as the printers were willing to provide. Mr. Hill's early experience in the printing business had given him a strong liking for this side of the publishers' work, and he was ambitious that his publication should be able to own and operate its own printing plant. In order that such a printing plant shall be commercially successful, however, it cannot concentrate its work upon a single journal, but must be able to distribute it over a number.

It was this situation among others which led Mr. Hill to add to the successful "American Machinist" other well-established technical journals of high reputation. His first purchase was "Power." Later the "Engineering and Mining Journal" passed under his control. In 1912 he purchased the "Engineering News" from its founder and chief owner, George H. Frost.

To carry on these various publications Mr. Hill organized the Hill Publishing Co., in which, while he held the largest interest, a number of those associated in the conduct of the various journals were also stockholders. A fifth journal, "Coal Age," was established in 1911 to cover a field which it had become evident was too broad to be successfully reached by the "Engineering and Mining Journal," chiefly devoted to metal mining interests.

An enterprise in which Mr. Hill took great pride and to which he devoted some of the best energy of the last years of his life was the construction on the west side of New York City of the great building to house his publications, which was completed in 1914.

Montreal Show Is Social Function

MONTREAL, Jan. 22—The third annual Motor Show, held under the direction of the Montreal Automobile Trade Association, Limited, was opened to-night by His Honor the Lieutenant Governor of the Province of Quebec, and took place in the basement of Almy's store, where every inch of the 20,000 sq. ft. floor space available was occupied. If the opening night is any criterion as to attendance, it is safe to say that the social recognition formerly given to the Annual Horse Show will be transferred to the Motor Show. The number of cars on exhibition reaches 75, while there are 45 exhibitors at this year's show. A considerable number of commercial trucks are on exhibition which last year were apparently lacking in numbers. Several new cars were shown for the first time, including the National, Davis, Grant, Saxon, Canadian, Briscoe, Crow and Chevrolet.

H. A. L. Ready to Produce

CLEVELAND, OHIO, Jan. 24.—The space leased by the H. A. Lozier Company in the old Royal Motor Car factory aggregates 59,000 sq. ft. The building is protected by a sprinkler system, and the natural and artificial lighting systems are of the best. Contracts for material were all awarded some time ago and the company will go right forward in the manufacture of the H. A. L. 12.

Stevens Bill in Mass Meeting

Bill Before Congress Intended To Prevent Price Cutting

NEW YORK CITY, Jan. 22—A mass meeting to discuss the Stevens Bill was held at Madison Square Garden yesterday in connection with the pure food and drug exhibit. The bill provides that manufacturers may legally fix the price at which their products shall be sold and is designed to eliminate price cutting. Several speakers dwelt on the merits of the bill and the evils of price-cutting, mentioning many specific instances of where a fixed price for a trade-marked article resulted in benefits to manufacturer, retailer and consumer.

WASHINGTON, D. C., Jan. 21—Under the title "To protect the public against dishonest advertising and false pretenses in merchandising" Representative Dan V. Stevens, of Nebraska, to-day reintroduced in the House of Representatives the original Stevens-Ayres bill with a number of important amendments designed to meet the views of many friends of the measure.

The new bill specifically permits discounts for cash and for quantity and for allowances and rates covering costs of transportation. The latest tally shows 209 members of the House in favor of this legislation, which is but nine less than a majority.

90 Per Cent of Cars in Cuba Are American

SANTIAGO, CUBA, Nov. 18—There is a constantly increasing demand for automobiles in Santiago and throughout this consular district. Most of the city and suburban roads are macadamized, and although made several years ago, are in excellent condition. Ninety per cent of the cars already in use are of American manufacture, the remainder being chiefly Italian and French. The greatest demand in this section is for a low or medium priced, strongly built car with a serviceable top for protection against the heavy rains as well as the sun.

Paraguay Sees First Truck

ASUNCION, PARAGUAY, Nov. 11—A representative of an American truck company, who is now traveling in South America, brought to Asuncion on Sept. 22 the first motor truck that has ever been in the Republic of Paraguay.

Numerous demonstrations of the truck were given. The President of the Republic, the Ministers of War and Interior rode on the truck over one of the worst roads and were favorably impressed. It is probable that several of these trucks will be purchased here. There is a plan on foot to form a transportation company using motor trucks to serve districts not on the railway or river, whose sole means of communication at present consists of bullock carts and pack animals.

Send Catalogs to Venezuela by Mail

WASHINGTON, D. C., Oct. 29—Automobile and parts manufacturers who are sending catalogs and other advertising matter to Venezuela will benefit by the latest report from the United Export Bureau, which states that if the above matter is sent by parcel post it is subject to duty, whereas it is admitted free when sent by mail. When a firm in Venezuela is called upon to pay 40 to 50 cents or more as duty on the catalog of some American maker, sent by parcel post, the usual result is that the catalog is refused and the maker in the United States wonders why his advertising in Venezuela brings little business.

Motoring in France Now Less Difficult

PARIS, Dec. 30—Continuing the relaxation of automobile restrictions outside the actual army zone, the military authorities have given orders that the gates of Paris shall remain open to automobiles until midnight instead of 10 o'clock, as previously. After 12 o'clock only taxicabs without passengers aboard, and going to or from their garages, are allowed through the city gates.

The annual automobile census, to take place this year during the month of December, will be more stringent than usual. Every owner is under an obligation to declare his car to the local authorities, who communicate the lists to the military, and in addition the police and gendarmes have been instructed to keep a look out for hidden cars or trucks. For several months there have been few or no requisitions of private cars, for the army is able to obtain a reasonable number of touring cars from the home factories and supplies from America are available, if required. Unless there are unexpected developments, it is doubtful if the private car owner in France will receive any further attentions from the military. The military registration scheme which allowed any man's car to be seized at a moment's notice was very useful in the first rush of the war, but now that fighting has become almost an established business, it is found more advantageous to go to the factories rather than to individual owners.

Regulations regarding touring are also less stringent outside the active army zone. Instead of fortnightly, monthly military passes are given to car owners. These passes are asked for by the police every time an automobile goes through the gates of Paris, but on the open road are only required to be presented at rare intervals, and principally in directions leading to the war zone. In the center, West, South, and Southwest parts of France there are hardly any more restrictions than under peace conditions. A register is maintained in each district of all automobile passes issued, and if any driver is reported as having made an illegal use of his pass he is caught when he presents himself for the monthly renewal. The very simple remedy is to refuse to renew the pass, and as no driver dare run without a permit, an effective control is maintained.

For the war zone exceptionally stringent regulations are in force. Civilian motorists can only travel in this district on obtaining a pass issued by the commanding officer, bearing the photograph and signature of the driver and each passenger, the number of the car and the precise itinerary to be followed. Each military driver not forming part of a convoy, must also possess a special pass, renewable at frequent intervals. As there are guards along the roads with orders to stop all cars, whether carrying civilians, private soldiers or officers, it appears to be impossible for any unauthorized person to travel by automobile in the war zone of France. Any attempt to break through, or to get through with a false pass would entail the confiscation of the car and court martial.

Private motorists outside the war zone are not experiencing any shortage of tires, except a few of the very large and little used dimensions. The standard sizes, such as 105 mm. and 120 mm., which are the two most commonly used, are obtainable in big quantities from practically all the makers, and at normal prices. The gasoline shortage which was rather serious has passed away, and the price has dropped slightly. There is still, however, a feeling of irritation against the big refiners who are popularly believed to have taken advantage of the war to boost the price of gasoline.

Dividends Declared

Willys-Overland; quarterly of 1½ per cent on common, payable Feb. 1 to stock of Jan. 22.

Cincinnati Speedway Gets Land

CINCINNATI, OHIO, Jan. 15—The Cincinnati Speedway Co., which is building a 2-mile board speedway, reports that it has already sold $410,000 worth of stock and has taken an option on a land site. Plans are at present being developed for the track and buildings and the speedway representative is studying the Sheepshead Bay track at New York.

"All Steel" Touring Car to Cost $425

New Machine Planned to Be Ready in August This Year

ST. LOUIS, MO., Jan. 15—The plant of the All-Steel Motor Car Co., which is being built at Macon, Mo., will be ready for operation early in April it was announced here to-day, following the annual meeting of the officers and stockholders of the company. The company plans to put out a touring car, including starter and electric lights for $425. If present plans are realized the All-Steel car will be on the market early in August.

E. J. Spencer resigned as president of the company at this meeting and his successor has not yet been named. The new directorate, it is announced, will include Charles L. Smith, designer of the car; Fred V. L. Smith, treasurer of the company; Oscar A. Trorlicht, secretary; Edward F. Stockho, Andrew C. Duncan and John Hambeacon. Louis Goodhart, formerly traveling representative of the Lewis Spring & Axle Co., manufacturers of the Hollier-Eight, has been appointed sales manager of the All-Steel company.

The company will occupy the plant formerly occupied by the Blees Carriage Co. at Macon, Mo., including four buildings and covering a city block 380 by 300 ft.

Salesmanship Congress at Detroit July 2

DETROIT, MICH., Jan. 24—From July 2 to 6 Detroit will entertain several hundred visitors who are expected to participate in the first "World's Salesmanship Congress" which will be held at the Detroit Board of Commerce.

As might well be expected the automobile industry will have a big share in this event and many prominent men connected with it are either members of the executive committee or of special committees. Among those who are executive members are Hugh Chalmers, president of the Chalmers Motor Co., Harry W. Ford, president of the Saxon Motor Co., Norwell A. Hawkins, manager of sales of the Ford Motor Co., E. Leroy Pelletier, advertising manager of the Reo Motor Car Co. and the Reo Motor Truck Co., W. C. Standish, resident manager of the U. S. Tire Co.

Mr. Pelletier is chairman of the publicity committee of which the other members are Lee Anderson, commercial manager of the Hupp Motor Car Co., Frank G. Easton, advertising manager, Packard Motor Car Co., Theodore F. MacManus of the Dunlap-Ward Advertising Co., Frank V. Martin of the Banker & Martin Co. and Julian C. Weed of the Timken-Detroit Axle Co. Among the members of the finance committee are Paul Smith, sales manager of the Chalmers Motor Co. and L. D. Robertson, manager of the Detroit branch of the Packard Motor Car Co.; H. H. Hills, general sales manager of the Packard Motor Car Co., is a member of the arrangements committee.

McCulla Returns to Packard

DETROIT, MICH., Jan. 22—W. R. McCulla, will return to the Packard Motor Car Co. Feb. 1. About a year ago he left Packard to take the position of assistant chief engineer of the Knox Motors Co., Springfield, Mass., and has been in Europe much of the time studying war truck conditions for his company. Prior to that he was associated with Packard in the research engineering department, coming to this company from the Hudson Motor Car Co., where he had been in the experimental end of the business. McCulla will resume research engineering work at the Packard factory, specializing on aviation.

Bayerline & Daly's New Car

DETROIT, MICH., Jan. 22—Details of the new car that is to be built by the manufacturing concern formed by J. T. Bayerline, former president and general manager of the King Motor Car Co., and W. L. Daly, who was general sales and advertising manager of the same concern have been divulged in part. It is understood that the car is to be a six-cylinder, 3¼ by 4½, to sell at $900 as a five-passenger. The wheelbase will be 114 in., tires 32 by 3½. Rear springs are cantilever, the axle floating, the clutch a multiple disk. The price of $900 is to include a convertible top, in addition to the regular equipment.

Trailer Steers with All Four Wheels

FLINT, MICH., Jan. 22—Nickle Bros. who have a wagon shop here have brought out a new automobile trailer which it is claimed has many novel features. Each of the four wheels is placed on a circle similar to the fifth wheel of an ordinary wagon. The left hind wheel and the right front wheel are connected through long rods. Also the right rear wheel with the left front wheel so that when the front wheels are turned in one direction the rear truck turns the opposite way, the wheel traveling upon the circumference of a circle the diameter of which may be as small as 20 ft. For the present the trailer is made with only a light wagon type of body to carry a load of 1500 lb. Heavier style bodies will be made. The members of the firm are William J. and Samuel Nickle, veteran wagon builders.

Portage Sales Increase

Tire Co. Closes Prosperous Year—Slashes Goodwill Figure by $100,000

BARBERTON, OHIO, Jan. 24—The Portage Rubber Co., this city, has just issued a report to its stockholders which states that the company's directors have marked down their valuation of the company's trademarks, patents and good-will $100,000. It is stated that the board contemplates further reduction from time to time.

The company has sent out a condensed balance sheet as of Nov. 30 last, which shows gross sales for the twelve months ended on that date were $1,067,858, as against $661,848 the previous year, showing an increase of 61.3 per cent. Total profits were $129,005, as against $88,102, an increase of 46.4 per cent. The balance sheet follows:

Assets	
Cash	$60,185
Receivables	250,697
Stock on hand (raw and finished)	284,842
Real estate and plant	337,979
Trademarks, good-will, patents	496,000
Other patents	15,536
Total	$1,445,240

Liabilities	
Payables	$10,807
Reserve (depreciation)	6,992
Preferred stock	750,000
Common stock	500,000
Surplus	177,441
Total	$1,445,240

Markets Easier

NEW YORK CITY, Jan. 25—Market prices last week were easier. Prices on those commodities which have seen violent rises during the past few weeks, either remained constant or were lower. Steel prices were unchanged, though the big demand by the manufacturers was as urgent as it has been during the past few weeks. The lead and copper markets, however, continue to rise, the former closing yesterday at $6.10 per 100 lb. and the latter at 25 cents a pound. Tin on the contrary, rose yesterday to $42.50 per 100 lb. or a net gain of $1.37 for the week. This metal has always been subject to violent changes, however and so the latter rise cannot be taken as a mark of further violent changes.

The rubber market was quiet last week and prices were somewhat unchanged. Para which earlier in the week reached the 88-cent mark, declined to 86 cents, yesterday, and the Ceylon pale crêpe made a gain of 1 cent, making the closing price 93 cents. There was a large demand for rubber all during last week.

Gasoline in this city remained dormant, closing at 22 cents a gallon. No new features developed in the refined situation last week. There was no further chartering of freight room for export of the oil, but the domestic demand continued good. Cold weather is still interfering with the development work in the Eastern fields, according to advices from Pittsburgh. The few wells to reach completion are located in the old districts and all are light or dry. There is no improvement in the size of the late completions in the southeastern Ohio fields.

$500,000 Garage Combine in Cincinnati on Novel Plan

CINCINNATI, OHIO, Jan. 14—Steps are being taken to form a combination of seven garages in Cincinnati and Covington, which will be controlled by a corporation with $500,000 capital stock. Those interested in the movement are W. L. Voight, William Junclas, C. Sandman and Col. P. Wing.

Plans for the latest garage in the combine have been completed. It will be located at Fifth and John Streets and will cost about $35,000. It will be a two-story building and will have entrances on both Fifth and John Streets.

It is planned that the stockholders, instead of paying monthly rental for keeping their cars both in the suburbs and in the downtown section, will pay but one rental and will be permitted to use any garage in the combine.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.53	.53	.53	.53	.53	.53	...
Antimony	.42½	.42½	.42½	.42½	.42½	.42½	...
Beams and Channels, 100 lb	2.17	2.17	2.17	2.17	2.17	2.16	— .01
Bessemer Steel, ton	32.00	32.00	32.00	32.00	32.00	32.00	...
Copper, Elec., lb	.24¼	.24¼	.24½	.25	.25	.25	+ .00¾
Copper, Lake, lb	.24¼	.24¼	.24½	.25	.25	.25	+ .00¾
Cottonseed Oil, bbl	9.10	9.10	9.00	9.00	9.10	9.08	— .02
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.50	.51	.51	.51	.51	.51	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime	.93	.94	.94	.94	.94	.94	+ .01
Lead, 100 lb	5.90	5.90	5.90	6.10	6.10	6.10	+ .20
Linseed Oil	.73	.73	.73	.74	.74	.73	...
Open-Hearth Steel, ton	33.00	33.00	33.00	33.00	33.00	33.00	...
Petroleum, bbl., Kansas, crude	1.25	1.25	1.25	1.25	1.25	1.25	...
Petroleum, bbl., Pennsylvania, crude	2.25	2.25	2.25	2.25	2.25	2.25	...
Rapeseed Oil, refined	.98	.93	1.05	1.05	1.05	1.10	+ .12
Rubber, Fine Up-River, Para	.88	.88	.88	.88	.87	.86	— .02
Rubber, Ceylon, Pale Crepe	.92	.92	.93	.94	.94	.93	+ .01
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	41.13	41.25	41.63	41.75	41.75	42.50	+1.34
Tire Scrap	.05¾	.05¾	.05¼	.05¾	.05¾	.05¾	...

French Exhibition Planned for May

Big Scheme on Foot to Hold Show of French and American Industry in Paris

NEW YORK CITY, Jan. 24—Although the end of the war is still in the distance the nations whose territory has been overrun and destroyed are already thinking and planning for the reconstruction of the devastated cities, towns, villages and farms. To assist in this matter several European nations have already sent commissions to various countries to ascertain what these various countries can supply to meet the great need. It goes without saying that it will cost a great deal more to repair the damage done than it has cost to defend against the damage. The French commission has been in America for many weeks making examinations of American goods and capacity. In an interview in Washington in December, Monsieur Damour made the following statement:

"It is our hope and purpose with the co-operation of American manufacturers to reconstruct the industries of France and re-develop its agriculture along the most modern lines. Above all to install machinery of the latest type to take the place not only of the men and horses which will be lacking at the end of the war, but of the old methods, and to enable her to produce her specialties in a most economic fashion. The Chamber of Deputies is now sending men all over France to make investigations into conditions to find out just how many machines will be required and what improvements in building and equipment can be best installed."

Every country in Europe whether belligerent or neutral, is in very great need of practically everything in the line of machinery and building materials. One of the reasons for this condition is that it has been the custom of the European countries each to depend upon the other for a large percentage of their needs and now owing to the war and the impossibility of either manufacturer or communication with the markets of Europe of every country are wanting in a large percentage of their requirements. This condition will doubtless continue for a long time after the war closes.

It is stated that the exposition has been financed in a manner satisfactory to the Government of France. For a partial reimbursement of this expense the American exhibitors will be charged eight francs per square meter for space plus 1 per cent of the sales contracts made during the exposition. Space for outdoor exhibits will be much less. Space will be reserved in response to cable or letter and one-half the price of the space must be paid on the allotment of the space and the other half at any time previous to May 1. All money should be sent to the Administrateur General Edouard Tijou, 16 Rue Taitbout, Paris. For everything else intending American exhibitors are referred to Henry C. Long, 5 Opera Square, Paris.

Should the plan be successful it should offer an opportunity to American truck manufacturers as their product is absolutely essential to reconstruction of the kind considered by the promoters of the scheme.

Receiver Appointed for P. R. Mfg. Co.

DETROIT, MICH., Jan. 24—Pending the hearing which has been set for March 17 in the Wayne County Circuit Court, the Security Trust Co. has been appointed receiver for the P. R. Mfg. Co., which makes the Zephyr carbureter and auto parts. It appears that some of the stockholders desire that the company be dissolved while others are opposed to this action.

Larrabee Elected President

BINGHAMTON, N. Y., Jan. 14—H. C. Larrabee was elected president; R. H. Deyo, vice-president and general manager; S. T. Macey, treasurer, and I. T. Deyo, secretary, at the recent annual meeting of the Larrabee-Deyo Motor Truck Co.

Dividends Declared

Stewart-Warner Speedometer Corp.; quarterly of 1¾ per cent on preferred and 1½ per cent on common, both payable Feb. 1.

Automobile Issues Active

General Motors and Chevrolet Strong with Substantial Gains—Packard Down

NEW YORK CITY, Jan. 25—The automobile and accessory securities showed more activity last week and prices were higher. A strong tone developed during the latter part of the week and several of the issues showed marked gains.

General Motors and Chevrolet, which have been more or less prominent on the stock exchange on account of the proposed merger, came to the fore last week with gains of 21 and 10 points, respectively, General Motors reaching 486 and Chevrolet 132. It is stated by a few of the holders of General Motors that many of the people interested in that stock are holding it at the present time until it reaches the 500 mark. Firestone and Kelly-Springfield Tire common showed considerable strength. It is stated of the latter company that trading in its issues will start on the local exchange early next month. The application will be made just as soon as the new certificates are ready.

The new stock will not share in the dividend payable Feb. 1. The company, it is stated, will probably show earnings for the year ended Dec. 31 last of over 28 per cent for the common stock.

International common and preferred showed a substantial gain for the week. The common went up 7 points, while the preferred rose 3 points. This company last year closed one of its most successful periods. Domestic sales in December, it is stated, made a new high record, and for the full 1915 year home business increased 20 per cent over 1914. Peerless stock went up 8½ points on rumors of placing that issue on a dividend basis within the next few months.

A few of the stocks, however, made considerable drops in prices. Packard common went down 22½ points, while that of Studebaker dropped 3¼ points. Texas stock dropped 13 points; Willys-Overland common closed 4 points lower. Maxwell, U. S. Rubber, Stewart-Warner, Swinehart Tire, Goodrich and Chalmers, showed decreases ranging from a fraction to 2 points.

General Motors and Continental Motor featured the Detroit issues with gains of 25 and 13½ points, respectively. The market on the whole was stronger last week, with the exception of one or two stocks, which were lower on both the Detroit and New York exchanges. These were Packard and Maxwell. Packard common dropped 21½ points on the Detroit exchange, and the Maxwell stocks all showed small losses.

Gasoline Selling at 29 Cents in New York

NEW YORK CITY, Jan. 25—At the present moment in New York 30-cent gasoline is not an actuality; but 29-cent gasoline is. That is to say, some distributers are asking that much for it. Tank-wagon gasoline is 22 cents; garages are selling it for from 25 cents up —nearly always up, and considerably so.

Last August the tank wagon price was 14 cents in New York; thus the advance is 8 cents, or a little more than 57 per cent.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	71¼	71½	+ ¼
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	75	85	86	88½	+1
Chalmers Motor Co. com	..	96	120	150	..
Chalmers Motor Co. pfd	90	93½	100	103	—1
Chevrolet Motor Co	..	..	132	135	+10
Electric Storage Battery Co	48½	49½	63	64	..
Firestone Tire & Rubber Co. com	371	376	730	..	+10
Firestone Tire & Rubber Co. pfd	109	111	112	..	..
General Motors Co. com	90½	91¼	486	500	+21
General Motors Co. pfd	94½	95½	112	114	—1½
B. F. Goodrich Co. com	30¼	30⅜	71⅛	72	—1⅛
B. F. Goodrich Co. pfd	96	98	110	111	—2
Goodyear Tire & Rubber Co. com	194	196	338	342	..
Goodyear Tire & Rubber Co. pfd	101	103	114	..	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	1	23	25	+7
International Motor Co. pfd	..	8	38	42	+3
Kelly-Springfield Tire Co. com	94	96	*296	298	+6
Kelly-Springfield Tire Co. com. (new)	..	..	74⅝	75	+1⅝
Kelly-Springfield Tire Co. 1st pfd	82	83	95	97	..
Kelly-Springfield Tire Co. 2d pfd	105	108	†73	74	..
Maxwell Motor Co. com	17¼	18	66½	67	—1½
Maxwell Motor Co. 1st pfd	53½	54	88¼	88½	— ¾
Maxwell Motor Co. 2d pfd	21	22	53	53¾	— ¼
Miller Rubber Co. com	158	165	260	270	..
Miller Rubber Co. pfd	101	103	113	115	..
New Departure Mfg. Co. com	..	120	..	..	..
New Departure Mfg. Co. pfd	101	..	..	..	..
Packard Motor Car Co. com	..	100	162½	172½	—22½
Packard Motor Car Co. pfd	93	95	102	104	— ½
Paige Detroit Motor Car	..	..	710	..	..
Peerless Motor & Truck Corp	..	..	38½	39	+8½
Portage Rubber Co. com	30	36	70	72	..
Portage Rubber Co. pfd	80	85	102	106	..
Regal Motor Co. pfd	..	..	11½	..	..
‡Reo Motor Truck Co	12	12¾	25	26	+2
§Reo Motor Car Co	25¼	26	32	33	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	50½	52½	¶88	89½	—1
Stewart-Warner Speed. Corp. pfd	100	102	¶108	..	..
Studebaker Corp. com	41½	42⅛	153¾	154½	—3¼
Studebaker Corp. pfd	94½	96	110	112	—1
Swinehart Tire & Rubber Co	69	71	87	90	—1
Texas Co.	133	134	209	210	—13
U. S. Rubber Co. com	57	57⅛	54½	55	— ¾
U. S. Rubber Co. pfd	102¾	104	107¼	108¼	— ⅜
Vacuum Oil Co	199	201	230	235	..
White Motor Co. (new)	..	..	49½	50	— ¼
Willys-Overland Co. com	91½	92	221	225	—4
Willys-Overland Co. pfd	93	95	110	113	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Chalmers Motor Co. com	..	96¼	..	145	+2½
Chalmers Motor Co. pfd	90	93½	100	102½	..
Continental Motor Co. com	175	200	265	275	+13½
Continental Motor Co. pfd	..	..	91	..	..
Ford Motor Co. of Canada	475	..	..	410	..
General Motors Co. com	89½	91½	475	500	+25
General Motors Co. pfd	94½	95½	112	114½	— ¾
Maxwell Motor Co. com	16½	18	65	68	—2¼
Maxwell Motor Co. 1st pfd	52½	54½	86½	89	—1½
Maxwell Motor Co. 2d pfd	20	21½	51	55	—1¼
Packard Motor Car Co. com	..	100	160	170	—21½
Packard Motor Car Co. pfd	93	..	103	104¼	+ ⅛
Paige-Detroit Motor Car Co	..	..	..	700	..
§Reo Motor Car Co	25	25¾	32¼	33	+ ¼
§Reo Motor Truck Co	12	12½	26¼	..	+2¼
Studebaker Corp. com	40	42	153	155½	—3¾
Studebaker Corp. pfd	93½	95½	110	114	..

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
§Atlas Drop Forge Co	..	25	31½	..	..
Kelsey Wheel Co	185	..	295	..	..
§W. K. Prudden Co	19	20	33	35	+1
Regal Motor Car Co. pfd	..	25	10	15	..

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*Old. †New. ‡And accrued dividends. §Par value $10. ¶Ex dividend.

Over in Newark the tank-wagon price is 21 cents; it was 11 cents last August. The lower price in Jersey is attributed to the fact that transportation across the Hudson is quite an item. The ordinary ferries and car ferries will not take the inflammable stuff, so it has to be ferried across the Hudson in special lighters, in steel barrels; it cannot be unloaded from the lighters until it can be loaded directly on trucks; and it must be emptied direct from the barrels, one by one, into the dealers' tanks. Then the empty barrels have to be returned whence they came.

The New York price is not the peak price, however. In Tucson and Douglas, Ariz., the price is 22.5 cents; in Boston it is 23 cents; and Santa Fe, N. M., seems to roost on the pinnacle with 25.5 cents, tank-wagon.

Chicago tank-wagon gas is 16.5 cents; last August it was 10.5 cents. For Minneapolis the corresponding figures are: 16.5 and 11.5; for New Orleans, 17.5 and 12; for Omaha, 15 and 10; for Philadelphia, 21 and 13; for Portland, Me., 22 and 15 and for Portland, Ore., 16.5 and 12.

Cleveland is paying 16 cents, Cincinnati, 21 and Chicago, 16.5; Los Angeles pays 16 and San Francisco, 15; Pittsburgh, 22; St. Louis, 15.9 and Kansas City, 15.8; Seattle is at the bottom of the list with 14 cents—an increase of only 2 cents since last August.

The reasons to which the price rise is attributed are more or less obvious with one or two exceptions. The large increase that has taken place in the employment of farm tractors is responsible for a considerable increase in the demand for fuel; in Central Illinois, for instance, the farmers keep their tractors going all the year round. The huge increase in the number of cars used is a vital factor; there were about a million and a half cars in use a year ago, and now there are about two millions. It is anticipated that next summer there will be close to two and three-quarter millions, all using gasoline at the rate of about 500 gal. a year. That makes a great many gallons—1,375,000,000 of them.

The refiners' plaint is that the cost of crude has increased enormously and that the crudes yielding the greatest percentage of gasoline are the scarcest; moreover, the percentage of gasoline yielded is decreasing, taking the country as a whole. Roughly averaging the country's crude product, it will yield about 12.5 per cent of gasoline; 17 per cent is considered a very good proportion indeed, and some oils are not worth working for the gasoline they will give.

The war—of course—is mixed up in it, for the supplies from Russia which came through the Dardanelles are cut off and the strain on the home industry increased just so much.

Five More Tire Rises

Ajax, Fisk, Hardman, McGraw and Federal Announce Increases from 10 to 20%

New York City, Jan. 22—Five more tire companies have fallen in line with the price increases of the other concerns, started by the Kelly-Springfield company around the first of Jan. The latest are Ajax, Fisk, Hardman, McGraw and Federal, making a total of sixteen. It is expected, however, that several of the remaining concerns have already adjusted their prices to a new schedule. One of the companies, namely, the Republic, announcement of whose increase in prices was made last week, instead of making a general increase, has merely adjusted its prices, in some cases the prices being as much as a dollar lower on its plain tread type. The non-skids, in the majority of the sizes, are about 10 per cent higher.

The rearrangement of prices of the five new tire companies to announce increases range from 10 to 20 per cent. The largest increase was made by Hardman, whose prices are 10 to 20 per cent higher. Ajax ranges from 10 to 15 per cent; Fisk is 10 per cent higher, and Federal is also 10 per cent higher.

A number of the tire companies which did not announce an increase in prices were swamped with orders from those automobile owners who wished to lay in a supply of tires before the rise.

This increase of prices, it is stated, will not cover the increases that have already taken place in the prices of crude rubber and other materials used in the manufacture of tires.

Although the majority of the companies have increased the prices on most of the popular-sized tires, a few of them have in some instances made no changes whatever. For instance, the Hardman company has made no changes on the 30 x 3½ and 31 by 3½ non-skid. The 32 x 3½ non-skid has only been raised 10 cents, from $26. The Republic company has made a change on its 28 x 3 plain tread, the price going up 10 cents.

The following lists will give the prices on a few of the popular-sized tires:

FISK

Plain Tread			Non-Skid		
Size	New Price	Old Price	Size	New Price	Old Price
30 x 3½	$12.75	$11.60	30 x 3½	$13.40	$12.20
34 x 4	21.35	19.40	84 x 4	22.40	20.35
36 x 4½	30.10	27.35	36 x 4½	31.55	28.70

HARDMAN

30 x 3	$15.00	$14.10			
36 x 4	34.00	29.60	36 x 4	$41.50	$36.20
36 x 4½	42.30	38.10	36 x 4½	50.00	42.30

FIRESTONE

28 x 3	$9.80	$8.90	28 x 3	$10.95	$9.95
36 x 4	23.00	20.90	36 x 4	25.75	23.40
37 x 5	39.10	35.55	37 x 5	43.80	39.80

REPUBLIC

28 x 3	$10.70	$10.60	28 x 3	$12.40	$15.15
30 x 3½	14.80	14.75	30 x 3½	17.35	21.70
34 x 4	24.80	23.80	34 x 4	29.10	31.15
36 x 4½	35.00	34.20	36 x 4½	41.00	41.85

DIAMOND

Popular sizes increased 10 per cent; other sizes 25 per cent. Advanced Jan. 18.

30 x 3½	$12.75	$11.60	30 x 3½	$13.40	$12.20
34 x 4	21.35	19.40	34 x 4	22.40	20.35
36 x 4½	30.10	27.35	36 x 4½	31.60	28.70

FEDERAL

Popular sizes increased 10 per cent; other sizes 15 per cent. Advanced Jan. 18.

30 x 3½	$13.40	$12.15	30 x 3½	$14.75	$13.95
34 x 4	22.40	20.35	34 x 4	24.65	23.40
36 x 4½	31.60	28.70	36 x 4½	34.75	33.00

McGRAW

Popular sizes increased 10 per cent. No increase on other sizes. Advanced Jan. 18.

30 x 3½	$12.75	$11.60	30 x 3½	$13.40	$12.20
34 x 4	21.35	19.40	34 x 4	22.40	20.35
36 x 4½	30.10	27.35	36 x 4½	31.60	28.70

NASSAU

No advance yet. Advance expected Feb. 1.

Austrian Tire Made of Wood Fiber

Vienna, via London, Jan. 15—An Austrian engineer named Von Dunikowski has applied for a patent on a tire, consisting of wood fiber and certain binders. The specifications show that the tire follows the old pneumatic principle in every detail, there being an inner tube and an outer tire. The main material used is willow and birch fiber. What the binder consists of has not ben revealed, but it is known that no rubber whatever is used. It is stated that an automobile fitted with the new tires ran 437 miles and showed no signs of undue wear.

Materials Cramp Tractor Output

Moline, Ill., Jan. 18—The Moline Plow Co. reports a marked scarcity in raw materials needed in the manufacture of tractors, resulting in a marked handicap in the production of this machine. Orders are heavy, but lack of steel and the difficulty in getting orders filled, due to the heavy demand on account of the war abroad, promises to greatly reduce the output of the Moline plant. Some varieties of steel have increased 60 per cent in price, while one grade has advanced 70 per cent. Despite the fact that prices for machines must necessarily be increased proportionately to the cost of steel and other raw materials, business does not appear to be affected.

Gasoline from Gas in Texas

Dallas, Tex., Oct. 23.—Several plants for the manufacture of gasoline from natural gas will be built in Texas within the next few months. It is stated there are now about fifty plants in Oklahoma manufacturing gasoline from casing-head gas, or gas which comes direct from the well with crude oil, formerly a waste product. The total output of these Oklahoma plants is about 80,000 gal. of gasoline daily. In California there are said to be about twenty plants of this kind with a total daily capacity of 35,000 gal. It takes about 500 cu. ft. of gas to yield 1 gal. of gasoline.

Armored Cars for N. Y. State

Squadron Expected to Be Ready in April—Eight Cars in All

NEW YORK CITY, Jan. 24—The armored motor car squadron to be presented to the State of New York by a group of prominent men is expected to be ready by April. It will consist of eight armored battle and cruiser cars, including an officers' car, tool car, tank car and emergency car. This will be the first armored car squadron in America, and since the plans for the enlargement of the United States army call for motor cars of a similar type it is expected that this will be a stimulus to the national equipment.

The donors of the cars are E. H. Gary, Henry C. Frick, Robert M. Thompson, Dudley Olcott, James N. Wallace and Harry G. Montgomery. In all the plans for the squadron no expense has been spared. The steel for the cars is the standard United States 0.3-in. bulletproof gun-shield metal. The frames are built by the American Bridge Co. and the chassis include two Macks, two Locomobiles, two Whites and two Jeffery quads. The commanding officer's car will be built especially for speed. Full electrical equipment is carried and a searchlight on each car will sink into a box when not in use. In order to provide for quick maneuvering the cars will be able to move backward at full speed as well as forward.

Farmers Own 14 Per Cent of Pennsylvania's Automobiles

YORK, PA., Jan. 20—The growing popularity of the automobile on the farm is demonstrated by the fact that Pennsylvania farmers own more than 14 per cent of the automobiles registered in the State during the past year. On the first of the year there were 22,608 automobiles in the hands of the farmers of the State, according to the estimates of the bureau of statistics of the department of agriculture. The reports show that 9.5 per cent of the farmers are car owners and this means that there is an automobile on one out of every ten farms. A year ago it was estimated that there were 15,000 automobiles in the hands of farmers of the State.

In 1915 there were 159,984 automobiles registered in Pennsylvania and the farmers are shown to own 14.1 per cent of that total. Many of the registrations granted by the State were for cars owned by non-residents and the percentage of farmers owning cars is likely to be much higher if the total number of State owners could be ascertained. The rural residents undoubtedly led by a fair margin all other classes as purchasers of cars during the year.

In ten out of sixty-seven counties the reports show that from 15 to 18 per cent of the farmers own cars and in thirty-one counties 10 per cent more of the farmers are shown as car owners. Lancaster county leads with more than 18 per cent of the farmers owning an estimated total of 1842 cars. Chester county farmers own 1019 cars and Bucks county farmers 963 cars. In many counties during the year gains of 100 per cent in the number of farmers owning automobiles were common, while in some counties the gain was from 150 to 200 per cent.

Wilmington Wants High Grade Cars

WILMINGTON, DEL., Jan. 24—Prominent in connection with the second annual show of the Wilmington Automobile Trade Association, held here last week, is the fact that the entire Delmarvia Peninsula is under the influence of an unprecedented wave of prosperity. The demand for automobiles has been beyond the dealers' ability to make prompt deliveries.

The most remarkable fact in connection with the industry here is that 75 per cent of all high grade cars sold are to du Pont employees. All makes together are purchased by these people to the extent of about 25 per cent. These employees a little over a year ago were clerks and mechanics earning a moderate salary but to-day are worth many thousands of dollars.

President J. H. Nixon, of the association, states that there is a larger percentage of high grade cars in the State of Delaware than in any other State in the Union and that sales possibilities are great. He substantiated this statement by saying that the per capita wealth is greater than in any other American city.

Must Not Wash Cars with Gasoline

YORK, PA., Jan. 22—The announcement by Fire Chief Harry L. Wills, of this city, that it is the intention of the State to rigidly enforce the act of 1914, providing regulations for the use, storage, sale and keeping of gasoline, naptha and kerosene, will affect more than a score of garages and automobile dealers in this city. The act provides that no person may wash automobiles or any part of an automobile with gasoline or naptha. This will not bar kerosene. One of the clauses set forth in the act is that suitable fire extinguishers must be kept on hand at all times by dealers in oil as well as a box of sand with suitable scoop to scatter the sand.

Vesta Electric Transmission Announced

Clutch and Gearset Replaced by New Device—Direct on High

CHICAGO, ILL., Jan. 24—A new Vesta centrifugal electric generating clutch will be announced later this week by the Vesta Accumulator Co., Chicago. The idea is the combination of the electro-magnetic drag between the armature and fields of any electrical machine and direct friction connection such as is obtained in the ordinary clutch. The Vesta clutch replaces the usual cone or disk clutch, the gearset, the flywheel, the electric generator and the starting motor.

The Vesta system is no new thing in principle, having been brought out in crude form by its inventor, William Morrison of the Vesta company, as long ago as 1898, and described in an engineering magazine at that time.

The system is composed of two parts, the armature and the field, the former constituting the flywheel of the engine and the latter mounted on the forward end of the propeller shaft. The fields are internal and rotate on bearings on the crankshaft extension within the armature. The armature carries an internal commutator and the fields carry the brush holders, the brushes pressing against the internal commutator.

It is in the mounting of these brushes that the real hub of the new idea is incorporated. The brushes are mounted in such a way that the centrifugal force of their rotation, increases the force with which they press against the commutator, in just the same way that the balls of a fly-ball governor swing out with increased speed. When the engine is still the pressure is very light, but as the speed of the car increases the pressure of the brushes against the commutator also increases, until, at high speed there is no slip between the armature and the field. That is, we now have a mechanical clutch, carbon against copper.

Must Label Upholstery in Milwaukee

MILWAUKEE, WIS., Jan. 20—A new law passed by the Wisconsin Legislature of 1915, and effective Jan. 1, 1916, which has generally escaped notice, but is of wide importance, is Section 1418s—3m relative to upholstering or repairing the upholstering of motor cars. The law now in effect requires the branding or labeling of the upholstery to show the kind of materials used. It is regarded as a measure to promote sanitation. The statute reads as follows:

"Any person upholstering or reupholstering any furniture or automobile box-spring or any other article or thing whatsoever, or who manufactures for sale, offers for sale, sells or delivers or who has in his possession with intent to sell or deliver any goods or article of any kind containing upholstering, without a brand or label as provided in subsection 3n of this section, or who removes, conceals or defaces the brand or label thereon, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine of not less than twenty-five dollars ($25.00) nor more than five hundred dollars ($500.00), or by imprisonment in the county jail not to exceed six months, or by both such fine and imprisonment.

"(3n) The brand or label provided in subsection 3m of this section shall contain, in plain print in the English language, a statement of the kind of materials used in the filling and in the covering of such upholstery or reupholstery, to be specified in true terms according to the grades of filling and covering used by upholsters or reupholsterers, whether such materials are, in whole or in part, new or secondhand, the qualities of the materials used, and whether the materials used, if second hand, have been thoroughly cleaned and disinfected. Such brand or label shall be in the shape of a paper or cloth tag to be securely fastened to each article upholstered or reupholstered."

The effect of the statute on manufacturers of motor and other vehicles can readily be discerned. Up to this time there has been no report of violations or arrests, but the situation is such that it should be watched very carefully by manufacturers and dealers.

New Sheridan Light Truck

Chicago, Ill., Jan. 22—Numbered among the new commercial car makers is the Sheridan Commercial Car Co., with headquarters in Chicago and factories at Harvey, Ill., which is bringing out a new light commercial car to sell at $465. It will be equipped with a 2 by 4-in., four-cylinder engine, block-cast, with removable cylinder heads. The carbureter is a Carter, the magneto, Bosch, the clutch a cone and the cooling is by thermo-syphon.

The gearset is selective with two forward speeds. The rear axle is of the floating type and the car is geared 5 to 1 on high, 12 to 1 on low and 12 to 1 on reverse. The maximum speed is said to be 30 m.p.h. The wheelbase is 104 in. In the matter of equipment is found windshield, horn, tools, Prest-O-Lite tank, headlights, delivery body, 43 in. wide, 65 in. long and sideboards 8½ in. high. This body comes with top and side curtains.

British Import Tax Has Small Effect

Greatly Increased Quantities of Parts Going from U. S. A. —Gasoline Importation Reaches Record

London, Jan. 8—In commenting upon the effect of the new British import duty of 33 1/3 per cent on automobiles and parts thereof, the *Times*, which is the leading newspaper of Great Britain, says:

"Although the matter is not one for which definite statistics can be given, in the opinion of men qualified to judge the demand for motor cars continues brisk. Second-hand cars by reputable makers and in reasonable condition command good prices, and such new cars as are available readily find purchasers. As the makers in this country—and the same is true in France—are devoting most of their energies to purposes other than the production of cars, or if they are making cars these are not available to the ordinary buyer, it follows that the demand can not be satisfied from home sources; and in these circumstances American manufacturers, who are said to have turned out over 600,000 cars during the past 12 months, have been enjoying a golden opportunity.

33⅓ per Cent Has Small Effect

"The import tax of 33 1/3 per cent to which certain motor vehicles of foreign manufacture have been subjected since the end of September on entering this country has, however, introduced a new factor. In September last, according to the Board of Trade returns, the number of complete cars and chassis imported for sale was 2661, with a value of $2,519,771, whereas last month the number fell to 1806 and the value to $1,622,515. The figures for last month are far above those for the same month of last year, when the number of cars and chassis was 336 and their value $460,663; but in view of the disturbed conditions existing last autumn perhaps a fairer comparison is with October, 1913, when the number was 1119 and the value $1,232,855. In September, 1914, the figures were 197 and $212,792, and in the same month of 1913 they were 1156 and $1,290,454. If the effect of the tax, as indicated by the figures for last month, is not so great as might be expected it must be remembered that the returns do not distinguish between cars intended for private use, which have to pay the tax, and those for commercial purposes, which do not; and for anything the official figures show the falling off may have been chiefly, if not entirely, in the former category.

"In passing it may be noted that the tax appeals to different sections of the motor-car trade in very different ways. Manufacturers can regard it with equanimity, at least; and though it can have no immediate effect on firms which are not at the moment making cars for ordinary sale, it may help to secure their position against the time when they are able to start producing again. But to the retailers or agents, through whom in normal times the bulk of the cars made in this country are distributed to the public, the matter presents itself in another light. They rely for much of their livelihood on the profits they receive from selling cars, and if they have no cars to sell those profits naturally disappear.

Gasoline and Parts Are Up

"As regards motor-car tires and tubes and their accessories, which are exempt from import tax, the figures for the last two months are almost identical, the value being $1,401,270 in September and $1,398,992 in October; but the value of 'other parts,' which are taxed, actually increased from $705,088 in the former month to $1,097,989 in the latter. These figures do not suggest any reduction in the total volume of motoring; and the statistics of the imports of motor spirit, the other chief item besides tires in the running expenses of a car, point to the same conclusion. In September 9,879,103 gal. were imported and duty was paid on 10,766,314 gal., while last month the quantity imported reached the enormous total of 15,982,832 gal. and duty was paid on 10,251,373 gal."

Dry Batteries to Be Dearer

Milwaukee, Wis., Jan. 22—That the price of the standard dry battery will advance soon and that material advances are to be expected within the year, was the statement of O. E. Rhuoff, of the French Battery & Carbon Co., Madison, Wis., before the annual convention of the Wisconsin Electrical Contractors' Association in Milwaukee. Mr. Rhuoff attributes the advancing prices to the increasing difficulty in obtaining materials and the heavy demand created by the European war.

Ford's Milwaukee Plant Opened

Milwaukee, Wis., Jan. 25—The new Milwaukee plant of the Ford Motor Co. was formally opened on Monday, Jan. 24. The company has experienced considerable difficulty in getting delivery of its machine tool equipment because of the enormous demands upon machinery builders. However, the plant will begin operations on schedule time. A. W. L. Gilpin, manager of the Milwaukee Ford branch, will manage the new works, which represent an investment of $285,000.

Michigan Is Great Sales Territory

Prosperity of Country Offsets Poor Roads—114,000 Automobiles Registered in State

DETROIT, MICH., Jan. 21—The coming season will be one of the biggest Michigan automobile dealers have ever had. Last year would have been a big year if more cars had been available, but practically every dealer was unable to get enough to supply the demand. This year, however, many of the dealers are stocking cars in anticipation of the spring demand and all of them estimate that their 1916 business will exceed that of 1915 by anywhere from 50 to 300 per cent.

The importance of Detroit as an automobile distributing center is not at all commensurate with its place in the industry. Although it is the automobile capital and is known the world over for its automobiles, the distribution of cars through branches and dealer establishments is not of large proportions.

This is due to the fact that the territory is limited geographically. To begin with, the State is cut in two by water. The lower peninsula is hemmed in on the west by Lake Michigan and on the east by Lake Huron and there is no direct rail connection between Detroit and the upper peninsula without passing through other distributing cities. It is possible, of course, to ship cars from Detroit to the upper peninsula by ferrying the freight cars across the Straits of Mackinaw, but shipping facilities to the upper peninsula are much easier out of Chicago or Milwaukee. Also the western part of the upper peninsula is easily reached from Duluth, which city is making a strong bid for recognition as a distributing center in all trades.

Because of this the distribution by dealers in this city is practically limited to the lower peninsula. Also there are in the lower peninsula several important cities, such as Grand Rapids and Saginaw, which are recognized by the factories as distributing points.

In Flint and Jackson are a number of automobile factories and considerable distribution in the State is done from these points. Fifty miles to the south of Detroit is Toledo, which in many cases includes in its distributing territory the southeast corner of Michigan. Chicago, at the lower end of Lake Michigan, also cuts into the State, some of the distributers in that city including a number of Michigan counties in their territory.

Some of the Detroit distributers have a territory that is quite limited. In some cases it includes only three counties. A few have the entire State, but practically none make an attempt to do much with the upper peninsula. The number of dealers used in covering the lower peninsula varies.

While the territory is limited geographically it is a productive area and will add its quota to the increased automobile sales of the country for the coming year. The agricultural interests of the State are diversified and it probably is generally unknown that the State leads in the production of rye, beans, dry peas and chicory. It is second in small fruit and apples; third in pears, grapes, buckwheat and sugar beets; fourth in potatoes, peaches and cherries, and is only ninth in oats, eleventh in barley, twelfth in wheat and fifteenth in corn.

As to live stock its comparative standing is: Sheep, eighth; dairy cows, tenth; poultry, eleventh; bees, thirteenth; horses, fourteenth; cattle, fifteenth; swine, nineteenth.

From these statistics it is at once apparent that the State is healthfully productive in that it is not dependent upon any one staple for its wealth. The crops for 1915 exceeded those of 1914 by more than $4,000,000 in nine principal products which are shown for three years in the following table:

MICHIGAN CROPS VALUE

	1915	1914	1913
Corn	$38,080,000	$42,210,000	$37,595,000
Wheat	20,652,000	17,835,000	11,371,000
Oats	22,491.000	22,838,000	17,550,000
Rye	5,138,000	5,402,000	3,324.000
Potatoes	11,729,000	13,213,000	17,808,000
Hay	42,188,000	36.132,000	33,012,000
Barley	1.555,000	1,521,000	1,265,000
Buckwheat	626,000	748,000	630,000
Beans	12,792,000	11,086,000	7.892,000
	$155,251,000	$150,985.000	$130.447.000

The prospects for 1916 in agriculture are encouraging and some statisticians go so far as to say that 1916 in the western part of the State will surpass all preceding years. Considerable new ground was cleared last fall and a greater acreage than ever before will be under cultivation when the snow goes away. The Grand Rapids and Indiana Railway Company maintains an agricultural and industrial department which is doing much to develop the section to which it is tributary. The company's agent has advised that the railroad will furnish without cost enough sugar beet seed to plant one-quarter of an acre to all farmers who make request. The only condition is that the agricultural work be carried on according to the company's instructions.

The good roads movement that has made such headway in Wayne County is spreading through the State and the automobile people look forward to the day when the State shall have a network of good roads. The truck people especially see a wonderful development in that business when the roads are better. As it is now many farmers are using trucks, but the development of sales among these buyers has hardly begun.

The tractor is looked upon as a coming business, especially the small farm machine. A truck man stated as his belief, based upon years in the implement and truck business, that the automobile dealer would be the tractor dealer of the future except in those tractors which are made by implement manufacturers. These companies, he said, will turn the factory business over to their implement dealers because in so doing they can take advantage of an existing organization.

The number of cars registered in Michigan during the past few years follows:

1909	11,718
1910	18,355
1911	27,796
1912	39,579
1913	54,366
1914	76,322
1915	114,845

Automobile Reserve Corps for St. Louis

ST. LOUIS, MO., Jan. 19—The question of organizing a St. Louis branch of the proposed National Automobile Reserve will be placed before the entire membership of the Automobile Club of St. Louis at a meeting early in February, it was announced here to-day by F. M. Flesh, president of the club. The club has a membership of about 3000 motor car owners.

Secretary Morse of the club, with a view of obtaining the sentiment of other automobile clubs, wrote to organizations of nearly every big city in the country and the answers he received indicate that a majority of the automobile clubs are strongly in favor of an automobile reserve.

Over 100 Cars at York Show

YORK, PA., Jan. 21—At least $500,000 worth of automobiles will be exhibited at the first annual automobile show of the York Automobile Dealers' Association to be held in this city Feb. 1 to 5. More than 100 cars, it is estimated, will be shown by the score or more of automobile and automobile accessory dealers in this city.

Iowa Loses Its License Tags

DES MOINES, IOWA, Jan. 22—Two carloads of automobile number plates for the State of Iowa have been lost in transit between St. Paul and Des Moines, and as a result the State automobile department is 25,000 number plates behind its orders for 1916. The number of registrations for the year already has passed 65,000.

Factory Miscellany

Standard Welding Adds—The Standard Welding Co., Cleveland, Ohio, is building an addition to its plant at 1280 West Seventy-third Street, that will cost about $15,000.

Perfection Spring Buys Land—The Perfection Spring Co., Cleveland, Ohio, has purchased two parcels of land adjoining its present buildings on which an addition will be built.

Nice Ball Bearing Co. Formed—B. G. Nice, Frank Beemer, S. W. Nice, George Wells and George Hoppes of Philadelphia are the incorporators of the Nice Ball Bearing Co., which is being organized to manufacture anti-friction bearings and machines for that purpose.

Sporub Tire Co. Formed—The Sporub Tire Co. has been organized in Milwaukee to manufacture and market a new type of puncture-proof tire employing a resilient filler to take the place of the usual inflated inner tube. Offices and store have been opened at 721 Grand Avenue, Milwaukee. Rudolph Fischer is general manager.

Avery Buys Kingman Plant—The Avery Co., Peoria, Ill., manufacturer of tractors and farm machinery, purchased the plant of the Kingman Plow Co., this week for $80,000, being the largest bidder. The Kingman plant will be used for foundry and warehouse purposes. The Kingman plant covers 14 acres and is located but a short distance from that of the Avery plant.

Sieverkropp Engine Starts Work—The Sieverkropp Engine Co., Eighteenth and Clarke Streets, Racine, Wis., manufacturing gasoline engines, self-starters and other devices and appliances for the automobile trade, has started work on the erection of a plant of its own at DeKoven Avenue and the North-Western tracks, Racine. The site is 185 by 154 ft., and the first unit of the new plant will be 50 by 100 ft. The concern intends to erect another shop upon the completion of the factory. About 75 to 100 employees will be added to the payroll as soon as the extensions are completed.

Large Chevrolet Plant for Oakland—The largest automobile plant on the Pacific coast, the Oakland Chevrolet assembling plant, is to be under construction within a few weeks. The plant is to be located on the electric loop tract close to the Foothill Boulevard, Oakland, Cal. The factory is to have a capacity of 15,000 cars per annum and will cost more than $200,000. Active work on the plant is to begin before Feb. 1, and the buildings are to be completed by May 15.

Wallis Tractor in Racine—The Wallis Tractor Co., formerly of Cleveland, Ohio, has completed the removal of the plant and offices to Racine, Wis. The company is backed mainly by Racine capital and has been manufacturing a gasoline tractor known as the Cub at Cleveland for two years. The Cub tractor recently traveled cross-country 1000 miles from Cleveland to Fremont, Neb., to the National Power Farming Demonstration. The removal was made to obtain more manufacturing space and better shipping facilities than were available in Cleveland.

The Automobile Calendar

Jan. 25-29	Lancaster, Pa., Show, Conestoga Park Pavilion.
Jan. 22-29	Montreal, Que., Show, Almy's Bldg., Automobile Trade Assn., Ltd.
Jan. 22-29	Chicago, Ill., Show, National Automobile Chamber of Commerce; Coliseum and First Regiment Armory.
Jan. 24-29	Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.
Jan. 24-29	Scranton, Pa., Passenger Car Show, Town Hall.
Jan. 24-30	Portland, Ore., Show, Armory, Portland Automobile Dealers' Trade Assn.
Jan. 25, 26, 27	Montgomery, Ala., Show, Klein Bldg., Montgomery Automobile and Accessories Dealers.
Jan. 29-Feb. 5	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Show Co.
Jan. 29-Feb. 5	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.
Jan. 31	Scranton, Pa., Show, Commercial Car Show, Town Hall. H. B. Andrews, Mgr.
Jan. 31-Feb. 5	Fall River, Mass., Show, State Armory, R. C. Borden, Mgr.
Feb. 1-3	Frederick, Md., Show, Armory.
Feb. 1-5	York, Pa., Show, York Auto Dealers' Assn.
Feb. 2-5	Buffalo, N. Y., Show, Auditorium, Buffalo Automobile Mfrs. and Dealers' Assn.
Feb. 2-5	Poughkeepsie, N. Y., Show, State Armory.
Feb. 7-12	Kansas City, Mo., Show, J. I. Case, T. M. Bldg., Kansas City Motor Dealers' Assn.
Feb. 7-12	Duluth, Minn., Show, Armory, Duluth Automobile Dealers' Assn.
Feb. 8-11	Grand Forks, N. D., Show, Auditorium.
Feb. 9-12	Peoria, Ill., Show, Coliseum, Peoria, Automobile and Accessory Assn.
Feb. 12-19	Albany, N. Y., Show.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Nashville, Tenn., Show, Hippodrome. J. A. Murkin, Mgr.
Feb. 14-19	Des Moines, Iowa, Show, Des Moines Auto Dealers' Assn.
Feb. 14-19	Winnipeg, Man., Show, Ford Plant, Winnipeg Motor Trades Assn.
Feb. 17-19	Racine, Wis., Show, Lakeside Auditorium.
Feb. 19	Newark, N. J., Show, First Regiment, Armory, C. G. Fitzgerald, Mgr.
Feb. 19-26	Harrisburg, Pa., Show, Emerson-Bruntingham Co.'s Bldg., Capital City Motor Dealers' Assn.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory. B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 28-March 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Paterson, N. J., Fifth Annual Show, Auditorium.
Feb. 29-March 4	Ft. Dodge, Iowa, Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
March 8-11	Mason City, Iowa, Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 21-25	Deadwood, S. D., Show, Auditorium. Deadwood Business Club.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 20	Chicago, Ill., Amateur Drivers' Race, Chicago Motor Speedway.
May 30	Indianapolis Track Race.
June 17	Chicago Track Race.
June 28	Des Moines, Iowa, Track Race.
July 4	Minneapolis Track Race.
July 4	Sioux City Track Race.
July 15	Omaha, Neb., Track Race.
Aug. 5	Tacoma Track Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Track Meet.
Sept. 15	Indianapolis Track Race.
Sept. 16	Providence Track Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Track Race.
Oct. 14	Chicago Track Race.

The Week in the Industry

O'Neil Fisk's Lowell Manager—C. C. O'Neil has been appointed manager of the Lowell, Mass., branch of the Fisk Rubber Co. of New York whose factory is in Chicopee Falls, Mass.

Ashcroft U. S. Tire Publicity Mgr.—R. W. Ashcroft, of the Canadian Consolidated Rubber Co. of Montreal, has accepted the appointment of manager of publicity of the United States Rubber Co. of New York.

Culver Heads Overland Zone in Atlanta—The Willys-Overland Co. has opened a zone headquarters office in Atlanta, Ga., in the former Locomobile building on Peachtree Street. The office will be in charge of E. N. Culver.

Dunne Now Buick Superintendent—G. W. Dunne, former assistant manager of the drop forge plant of the Buick Motor Co., Flint, Mich., is now superintendent of the Muskegon (Mich.) plant of the Continental Motor & Mfg. Co.

Williams Shifts to Kansas City—W. S. Williams, who was manager of the Studebaker Corp. branch in Dallas, Tex., has been promoted to manager of the more important branch at Kansas City, Mo.

L. B. Alford, who was assistant branch manager in Dallas, is now branch manager, and W. D. Lacey, who was wholesale salesman at the branch, is now assistant branch manager.

Kidder Promoted—E. H. Kidder, who has been manager of the Boston branch of the United States Tire Co. for some years, has been advanced to New England manager, having charge of Boston, Providence, Worcester, Bangor, Portland and Manchester offices with headquarters at the Boston office. J. C. Toomey, manager of the Providence branch, has been brought to Boston to have charge of that territory and H. E. Crocker has been placed in charge of the Providence branch.

Headley Promoted—J. P. Headley, who has been acting for some time as assistant zone supervisor of sales for the Maxwell Motor Corp., has been promoted to the position of special representative, with headquarters in Detroit. His work will be almost entirely in the field and he will travel constantly over the Southeastern States. The Maxwell Company has leased the building at 165 Peachtree Street, Atlanta, Ga., and has sent one of its most experienced salesmen here as manager. C. H. Batchelor will have charge of the salesrooms in that city.

Motor Men in New Roles

Johnson New Seattle Mgr.—Edward Johnson has succeeded J. E. Shellenberger as manager of the Seattle branch of Hughson & Merton, Pacific Coast accessory firm.

Cole Makes Change—W. C. Cole, formerly manager of the used-car department of the Hudson-Phillips Motor Car Co., St. Louis, Mo., has become associated with the Packard Missouri Motor Co. of the same city.

Glazier Wichita Truck Mgr.—J. L. Glazier of Portland, Ore., has been appointed manager for the Wichita Truck Co.'s branch in that city, which will control the Oregon, Washington, Idaho and British Columbia territory.

Johnson St. Louis U. S. Tire Mgr.—O. S. Johnson has been appointed manager of the St. Louis branch of the United States Tire Co., succeeding H. H. Hubbard, who has been transferred to the home office of the company.

White Goes to Toledo—T. W. White, formerly manager for J. W. Leavitt & Co., Overland distributor in Seattle, Wash., has left the Western field for Toledo, Ohio, and will enter the foreign department of the Willys-Overland Co.

Scott Willard Distributor—Sam Scott of Tacoma, Wash., has been appointed exclusive distributor for the Willard Storage Battery Co. for this city. Mr. Scott has organized the Storage Battery Supply Co. He is located with the Pacific Car Co.

New U. S. Branch Mgr.—Howard E. Crocker has been appointed manager of the Providence, R. I., branch of the United States Tire Co. John Toomey, former manager, has been promoted to the management of the Boston branch of the company.

Three Studebaker Men Promoted—Three changes in the Studebaker organization, each in the nature of a promotion, are announced by The Studebaker Corp.

W. S. Williams, formerly manager of the Dallas, Tex., branch, has been appointed manager of the larger branch at Kansas City. Mr. Williams was retail sales manager for the L. Markle Co., Studebaker dealer in Chicago, previous to becoming branch manager in Dallas.

L. B. Alford succeeds Mr. Williams as the Dallas branch manager. Mr. Alford leaves the post of assistant branch manager, which he held for several years.

W. D. Lacey is advanced from wholesale salesman to assistant branch manager in Dallas, succeeding Mr. Alford.

Little Transferred to N. Y. by Bowser—E. J. Little, who has been manager of the Fort Wayne sales district of the S. F. Bowser Oil Tank & Pump Works for the past five years, has been promoted to the managership of the New York office. Mr. Little succeeds H. C. Carpenter, who has taken charge of the Atlanta, Ga., office. It has been decided to divide the Fort Wayne district, and make out of it the Michigan, Ohio and Indiana districts. L. L. Walker will have charge of the Ohio district. Mr. Walker has had charge of the Philadelphia office. A. S. Bowser, secretary of the company, will look after the Michigan sales district and J. W. Burrows will have charge of the Indiana district. Mr. Bowser has been in Albany, N. Y., for the past several months in the interests of the company, and J. W. Burrows has been chief clerk in the sales department. The Philadelphia office will be discontinued.

Russell-Dewey Co. Formed—The Russell-Dewey Co. has been incorporated with offices at 1790 Broadway, New York City, 1024 Wabash Avenue, Chicago, and Watertown, Mass. The officers are M. A. Dewey, Jr., president, for many years sales manager for N. B. Arnold, Brooklyn, N. Y., manufacturer of Slikup Specialties; C. A. Russell, treasurer, formerly sales manager for Hopewell Bros., manufacturers of the Hopewell tire case and other fabric specialties, and C. A. Hillers, secretary, for the past eight years salesman and New England manager for Hopewell Bros.

The company will act as selling agents for the following companies:

N. B. Arnold, Slikup Specialties; Croxford Auto Rim Tool Co., rim tools; Double Seal Tire Valve Co., tire valves; Flint Motor Plate Co., specialties for Fords; Gibson Hollister Mfg. Co., Jumbo spark plugs; Hopewell Bros., fabric specialties; United Engine & Mfg. Co., garage and shop equipment; Woodbridge Chemical Co., Air-In-Al for punctures. All of which lines will be marketed solely through the jobbers.

M. A. Dewey will make his headquarters at Chicago; C. A. Russell at New York, and C. A. Hillers at Watertown, Mass. These men will cover the Dominion of Canada, and the United States, east of the Rocky Mountains.

Recent Washington News Items—Jamieson Motor Car Co., Spokane, Wash., have been named distributors for Pathfinder and Pullman cars. Salesrooms have been opened at 1229 Second Avenue. Associated with Mr. Jamieson is C. A. Dudley, as salesmanager. The company has secured the territory from the Cascade Mountains east in Washington, north of Salmon River in Idaho, and the State of Montana as far east as Butte.

Doud-MacFarlane Machinery Co., Tacoma, have recently added two modern machines to facilitate repair work. One will be a cylinder grinding machine capable of grinding from one to six cylinders at a time. The other will be an automatic gear cutting machine, which will cut any size or style of gears.

George Clark and A. C. Olson have formed the Motor Force Co. for the manufacture of a new hydrocarbon product, which is declared to be highly efficient. Salesrooms have been established in Seattle at Pike and Melrose Avenues.

The Auto Tire Repair Shop, Tacoma, Wash., is city distributor of Kelly-Springfield and Republic tires, in addition to making a specialty of quick and efficient repairs of all makes of tires.

H. C. McCulloch, of 1431 Broadway, Seattle, has been appointed Seattle agent for the Federal tire.

The Sunset Electric Co., 606 East Pike Street, Seattle, has been appointed Seattle service station for Gray & Davis starting and lighting systems. The firm also acts as service station for Exide batteries.

Agency for the Gordon tire has been placed with the Pacific Tire & Rubber Co., 604 East Pike Street, Seattle.

Philadelphia Trade News—Alterations are being made at 1617 Chestnut Street, Philadelphia, which when completed will be occupied as a local branch by the Maxwell Sales Corp. of Detroit. The branch will be under the management of L. G. Peed, for five years with the sales organization of the company.

The Philadelphia branch of the H. W. Johns-Manville Co., on North Second Street, is being moved to its new modern home at Broad and Race Streets, recently completed.

H. H. Kirkpatrick of Philadelphia has been made branch manager of the Hardman Tire and Rubber Co., 809 North Broad Street, this city.

The Willard Storage Battery Co., Cleveland, has opened a branch and service station at 1434 Brandywine Street, Philadelphia, and has placed in charge P. M. Evans, who for several years has been chief chemist of the company.

Canadian News Items—The Tyre Shop, Vancouver, B. C., has opened at 1015 Blanshard Street under the management of W. Tergeson, formerly with the Auto Supply Co. and S. V. Marks, manager for the Tait Tire Co. A modern vulcanizing plant has been installed and all makes of tires will be handled.

The Western Oil & Supply Co., Vancouver, B. C., has been appointed agent for Savage tires and is opening a store at 427 Howe Street.

The Colonial Tire & Rubber Co., Ltd., Vancouver, B. C., has given up the agency for Michelin tires and is now handling Goodyear tires.

The Johns-Manville Co. has opened a new store and offices on Portage Avenue, corner of Edmonton Street, Winnipeg, Man. J. Papineau has been appointed sales manager.

Denver Trade Items—The Quick Service Tire Co. is the name of a new Denver concern formed by J. A. Rayment and E. M. Tucker, formerly salesmen respectively for the Dry Climate Tire Mfg. Co. and the Boss Rubber Co., has opened an agency for Quaker and Batavia tires at 136 Sixteenth Street, facing Automobile Row, on Broadway.

The Highway Auto Sales Co., a $25,000 corporation, has opened headquarters at 1439 Cleveland Place, Denver, to distribute the Argo and the Crow-Elkhart in Colorado, Wyoming, Utah, New Mexico and Arizona. The officers are S. R. Fitzgarrald, president; N. A. Ballou, vice-president; W. C. Pochon, secretary and treasurer; W. Aldridge, general manager. The new firm will also have a branch office at Salt Lake City.

The Mid-West Auto Sales Co., 1512 Broadway, Denver, distributor for the King, Regal and Jackson, has dropped the last two lines and is handling the King exclusively in the Colorado and Wyoming territory.

The Foster Auto Supply Co., a new Denver concern headed by J. W. Foster, formerly manager of the Denver Auto Goods Co., has opened an accessory store at 138 Sixteenth Street, corner of Broadway. The new firm has contracted for the Colorado territory on the Rayfield carbureter, and has secured the Colorado and Wyoming agency for the Eisemann magneto, Auburn spark plug, Sioux non-leak piston ring and the Kellogg line of pumps.

The Tibbals-Anderson Motor Car Co., formerly the Regal Sales Co., has given up the Denver agency for the Regal and secured the Colorado and Wyoming distributing agency for the Jackson. The new concern will open headquarters at Broadway and Twelfth Avenue.

The Quinn & McGill Motor Supply Co., 1532 Broadway, has taken the Veedol oil agency for Colorado, Wyoming and New Mexico.

Robert Rhea, secretary of the Boss Rubber Co., 1548 Broadway, has resigned his office and left the firm entirely on account of ill health. Arthur Lewis, vice-president, is acting as secretary temporarily.

Cleveland Changes—A number of automobile dealers have moved to new locations in the past week in Cleveland. Within the next few weeks J. H. Greenwald, Chalmers representative, will move to the large building occupied by the Packard Cleveland Co., 1900 East Thirteenth Street.

The Packard Cleveland Co. will then move to its new building, now under construction on Carnegie Avenue, near East Fifty-fifth Street. The Stearns Motor Sales Co. will occupy the former Chalmers quarters at 2106 Euclid Avenue.

The Hamilton Motor Car Co., Chevrolet distributor, is now located at 2336 Euclid Avenue, formerly occupied by the Cuyahoga Sales Co., Chandler distributor. The Cuyahoga Sales Co. has moved to 4400 Euclid Avenue, formerly the Ford home.

The Oldsmobile Cleveland agency, formerly the Windermere Euclid garage, has moved to 2344 Euclid Avenue, the former Chevrolet home. The Windermere Euclid garage will be used as an Olds service station, and the Olds Lakewood service station is soon to be enlarged to give west-siders service.

The Hills Motor Car Co., which handles the Briscoe and the Pathfinder, has moved from 6110 Euclid Avenue to 6010 Euclid Avenue.

The Albaugh Motor Sales Co. has opened a new service station for Metz and Lewis owners.

Stewart Buys Out Partner—J. T. Stewart of the Stewart-Toozer Motor Co., Omaha, Neb., has purchased the interest of George Toozer, and will henceforth conduct the business under the name of the Stewart Motor Car Co. The company will remain in the same quarters, and has taken on the Mitchell car with the Pierce-Arrow, the former of which replaces the Chalmers agency, recently relinquished. F. C. Hill remains with Mr. Stewart as sales manager.

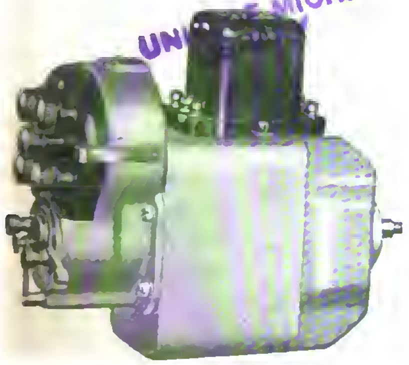
Nikrent Joins Earle C. Anthony—Louis Nikrent, veteran automobile racer, of southern California, has been appointed the technical expert of the Earle C. Anthony, Inc., Los Angeles, Cal., which organization controls the Packard sales throughout southern California and controls the State territory for the Reo.

The Earle C. Anthony, Inc., has added two branches, one in Bakersfield under the management of C. B. Pentoney, and one in San José, under M. N. Brodie. With the addition of these two houses Anthony is represented by branches in six of the largest cities in California.

Michelin Adds—The Michelin Tire Co., Milltown, N. J., will increase its manufacturing building by an addition measuring 53 by 117 ft. The addition is to be one story, brick walls, and a saw tooth roof.

The AUTOMOBILE

Vol. XXXIV, No. 5 NEW YORK, FEBRUARY 3, 1916 Ten cents a copy Three dollars a year



GRAY & DAVIS

Ignition Dynamo

Here is an ignition system of exceptional efficiency. It produces maximum results at **all** speeds.

Very simple in design and construction. Parts immediately accessible.

Quality in material and workmanship exceeds that of any similar device.

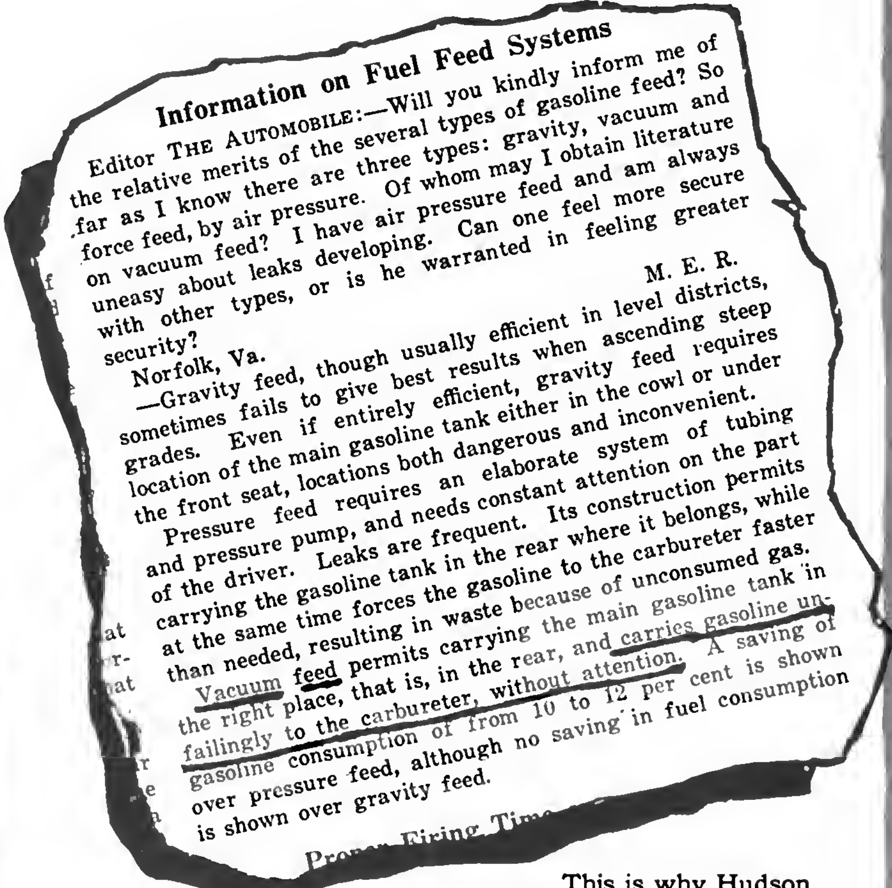
When used with Gray & Davis starting motor, this ignition dynamo offers the utmost in electrical equipment.

Particulars gladly furnished

GRAY & DAVIS, Inc. **BOSTON, MASS**

"Carries Gasoline Unfailingly without Attention"

says "Automobile"



Information on Fuel Feed Systems

Editor THE AUTOMOBILE:—Will you kindly inform me of the relative merits of the several types of gasoline feed? So far as I know there are three types: gravity, vacuum and force feed, by air pressure. Of whom may I obtain literature on vacuum feed? I have air pressure feed and am always uneasy about leaks developing. Can one feel more secure with other types, or is he warranted in feeling greater security?

Norfolk, Va. M. E. R.

—Gravity feed, though usually efficient in level districts, sometimes fails to give best results when ascending steep grades. Even if entirely efficient, gravity feed requires location of the main gasoline tank either in the cowl or under the front seat, locations both dangerous and inconvenient.

Pressure feed requires an elaborate system of tubing and pressure pump, and needs constant attention on the part of the driver. Leaks are frequent. Its construction permits carrying the gasoline tank in the rear where it belongs, while at the same time forces the gasoline to the carbureter faster than needed, resulting in waste because of unconsumed gas.

Vacuum feed permits carrying the main gasoline tank in the right place, that is, in the rear, and carries gasoline unfailingly to the carbureter, without attention. A saving of gasoline consumption of from 10 to 12 per cent is shown over pressure feed, although no saving in fuel consumption is shown over gravity feed.

Pro Firing Tim

Can be installed on any car—old or new

This is why Hudson, Studebaker, Chalmers and Dodge Bros. discarded gasoline tanks in the cowl and pressure feed systems, and are equipping their entire output with Stewart Vacuum System. This is why more than 53% of ALL CARS MANUFACTURED are now equipped regularly with Stewart Vacuum System.

Stewart Vacuum Gasoline System

$10

Any dealer can put this system on any old car and thereby bring it up-to-date. It has put back into the running more old cars than any other feature ever offered the automobile public.

Stewart-Warner Speedometer Corporation, Chicago, U. S. A.

Vol. XXXIV New York—Thursday, February 3, 1916—Chicago No. 5

The Automobile

Driver's Lot 99% Discomfort

Although Driver Is Most Often Owner, Comfort of Tonneau Occupants Is More Studied—Entrance and Seating Positions Ill-Considered

By J. Edward Schipper

WHY has the owner-driver been neglected and all the brains and genius of the body builder been concentrated on his wife, children, invited guests and other occupants of the tonneau? Why do we have 21-in. doors on our automobiles and then have to compress our anatomies sufficiently to squeeze our bodies, along with a heavy driving coat, through a space of 7 in. between steering wheel and body combing? Why do we have luxuriously lounging driving seats in which we can repose comfortably, when the car is standing at the curb, but in which we cannot drive for any time without an aching neck due to continuous craning to see the road around, above or below the wide rim of the steering wheel?

There are a multitude of things that go to make a car comfortable, and the hundreds of dollars worth of upholstery placed on a fine body can be set at naught by the neglect of the little details. For several years the exterior appearance of the car has been the study of hundreds of engineers and artists in this country and abroad. Is it not possible that in our race after beauty of outline, we have neglected the, perhaps more important, comfort of the interior?

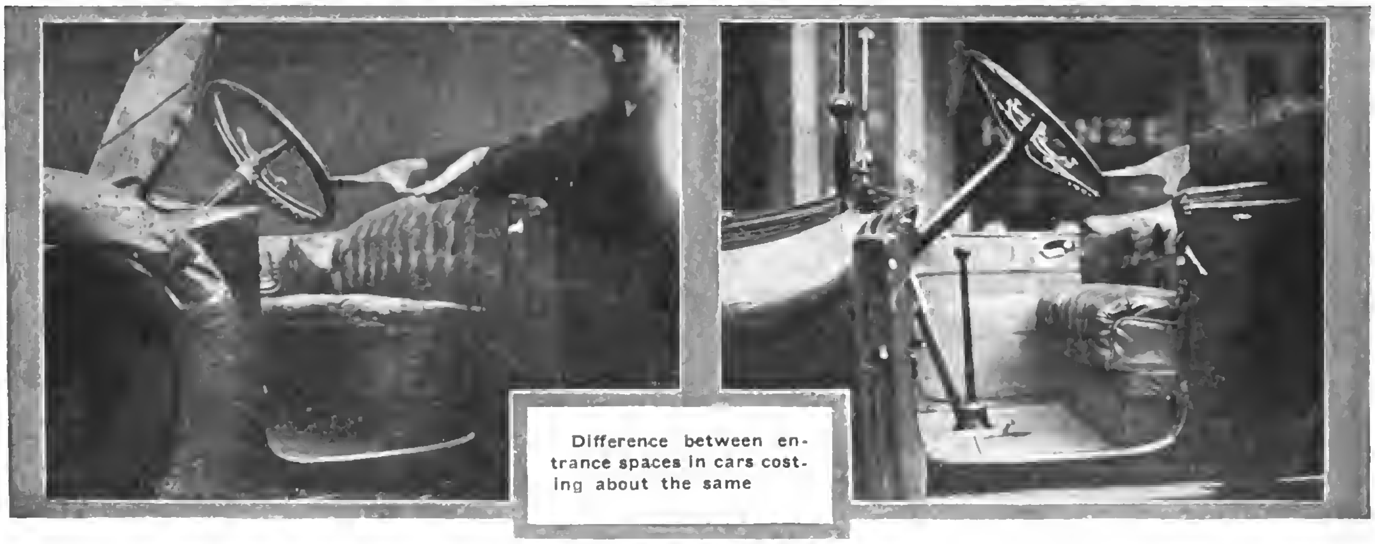
Ninety per cent of the cars in this country are driven by their owners. This means that on all but 10 per cent, the owner of the car is sitting in the driver's seat. This condition is worthy of thought because it means that some of the attention which produces comfort should be focussed on the seat occupied by the man to whom it is most essential that the comforts of motoring should appeal. As the matter stands now he is not only uncomfortable while driving, but on entering or leaving the car, especially with a heavy coat, he is compelled to perform a series of contortions the inconvenience of which is limited only by the narrowness of his waist-line.

The difference between leaning to make a gear change and changing gears in erect position

After having forced an entrance to the car with an effort that is destructive to coat buttons and patience, the next consideration is the sitting posture. On some cars, the driver leans back, on a great majority he sits as erect as the drum major of a crack military band, on a few others he is actually leaning *forward.* The erect position is fair. It is more comfortable to lean back slightly so as to take a little [illegible] strain off the spinal column, b[illegible] it certainly bad to lean forward.

There are many other detail considerations that actually mean comfort or discomfort to the driver, and it must be always remembered that he is generally the man who has bought the car. The position in shifting gears, the amount of reach to get at the emergency lever, the width of the seat, elbow room on the left side in the left-drive car and the position of the feet in driving.

All the trouble is not in the driv-



Difference between entrance spaces in cars costing about the same

er's seat however, although it must be conceded that most of it is. The occupant of the tonneau is quite comfortable in most of the cars, but there are exceptions in cars in which considerable expense has been gone to in providing good upholstery. For instance the camber or curve of the seat in conjunction with the camber of the back rest form a combination which must be just right, or else the occupant of the car, if he is of ordinary stature will quit his seat after the end of a long day's ride with a feeling of relief instead of regret. It is recognized that it is impossible to turn out the bodies of stock cars in the same manner as a tailor fitting suits of clothing, on the other hand, the designer must work to the needs of the person of ordinary stature. Since the tonneau seat must accommodate persons of varying heights and degrees of embonpoint, it is necessary to use care that the camber of seat and back rest do not make the seat uncomfortable to any except the one person that it fits.

To secure accurate data on some of the details which go to make a car comfortable and convenient, a number of measurements have been taken on representative 1916 cars. These measurements have been made for the purpose of bringing comparisons and recommendations down to a definite basis, thereby giving something which may be worked from in designing a body that will eliminate the maximum number of difficulties which are sure to crop up if these little points are neglected.

The measurements taken are shown on the accompanying charts and the tabulations show the actual dimensions of the points noted on the diagrams, in inches. Several inches variation will be noted in several of the columns, and in many of the instances the difference of 1 or 2 in. was the determining factor as to whether the particular point referred to was one of the factors of comfort or discomfort in the design.

Movable Steering Wheel

THE possibility of the non-stationary wheel should be carefully considered. The use of a universal joint at the base of the steering column, a folding wheel that is not clumsy or a telescopic column with adjustable rake are all possibilities, and when any manufacturer puts one of these arrangements or another on his car so that when the driver enters or leaves the car he can push the steering column out of the way, he thereby obtains a talking point which will appeal to every motorist who ever drove his own car.

Squeezing into the driver's seat—This car had more room than most others

Narrow Space Exhausts Patience

The dimension at *A* is the distance from the steering wheel to the seat. It varied all the way from 7 in. to 10 in. on the various cars, and the further away from 7 and the nearer 10 the distance, the more comfortable is the car for a person wearing a heavy coat. There is no advantage in having the steering wheel scraping across the lap of the driver. In entering the car the distance at *A*, is all important. Take the salesman, for instance, who is using the car to make a number of calls necessitating his entering and leaving the car several times during the course of a comparatively short drive; or, take the doctor, or the man on a shopping tour with his wife, or the lady herself; every one of these is compelled to squeeze his or her body and a mass of clothing through a 7-in. space every time he or she leaves or enters the car.

There have been men who have raved against the discomfort of the car under these circumstances, especially in winter when fur coats are the rule. And, since winter driving is becoming the rule and not the exception, this extra thickness of coat must be taken into consideration in determining these dimensions. From the thirty or more cars experimented upon, one could not fail to come to the conclusion that the measurements had been determined in a great many cases by a very thin person clad in very scanty garments.

The distance from the bottom of the steering wheel to the seat should be 9 in., and the driving seat is not convenient and comfortable for even an average person unless it is at least that.

The distance *R*, is closely allied to that at *A*, and is measured from the edge of the door passage to the nearest point on the steering wheel. It is the narrowest part of the entrance through which the

Recommended Dimensions for Comfort

Part of Car	Key Letter on Chart	Dimension in Inches
Wheel to front seat vertically	A	9
Wheel to seat back, horizontally	B	16
Front seat height, vertically	C	14
Shifter to seat, horizontally	D	6
Center of wheel height, vertically	E	27
Pedal to seat, horizontally	F	19
Shifter lever handle height	G	19
Brake lever to seat, horizontally	H	12
Level line of eye and wheel top	J	Over
Must one lean to shift gears	K	No
Must one lean to apply emerg'ncy	L	No
Width of front door	M	21
Position of driver in seat	N	*
Transverse distance sill to shifter	O	18
Transverse distance sill to brake	P	20
Width of front seat for driv'r only	Q	18
Entr. space bet. wheel and side	R	11
Front seat back to rear seat	S	†27
Height of rear seat	T	14 to 17
Depth of rear seat	U	21
Width of rear seat	V	‡46
Width of rear door	W	21

*Not quite erect. †For five passengers. ‡For three passengers.

driver must squeeze in entering the car. Here the distance runs down to 4 in. on one car, 5 in. on another and 7 in. on several. The driver actually has to pass through this space before he can sit down. The car is equipped, taking the 5-in. case as an example, with an 18-in. door. Of what use is the wide door when directly inside it is a passage less than one third the width?

The front door must not only be of good width in order to make it an asset to the car but it must also be far enough back so that when it is open there is no interference with entrance. This can readily be done as shown by car No. 4. In this car the width of the front left door is 20 in., the distance *A*, from steering wheel to seat, is 8 in., which is fair and the important distance *R*, which measures the ability of the driver to enter the car comfortably and quickly, is 11 in. This is good. The *R* dimension is secured by having the door carry away that part of the body which would interfere with entrance, by simply having the side of the seat as part of the door. To put it another way, the position of the door is nearer the back of the car, thus allowing the driver to enter through the center of the door instead of having available only a small part of the entrance space due to the position of the steering wheel.

Easy Steering Position

The *B* distance, which is measured horizontally from the edge of the steering wheel to the back of the front seat should be as large as is consistent with the lines of the car. It is not so vitally important as long as it is within certain figures which can very well be put as 13 and 18 in. With the *A* measurement correct, the driver will normally carry

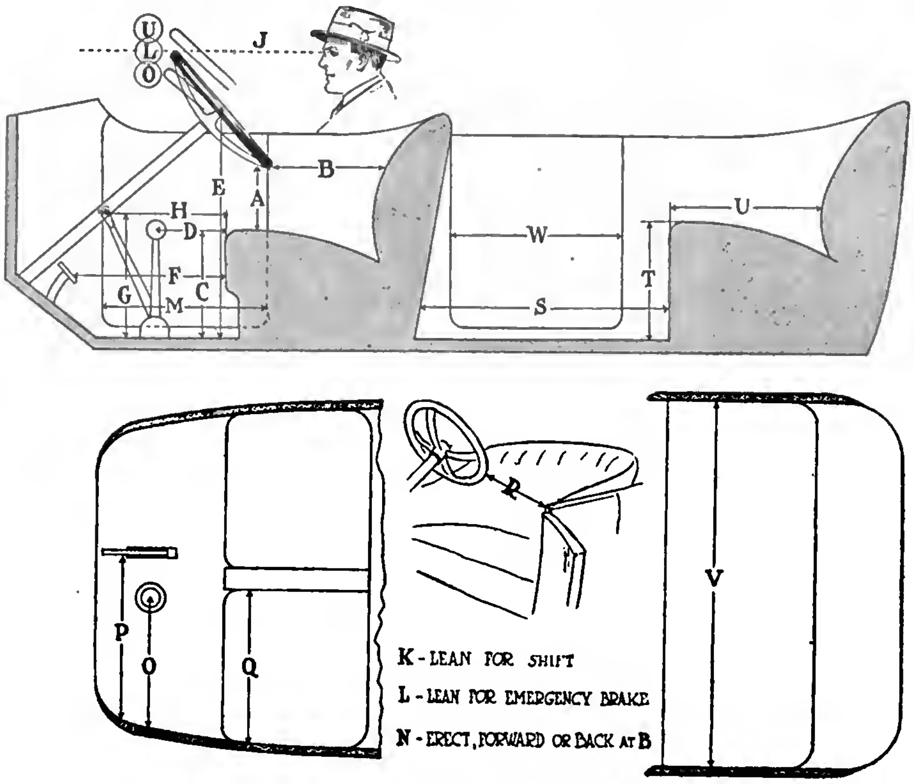


Diagram showing points at which tabulated dimensions were taken

Dimensions of Front Compartment on Typical Cars

Car No.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	Remarks
1	9	19	13	7	26	20	10	15	L	No	Bad	21	E	16½	20½	15	9	Narrow—no room on left side.
2	9	15	12	14	27	19	15	14	Good	Yes	No	17	E	18	15½	16	10	Not enough leg room. Leg touches wheel.
3	8½	13	14	5	29	15	16½	14	0	No	Bad	19	E	19	22½	15	8	High but good.
4	8	13½	13	6	27	19	19	17	0	Good No	Bad	20	E	19	22½	x 21	11	Fairly comfortable.
5	7	15	15	7	28	21	17	16	0	No	Very poor	16	Ex	16	19	Cont.	7	Seat too high and too erect.*
5	8	16	15	12	28	20½	17	20	x L	Yes Left	Fair	21	Good	2½	3½	Cont.	11	Wheel interferes with vision. Windshield split also and in way.
7	7½	14	13½	5	26½	19	17	11	0	No	No.	19	E	18	20½	x 21	10	Seat too erect.
8	5	15	16	7	28	16	17	8	0	No	No	19	E	20	23	x 20	8	Wheel too close to seat.
9	7	14	15½	7½	27	19½	14	15	0	No	Yes	18	E	18	20½	Cont.	9	Fairly comfortable.
10	9	14	15	10	28	21	18	19	0	No	Bad	21	Fd.	20	23	Cont.	10	Back of seat too straight. Break down wheel good.
11	8	14	11	7	25	18	15	14	0	Good	Left	17	E	17	4	x 15	4	Bad left door. Practically useless. Poor leg room.
12	10	15	13	13	29	19	17	19	L	Yes	Yes	19	B	20	22	16	9½	Good.
Roadsters																		
13	7	16	13	9	26	20	15	16	0	No	Yes	19	E	17	20	Ct.	8	Good.
14	8	15	12½	12	27	20	15	14	0	Yes	No	21	E	18	15½	15	12	Easy entrance. Leg room short.
15	7½	18	13	6	26	18	16	12	U	Yes	Yes	23	B	19	16	17	15	Easy entrance. Look through wheel.
16	10	14	9	7	26	18	15	11	U	No	Yes	18	B	R	t.	C	5	Door useless. Look through wheel.
17	9	13	9	8	24	22	13	10	LU	No	No	20	B Good	19	22½	C	7	Comfortable. Bad entrance on left.
18	7	15	14	5	29	17	18	15	LU	No	Yes	19	B	19	23	18	8	Good leg room but bad entrance.
19	8	14	11	16	26	20	17	18	0	Yes	Yes	*	E	17	15	17	*	No room for left foot.

*Right door only.

Dimensions of Rear Compartment on Typical Cars

Car No.	S	T	U	V	W	Remarks
1	32	15	19	46	21	Comfortable, good back rest.
2	31	13½	18	45	25	Seat seems shallow due to excessive camber.
3	34	14	21	46	21	Good. Rear seat flat giving impression of width.
4	32	15	18	46	21	Back seat too erect.
5	27	14	18	42	17	Seat and back rest hard and stiff.
6	31	17	19	48	22	Good slope on rear seat with small hut comfortable camber.
7	34	13	18	47	18	Seat seems shallow due to excessive bulge of hack at too low a point.
8	24	15	22	45	21	Good. Deep seat with high back rest.
9	29	14½	21	46	20	Bad entrance. Door width is 20-in. but passage only 14 in. Seat too erect.
10	36	15½	19	48	20	Good. Soft back with springy upholstery.
11	26	15	20	40	20	Fine deep seat with correct back camber.
12	32	15	18	44	19	Very good. Sloping seat with high back. Could be improved by greater depth of seat.

Of what use is a door that cannot even open? Tire carriers on side

Position taken by driver too low in expensive special body

his hands at about the center of the wheel and with a correct *B* distance he will sit neither too uprightly nor will he recline too much.

The two distances *C* and *D*, that is seat height and reach to shifter lever, should be considered together as they are inter-related to a great degree as regards convenience in changing gears. In nine cars out of every ten, it is necessary to lean into a cramped position to change gears. To reach the change gear lever the driver ought not have to do more than lift his hand. The assembled car is the greatest offender in this detail as the upright shifter lever is allowed to fall where it will, because it is assembled on the coverplate of the unit powerplant gearset. A few considerate manufacturers have taken the trouble to bend the lever so that it is at the driver's hand whenever he wants to use it.

It means much to the life of the car if the gears are changed every time that occasion really demands, and the manufacturers are now endeavoring to educate the public to the use of the gearshift. One of the greatest educators in this respect is to put the gearshifter lever where it can be reached. A bend in the lever will not affect its manipulation in any way and will eliminate the burden of unhandy shifting and be a real asset to the car and driver as regards life of the former and the convenience of the latter. Therefore, the distance *D* should be short, about 6 in. being very good on a car where other details of design allow it. On cars measured, the distance amounted to as much as 14 in. which is double what the maximum should be.

The distance *E* measures the height of the steering wheel center above the floor of the car. It is only important when taken into consideration with the dimensions which govern the height of the driver's head above the floor. The letter *J* indicates whether the driver looks over, under or at the top rim of the steering wheel. The critical line is taken from the eye horizontally. In the tabulation the letter *L* signifies level, meaning that the eye and top of the wheel are on the same level, the letter *O*, means that the eye looks over the wheel and the letter *U* that the driver looks through the wheel.

Must Peer Through Wheel

There are a few people who like the racy appearance of the man who is lying almost flat on his back peering through the interstices of a steering wheel, the majority however, like to have a clear vision of the road and the surrounding country although without the feeling of height and prominence that is imparted by a seat on a municipal sprinkling cart. The happy medium is what is desired and if the line of sight from eye to top of radiator just clears the steering wheel, a very desirable effect is secured.

A very important dimension is denoted by *F*. It measures the distance horizontally from the center of the clutch pedal to the front seat wall. On some cars this distance is too short and the result is that when the leg is drawn back to place the foot upon the clutch pedal, the knee strikes the steering column or the upper part of the leg strikes the steering wheel. Actual sales have been lost because persons, with a slightly longer leg length than usual simply could not drive the car. The adjustable pedal which is increasing in use all the time is the necessary solution. The distance *F* should average about 19 in. with an adjustment of 3½ in. each way.

The height *G*, of the shifter lever is one of the factors which determines whether or not the driver will have to lean every time he makes a shift. It is very interesting to note the differences between the seat height *C*, and the shifter lever height *G*. In the car that had the best shifting arrangement of all those measured, the seat was 13 in. above the floor and the lever center 19, a difference of 6 in. This difference seemed about right to the observer who is of medium build. Other observers checked these claims and substantiated them. The remarks which cover the shifter lever also apply to the emergency lever, although for the latter it may be said it is hardly ever in use. It may be necessary some time to use both the emergency lever and the steering wheel at the same time. This would be almost impossible on a very large proportion of the cars.

In listing the cars that required a lean to make a shift, the symbol *K* is used. Under this heading the words Yes and No signify whether or not it is necessary to make a noticeable lean to shift gears. In many instances where the word No appears, although the driver did not have to bend his body excessively to make the change of gears, the arm had to be uncomfortably stretched. This gives the final check on the other dimensions governing the position of the driver in the seat.

Leaning to Shift Gears

Under the heading *L* will be found a list of cars in which an excessive lean was required to apply the emergency brake. This list is much less severe then it should have been because only very excessive leans are noted as Yes, and any car that allowed the driver to remain in his seated position was classed as No.

The divided seat cars skimp the driver's room in many instances. Where this skimping is felt is in the cramping of the left elbow space. With the high body now in use, it is impossible for the driver to rest his left elbow on the left gunwale without attaining a slouching posture due to a decided list of his body to starboard. A 15-in. seat is not wide enough to give elbow room unless there is a decided flare on the body. With the tendency now to have the body side straight, or even with a slight tumble home, the elbow room is sure to be poor unless the seat is 17 in. or more.

In some respects the divided front seat defeats its own object, unless great care is used in laying out the dimensions. The passage between the seats is supposed to be for the purpose of allowing a passenger to enter or leave the front compartment without stepping outside the car. It would be impossible for a lady clad in heavy garments to squeeze her way through on many of the cars using the divided seat. In fact, many a man would prefer to walk around on the outside. The result is that not only has the driver's seat been cut down to an uncomfortable 15 in. but the object of the sacrifice has not been attained. The suggestion which has been carried out by some, of raising the floor between the two seats, does away with this objection.

Leg-Room in Cloverleaf Types

Speaking of divided front seats brings the cloverleaf roadster immediately to mind. One of the questions which the designers of some of these bodies have failed to ask themselves is, "What is the passenger in the rear seat going to do with that portion of his anatomy which is below his knees?" Sometimes a seat in the theater is very uncomfortable because the aisles are too narrow. Anyone long enough to have suffered through a 2 or 3-hr. performance in a narrow-aisle theater seat will not anxiously look forward to a 7-hr. drive in some of the cloverleaf roadsters, even if the suffering is mitigated to some extent by the privilege of whispering into the ear of the driver without leaving the seat. Knee-room must be allowed and this must be carefully watched in the four-passenger design especially, or the two rear passengers will leave the car as sworn enemies in spite of the efforts of the body builder to secure the effects of sociability or chumminess.

Entering the rear door of the 1916 car, one cannot help but be impressed by the lavish use of space. Perhaps the first thought will be one of wonderment as to what the passengers in the rear seat could possibly have against the driver, that they must be kept as far away from him as possible even if this distance is secured by pushing him close to the cowl board. The distance from the rear seat to the back of the front seat is measured by *S*, in the table. Even on the smaller cars this distance is 27 in. Compare this with 16 in. in the front compartment without even taking into consideration the deeper rear seat. Well may the driver cast his eye longingly behind him and wish that he had an inch or two of the surplus space!

The height *T*, of the rear seat does not vary greatly. On the other hand, the depth *U* varies materially. The seat depth dimension *U*, is quite important. An inch can be perceptibly felt and as long as there is so much room in the tonneau there is no use in sacrificing an inch or two of seat depth when it is really the key to comfort in many instances. If soft upholstery is used a marked camber can be successfully used on the back cushion and the result will be a comfortable seat. On the other hand if the seat is quite solid, it should be flat. An impression of depth is given by flatness. A good deep seat is often destroyed by having the bulge in the back rest too low. This pushes the occupant forward and destroys the effect of the deep seat. It is also the reason for the bolt upright position one is forced to take in so many of our cars whereas a slightly reclining position would be far more comfortable.

No criticism can be made on rear door width. There is plenty of that this year and this has been a most meritorious improvement. In fact in the entire tonneau design each year sees a marked advance in comfort and convenience. The only trouble is that some of this improvement is being secured at the expense of the front compartment and since the man that paid the money for the car is sitting in that compartment compressed between the steering wheel and the seat, it would be well to turn the tide in the other direction for a time.

Conveyor Saves Eleven Minutes Per Assembly

A GOOD illustration of modern speeding up is provided by the aerial conveyor system of the Studebaker Corp., which is used to carry bodies and wheels through the air from one building to another, a distance of 780 ft.

The conveying cables stretch from the third floor of one building to the fourth of another, and the object is to transport the bodies and wheels from manufacturing to assembly departments. Steel trestles support the cables, with the longest span 178 ft. At the terminals it was found necessary to install steel construction in the buildings from the ground up that the weight could be properly supported. The conveyor also crosses a steam railway track, and for safety against damage due to breakdown, a steel overhead bridge protects the cable-way here.

Variations in load are cared for by counterweights that take up any cable slack. The riding cable measures 1¼ in. diameter, and above it is the tow cable, operated by a 10-hp. electric motor.

Twelve Times Quicker Than Trucking

Formerly the bodies and wheels were trucked to the assembling room. This necessitated their being taken down an elevator from the third floor of the finishing department, trucked through a tunnel to the assembly building and then another elevator was used to bring them to the fourth floor. On the average, 12 min. were required for the delivery of a body, with four men to handle it.

Now, two men at each terminus take care of the conveyor and do the loading and unloading. One man can draw a body either onto or off the conveyor car. The best record as yet attained in operating the conveyor has been the delivery of forty-one bodies in 42 min.

As traps catch and release the cable grips without requiring any attention, the operation is merely a matter of attending to the cargo. Wheels are carried in specially-constructed trucks, each made to hold fifteen wheels.

Needless to say the new conveyor scheme, which is only one of many of similar nature now installed in the factories of the concern, is effecting great savings and doing its part to cut down overhead expense.

New aerial conveyor system installed by the Studebaker Corp., Detroit, for the transfer of bodies and wheels from the finishing department to the assembly floor, a distance of 780 feet. Steel cables carry the load, and they are supported by trestles, with the longest span 178 feet

Enlarge French Automobile Factories

Demand for Increased Output of War Munitions Renders Expansion Necessary—All Plants Building Some Cars

By W. F. Bradley

Special Representative of The Automobile with the Allied Armies in France

PARIS, Oct. 15—If it were possible to find a stranger unacquainted with conditions in Europe and to take him on a tour of the automobile factory districts, he would come away with the conviction that the industry is in a most healthy condition. This conclusion would be based on the observation that at every automobile factory of importance building operations are in progress or nearing completion. It would be quicker for me to give a list of the automobile firms which have not, or are not, extending their works, than those having extended their ground area. No attempt will be made to prove that the allied armies have or have not attained their maximum power; but so far as the automobile industry is concerned the output of munitions of war is capable of further development.

Increase Outputs 50 to 100 Per Cent

The organization of the automobile industry of France as an auxiliary of the war department has been complete for a long time, but as the war has lengthened it has become possible to modify plants and extend factories so as to obtain increased outputs varying from 50 to 300 per cent. The machinery in any automobile factory is capable of shell production, but the best results can only be obtained by certain reorganizations and the expansion of certain departments. Until assurances were given that contracts for immense quantities would be placed, factory managements were not inclined to modify their plants and erect new buildings. These assurances have been given, and there are now automobile factories which might have been originally laid out for no other purpose than the production of war material. At the expenditure of considerable capital, plants have been modified so that shells are now produced under conditions which could not be improved upon by the best high-efficiency experts.

At the outset heat-treating and hardening departments were insufficient. Although the plant might be up to date for automobile work, it was not designed for big quantities of one particular type of shell. Some firms might be mentioned which have pulled down their old ovens, intended for various kinds of automobile parts, and replaced them by increased numbers of ovens designed exclusively for handling 75 mm. shells. Some of the smaller factories did not undertake their own hardening and were obliged to send their shells to outside specialists for treatment, with a consequent loss of time in handling and transhipment. In nearly every case this has been remedied.

Forging Plants Were Insufficient

When the automobile industry was taken over by the army there was a considerable shortage of forging plants. During the summer steam hammers were bringing fancy prices and not enough could be found to go round. Instead of shaping the shells under a steam hammer, all the leading factories now have special presses by which it is not only possible to make one-piece shells, but also to avoid all internal machining. Before it was possible to put down the new presses, important foundations had to be dug, in some cases new buildings had to be erected, and the ovens had to be increased in number to keep pace with the presses. In many cases it has been possible to increase output more than 200 per cent by this new plant. In the past it frequently happened that one particular department was so ill-equipped as to hold back the whole factory. As an instance, an automobile factory producing 1500 shells a day had but one machine for testing shells under hydraulic pressure—this pressure being practically 9 tons per sq. in. A lazy or inefficient operator, or a breakdown of this machine, was sufficient to hold back the entire output. These defects have been, or are being very largely remedied, with the result that the output is steadily on the increase, although the number of hands engaged has not appreciably altered.

Shells constitute about 60 per cent of the output of the French automobile factories. Conditions are very varied. In one automobile factory the only automobile parts were in the store room, and the door of this room was locked. In this case the factory had decided to specialize on shells to the exclusion of everything else, and after putting down die presses and erecting a hardening plant, is doing this work in a most efficient manner.

All Factories Building Some Cars

As a general rule, however, all factories are producing some cars, most of them being intended for the army. Although France has placed considerable orders in America, there do not appear to be many cases of touring cars bought abroad. The nearest approach to the touring car hailing from across the water is the Jeffery ¾-ton model, fitted with twin pneumatic tires on rear wheels. Several hundreds of these have gone into service with the ambulance formations. With this exception, all the touring cars for staff officers' use, all the light ambulances, and all the special cars for aviation, wireless telegraphy, searchlights, postal service, etc., are of French construction. The factories most busily occupied on this class of work are Renault, Panhard, Lorraine-Dietrich, Bayard-Clement, Unic, Delaunay-Belleville, Mors, De Dion-Bouton, Berliet and Delahaye. Although these firms are in a position to build cars in really important quantities, they are not supplying much to the public and are shipping next to nothing abroad.

Demand for Aviation Motors

During the last six months the automobile factories have been considerably interested in the production of aviation motors. As the Ministry of War has now allowed it to be announced, France has created since the war an immense fleet of aerial cruisers, both large and small, armed with quick-firing guns and cannons. Most of these aeroplanes have fixed cylinder, water-cooled motors of 150 to 250 hp. One of the biggest of the airships has four Renault twelve-cylinder motors of 250 hp. each, or 1000 hp. in all. The firms which have been most interested in producing the new engines required for the aerial fleet are Renault, Lorraine-Dietrich, Peugeot, Hispano-Suiza, Darracq, De Dion-Bouton, Delaunay-Belleville, and of course the aviation motor firms Clerget, Gnome, and La Rhone. All the motors built by the automobile firms have six, eight or twelve water-cooled cylinders. While the aviation motor firms are continuing their rotary types, they have been obliged, under the call of the war department, to produce fixed cylinder water-cooled types. Clerget has brought out a six with piston valves, and Gnome, who formerly produced nothing but rotaries, is now making a nine fixed-cylinder water-cooled type and a double opposed eight, also with fixed cylinders.

Eight-Cylinder V a Success

One of the most successful of the new aviation motors is an eight-cylinder V-type in aluminum with steel liners screwed into the cylinders. Each set of four cylinders forms a block. Cylinder heads are detachable and carry a pair of valves for each cylinder. An overhead camshaft operates each set of valves direct, there being no intermediate gear whatever. The nearest approach to the elimination of intermediate valve gear has been in the Peugeot racing motors, but on the aviation motor in question even this has been dispensed with, the cam being in direct contact with the valve stem. Another feature of the motor is the elimination of the base chamber as an oil reservoir. All the lubricant is contained in an oil radiator, pumped to the bearings, and then back to the radiator. This is a type of motor conforming to automobile design, and having a direct bearing on automobile production. Yet it has been possible to get the total weight as low as one kilogram (2.2 lb.) per horsepower and to reduce gasoline and oil consumption to 200 grams per horsepower-hour. The best featherweight rotary motors were far from giving such results. It is obvious to anybody who has been able to follow these developments that one outcome of the war will be the production by French manufacturers of six-, eight- and twelve-cylinder automobile engines of a weight hitherto undreamed of. Even though it is not desirable commercially to reduce weight to the low limits pertaining to aviation work, car engines will certainly weigh less after the war than before it.

Big Aviation Sixes

Delaunay-Belleville is producing big six-cylinder aviation motors under the direction of Charles Picker. Picker is a high-efficiency motor expert who before the war specialized in racing motors and produced such motors for various automobile firms. Darracq has secured the designs of the Isotta-Fraschini six-cylinder aviation motor and has laid plans for quantity production. Renault is turning out immense quantities of aeroplane motors, the line comprising his old eight-cylinder, air-cooled model, a six-cylinder, water-cooled, and a twin six, water-cooled. De Dion-Bouton is building an eight, water-cooled, Hispano-Suiza the same general type. Peugeot has made use of racing experience and is producing eights of the same general design as its racing fours. Engineer Henry, who did all the technical work on the Peugeot racing cars, has left his old firm and has obtained a contract for a quantity of eight-cylinder, water-cooled motors of the same design as those he built for the French races, and necessarily having much in common with the Peugeots. Bayard-Clement is interested in six-cylinder airship motors. All the new motors produced by these automobile firms have to undergo a thorough test at the government laboratories. Each engine must run without a stop for 10 to 15 hr., at full power, and attain a certain standard as regards horsepower-weight ratio, fuel consumption, etc. Charles Faroux, who will be remembered in connection with the 1913 race at Indianapolis, is one of the experts at the army laboratory.

Car Plants Help in Aeroplane Work

Not many automobile firms have taken up the production of army aeroplanes. Bayard-Clement is building both airships and aeroplanes, but did so before the war. Darracq has secured the license for the Vickers biplane and is producing Darracq-Vickers aeroplanes for the British army. In a short time this firm will produce aeroplanes complete with motors. There have been so many improvements and so many modifications of type of aeroplanes, that it has hardly been possible for automobile firms with no special experience in aeroplane construction to take up this work. All that the automobile factories can do is to take an accepted design and copy it in every detail. Obviously the aeroplane factories have had to increase their output enormously. In some cases streets have been closed to traffic and built over to provide additional shops, while other firms are obliged to leave their finished machines in the open air, under a military guard, owing to inability to get enough buildings to house them all while waiting delivery. The automobile body shops are able to give considerable help in aeroplane construction, but up to the present have not been called upon to any great extent. While the automobile factories are working at full pressure, the body shops have nothing more important to do than

How a little Zedel wireless telegraphy car came back from the war. The two mechanics had gone for a drink when a shell fell to the right of the car; a second struck to the left and a third squarely on top of the hood, blowing a hole in it, shattering the radiator and breaking the water jacket

Jeffery quad drawing a captured gun into Les Invalides, in Paris

produce ambulance bodies, field kitchens, etc. This class of work does not by any means compensate for their usual high-class business.

Army Takes All Trucks

Although the automobile industry of France is purely an accessory of the war department, it is possible to produce a certain number of cars for private use. These are mostly small cars not required for army purposes. As an instance, Renault is able to furnish a number of his twin-cylinder taxicab chassis which is used for light delivery work. It is absolutely impossible to buy a truck anywhere in France, for, although such firms as Saurer, De Dion-Bouton, Panhard, Bayard-Clement, Lorraine-Dietrich, Delahaye and Aries are producing in fairly large quantities, everything is taken up by the army. As every private truck has been requisitioned for army use, and is either in actual service or held in reserve, business firms find it a difficult matter to make deliveries of general goods. Marseilles, which has a very large trucking business, is one of the towns protesting at being deprived of automobile trucks. Even firms supplying the army have been deprived of their trucks and have to make deliveries by horses and various old types of vehicles.

Demand for Castings and Forgings

Firms endeavoring to produce cars are working under no ordinary difficulties. When the orders are for the army, government assistance is given in securing raw material, and requisitions will be made if material can be found not used for army purposes. The greatest demand is for iron and steel castings, stampings and forgings. One of the leading makers of drop forgings declared recently: "The only question automobile manufacturers ask now is, 'When can you make deliveries?' They never inquire about price; if we can make deliveries, they will foot the bill."

One manufacturer who is trying to do some private business declared that certain forgings for which he paid $16 before the war now cost him $36. Crankshafts for which he paid $23 before the war had gone up to $66. He had been able to place an order in America at $40, but his experience was that this firm did not work to the same fine limits as in Europe, and if there were any defects he would have to bear the loss.

There appears to be comparatively little difficulty in getting aluminum die castings, probably because these are not extensively produced in the invaded area. Steel and iron castings, stampings and forgings, all came from the Ardennes, the North of France and Belgium, all of which is country held by the Germans. Several thousands of dollars' worth of patterns are tied up in the invaded country. New patterns can be obtained readily, but the old patterns will not be available until after the war, if ever. One of the most important forges for automobile parts is the Arbel works, at Douai, which although within sight of the French lines is still in the hands of the enemy. Much ingenuity has had to be displayed in order to use material not usually considered suitable. One firm building a high-class car with axle housings machined from the solid forging found itself for a time unable to secure these forgings, and in consequence made use of a cast-steel housing with a steel tube liner. The same external experience was observed, so that the client was not aware his housing was not machined from the forging.

All automobile supplies have increased in price from 10 to 50 per cent. The fact that half-price has to be deposited with order and remainder on delivery is also an increased cost, for before the war 30 days credit was allowed. The effect of the war is felt in the accessory business, where there is an all around increase. Brass, bronze and iron castings, on which there has been a certain amount of machine work, have increased 40 per cent. Automobile factories have increased the price of spare parts by 30 to 40 per cent, although very few of these spares have been put into stock since the outbreak of war.

With only two or three exceptions, automobile factories are not military establishments, in the same sense as State arsenals, forts, docks, etc. At the same time they are practically all under military control. Broadly, there are three classes of workmen: men under direct military law, who have been ordered to return to the factories; men of the army reserve whom it has been considered desirable to leave at their ordinary employment; and those men who have been rejected as physically unfit or too old for active military service. To this latter class must be added a small number of neutral foreigners. Military inspectors visit the factories daily and exercise direct control over the two classes of military workmen. It is common practice for the inspector to enter and ask for some man whose name is on the military list. He insists on being taken to the place where the man is working; if that man cannot be found, or if he is discovered on private instead of military work, there is trouble in store for somebody. It is only possible to do non-military work with non-military workmen. Although the military men receive their usual pay, live at home and are apparently under the same conditions as in peace times, they are nevertheless subject to stringent supervision. They are not allowed to be absent from work; they are not allowed to change their employment; they are not allowed to work short time, and in many districts there are restrictions as to the sale of liquor to these men.

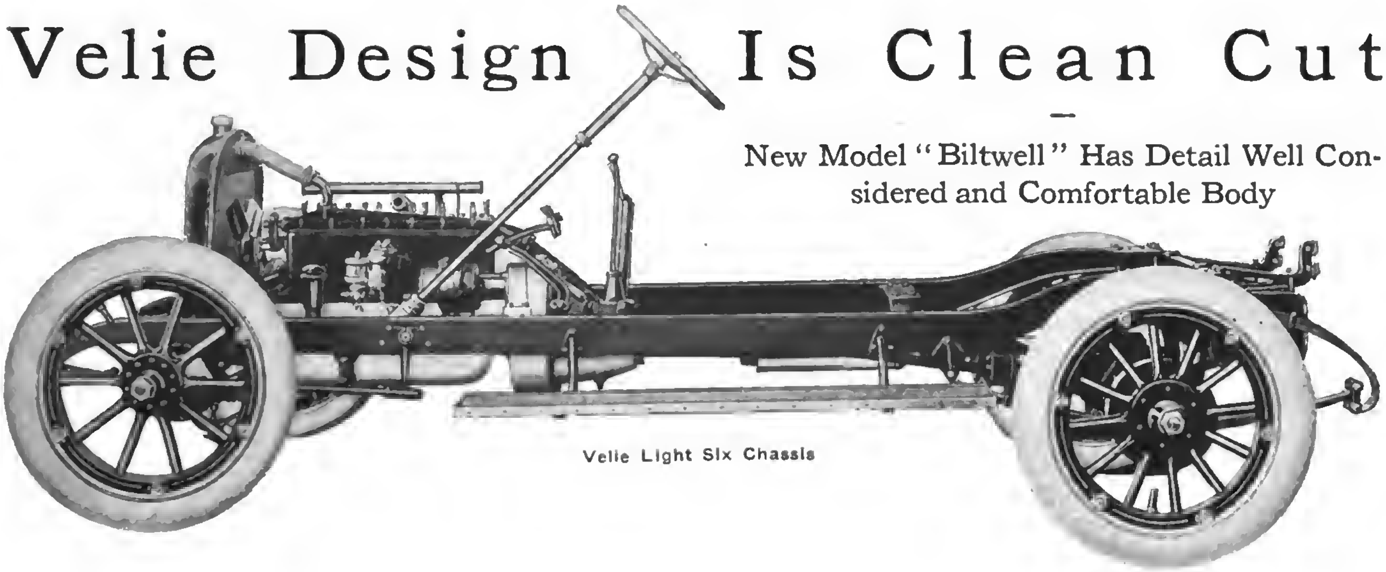
While the military laws cannot be applied to the non-military men, the general effect is to put the entire staff under the same moral obligations. Thus as the military workmen are practically obliged to work 11 hr. a day and six and one-half days per week, the others consider they are under an obligation to do as much. Short time is practically unknown. The strike spirit is entirely absent; if any attempt had to be made to foster a strike it would certainly be suppressed energetically.

Little Change in Tire Factories

There has been comparatively little change in the tire factories. The French factory of the Dunlop company which was closed for a number of months, has been reopened. Michelin is producing both solid and pneumatic tires and also parts of shells in the valve department. The Michelin firm is also interestd in the production of Breguet aeroplanes. The Goodrich factory is working on all kinds of tires, and is supplying both the army and civilians.

Velie Design Is Clean Cut

New Model "Biltwell" Has Detail Well Considered and Comfortable Body



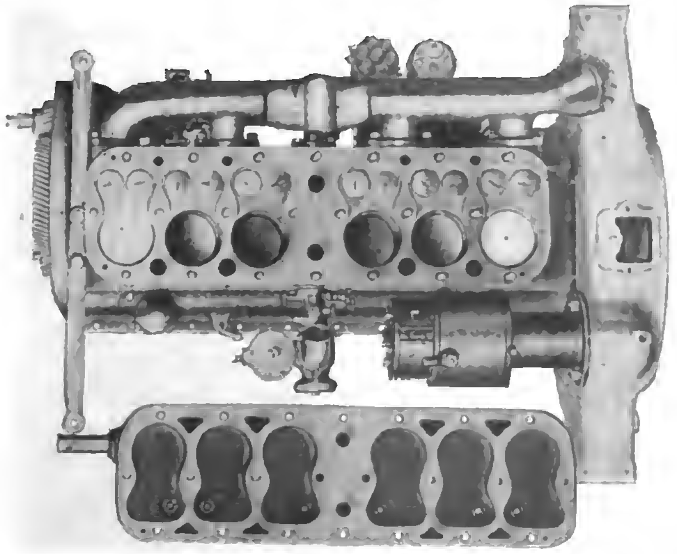
Velie Light Six Chassis

THE Velie Motor Vehicle Co., Moline, Ill., has produced a light six for 1916, selling for $1,065 with five-passenger body, and $1,045 as a roadster, the power plant being the Continental 3¼ by 4½ in. In the layout for the body, the comfort of driver and passengers has been studied, and many little details go to increase the convenience of the former individual. In the chassis, the aim has been to assemble good parts in a way which will enable each to show up to the best advantage, and the frame is designed to support the body at its edges, thus eliminating a certain amount of the ever-present possibility of body squeak after a few months of use.

Uses High-Speed Continental Motor

The engine is a type introduced by Continental last summer, and a sufficient number of the motors are now in use to have earned an excellent reputation. It is the first Continental engine to have the cylinders and upper half of the crankcase in one piece, with the exception of some small fours, and is certainly one of the best appearing jobs the big Detroit plant has ever turned out. The cylinder head is detachable, being held down by twenty-two studs, the nuts being all so accessible that they can be removed very quickly.

High crankshaft speed is aided by the comparatively short stroke, and by the large size of the valves, which are 1⅝ in. diameter in the clear and have a lift of ¼ in., this being sufficient to give a free flow of gas at speeds of 2000 r.p.m. and over. To guard against vibration the crankshaft is 1⅞ in. on the center bearing, the rear and front end bearings being 1/32 larger and 1/32 smaller respectively, to facilitate the reaming operation in assembling the motor for the first time.



Plan of Velie motor with head off

Everything that needs to be handled in a normal way is on the left side of the cylinder block, the carbureter, a Stromberg, bolting direct to the casting and having the oil filler cap close alongside. Just behind the steering gear box, where it is protected and yet easy to reach, is a junction box containing every electrical connection, so that lifting the left side of the hood uncovers everything likely to require inspection. The starting motor also is on this side of the engine, mounted high up where it is safe from inroads of water.

On the right side there is a Remy combined generator and ignition unit of the new, greatly neatened type, this being driven by a universal shaft from the water pump, through a flexible leather coupling. The generator is placed high enough to be accessible, and yet is sufficiently low not to interfere much with the accessibility of the valve stems, when the cover plates are removed. The new Remy generator and igniter has a vertical distributor shaft, or rather a shaft set at a slight angle to the vertical, so as to allow the high tension leads to be carried up well clear of the side of the motor so that interference from the exhaust manifold is prevented.

At the center of the manifold there is a very neat hot-air pocket, made integral with the main manifold casting, the hot-air pipe passing across the cylinders. In the plan view of the motor with the head removed it is easy to see how nicely the various fittings are disposed around it.

Lubrication is on the customary Continental system, there being a small plunger pump which is driven off a cam on the main camshaft. Oil is delivered to the main bearings of the crankshaft and to the timing gears; the large gear is a noiseless material, by the way, and there are also dip troughs for the connecting rods.

Clutch Adjustment Well Cared For

The clutch is a three-plate dry disk having two plates faced with Raybestos gripping a single disk of steel. Pressure from the spring is applied by a system of three levers, and the ball clutch thrust bearing receives its oil supply from the gearset lubricant automatically. Great care has been taken with the clutch adjustment so as to make it as simple and as effective as possible. Firstly, after removing the cover of the bell housing which incloses the clutch, it is only necessary to loosen two cap screws and revolve the toggle carrier in the desired direction and then, when the spring tension is correct, the clutch pedal can be brought back to its original place by a slot adjustment at the foot of the lever. There is also an adjustment on the pedal plate itself and the purpose of providing a setting at both ends of the lever is to enable the pedal to be set to the very best advantage. The adjustment at the upper end is to allow the pedal to be put in the position best suited to the stature of the driver, and this adjustment is not intended to be used in connection with any alteration of the spring pressure, as the more delicate setting at the bottom end of the clutch pedal lever cares for this. Another point about the clutch is that the necessary grip is obtained with a light spring, a pressure of little over 30 lb. being necessary to disengage it.

The three-speed gearbox is of that type in which the countershaft is fixed in the cast-iron outer case, and the countershaft gears revolve upon their shaft, being bushed for this purpose with phosphor bronze. Ball bearings are used upon the main shaft, and the gear ratios provided are 13 to 1 on low, 7.8 to 1 on middle gear and 4.25 to 1 on high. The gear shift is performed by a conventional rocking lever mounted on the gearset cover, but the upper end is brought to a position where it is conveniently within the driver's reach.


Rear end of Velie chassis, showing brake balance gear

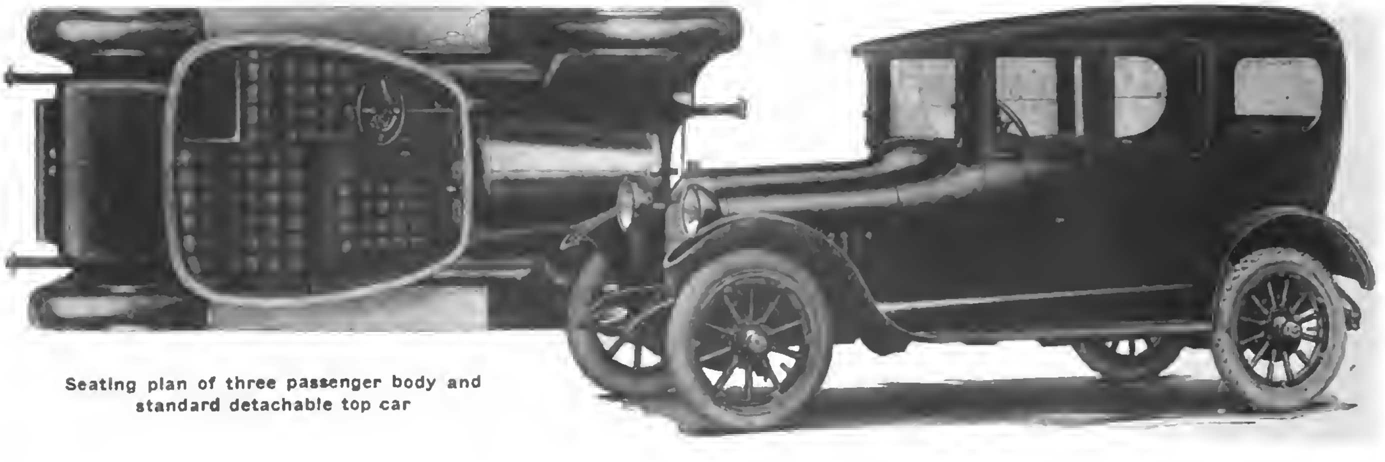
In the rear axle, which is a three-quarter floating Weston-Mott, spiral bevel gears are used, and Hyatt heavy duty roller bearings. Brakes are conventional, the service brake being external, and the bands have the quick-acting thumb nut adjustment introduced by Weston-Mott some months ago. There is a balance beam countershaft for the service and emergency brake, this being made in a unit assembly on a cross rail of the frame, and the pull rods are so arranged that all are straight. Precautions are taken to prevent rattle by attaching coil springs to steady the pull rods, and it is noteworthy that these little springs are stronger than usual and much more neatly applied. It is evident that they are a part of the design and not merely an afterthought.

It was mentioned that special pains were taken in laying out the frame. At first glance this appears to be a simple taper with straight sides wide apart at the rear and close together at the front end, but close examination shows that the frame reaches its full width at the point where the brackets at the front ends of the rear springs are attached. Thence, rearward from this point, the two side rails are parallel, the springs being carried directly beneath them, this removing all twisting stresses from the frame.

Being so wide, the frame is able to support the body in such a way that there is but little overhang at the sides, the floor of the tonneau being almost as wide as the rear seat itself, which has, by the way, ample room for its three passengers. The front compartment is distinctly a good one from the viewpoint of comfort, and the driver can get to his seat without a struggle through the left side door. A very neat radiator shell is used with a bulge in the face of the top water compartment, this giving the car a distinctive front view. Equipment includes double bulb lamps, and all the usual accessories, fuel feed being from a rear tank by Stewart vacuum system. There is a notable absence of points needing lubrication. Of course, the two universals need repacking with grease occasionally and the spring shackles have each their greaser, but the brake connections are mostly supplied with self-lubricating bushings and there are few other parts requiring individual attention. The wheelbase is 115 in., with tires 32 by 4 in.

An Interesting Special Body

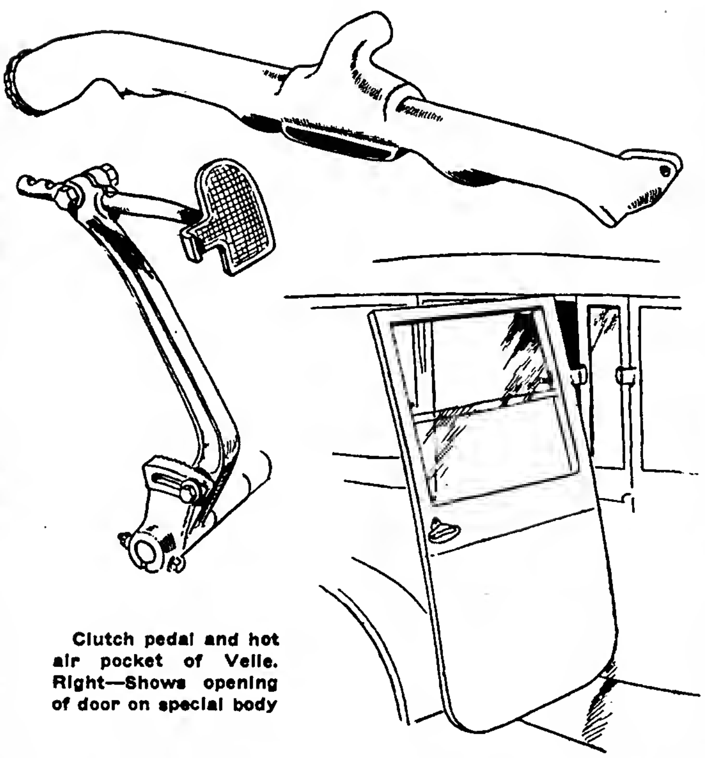
Though not a standard factory product, a special body at present in the New York dealer's showroom is worthy of mention, because it includes an extremely neat idea. It is a neat, demountable top design which suits the lines of the Velie touring body excellently, but its special feature is the manner in which the upper half of the door is held. It is well known that when the ordinary side door is opened it falls a little, and all sorts of sliding connections have been devised by detachable top makers to connect the upper and lower portions of the door and yet allow a gap to open between them, the lower half dropping its outer end as it opens and the upper half swinging square to the side. The makers of the special top hit on the happy idea of using a single hinge for the upper portion and putting the hinge pin at an angle, so that the top part of the door drops, when opened, just like the lower half. The two parts operate precisely like a solid door, and yet are more readily divisible than is usually the case with most similar types of body.


Seating plan of three passenger body and standard detachable top car

In addition to the standard bodies mentioned, the Velie Co. make a touring car with a detachable top, illustrated on the preceding page, and a comfortable car with seating for three passengers, which is likewise shown in the same illustration. These bodies have the same characteristic lines, and the detail in them is just as well cared for as in the other models.

Though they are not supplied as a standard fitting, the Velies that have been supplied with wire wheels disclose the fact that the latter suit the general lines of the car very well. A recently exhibited example of the five-passenger touring car was finished in the regulation dark blue, with a fine white line to outline the upper edge of the body, and white wire wheels. The appearance was extraordinarily smart, though it might be debated upon the score of lasting qualities, it being doubtful whether white is a really good color for wheel painting.

A petty detail that has not so far been mentioned, and yet is characteristic of the care taken with the design as a whole, is the aluminum heel plate which supports the driver's right foot in convenient proximity to the throttle pedal. This accelerator pedal is situated well to the right of the brake pedal, where it can be reached when the leg is fairly well extended, this being thought to be a more comfortable location than the more customary position between the other two pedals, as in this case the leg must be bent a good deal. However, placed so high as it is, the accelerator pedal is only to be reached when the whole of the foot is upon the sloping part of the toe board and there would be a tendency for the foot to slide downward off the accelerator. To prevent this a neat casting of aluminum is attached to the toe board by a couple of screws, having a small curved rest for the heel of the shoe. In this the foot rests easily and the operation of the pedal is ideally easy. The screws that make the attachment can easily be taken out and the heel rest moved to whatever position best suits the driver's convenience in a matter of a few moments.



Clutch pedal and hot air pocket of Velie. Right—Shows opening of door on special body

The Roamer—New Car of Striking Appearance

A NEW car of striking appearance slipped into the Chicago Automobile Show the middle of last week. It is the new Roamer which is being built by the Barley Mfg. Co., Streator, Ill., for the Thomas, Evarts Adams Co., importers of the Lancia car in New York. This company is to be the selling agent for New York and Boston and will also handle all export business on the machine. The Barley company also manufacture the Halladay car, and outside of the territory to be handled by the importers of the Lancia, the Roamer car will carry the name Halladay Special.

The car has been produced primarily with the idea of being marketed to that class of motorists which wants something distinctive in appearance and not too large. The radiator and hood design are copied from the Rolls-Royce and have the characteristic flat-sided appearance that has always helped to distinguish the well-known English product.

The car sells at $1,800, and outside of its somewhat different body lines and general exterior appearance, it is constructed of standard parts, such as Rutenber motor, Grant-Lees gearset, and Lavigne steering gear, Bijur starting and lighting, Bosch magneto ignition, and a Stromberg carbureter are among the important accessories.

In standard form the Roamer is equipped with Houk wire wheels, which add materially to the general appearance. The body is somewhat of the modified boat design with the widest point at about mid-center, and curving and rounding toward the back as well as the cowl. The front seats are individually divided and are almost in the armchair class. A slanting windshield and dome fenders do their part in promoting the good looks of the car. Any color and upholstering can be secured at the list price.

Among the main constructional features of the Roamer chassis are unit power plant, with the gearshift in the center and drive on the left, floating rear axle, a wheelbase of 122 in., three-quarter elliptic rear springs, and 34 by 4 tires. The motor, a standard Rutenber, block-cast, with 3⅛ by 5 dimensions is said to develop 46 hp. on the block.

Cooling is secured positively by a rather large pump, driven by shaft from the front gears. The Bosch magneto ignition is entirely separate from the starting and lighting system which is the Bijur two-unit design with the starting motor connecting by the Bendix shifting mechanism with teeth cut in the flywheel. Throwing on the starting current automatically meshes this Bendix transmission to give driving connection between starting motor and engine, and it is just as quick to release, once the engine is running under its own power.

In connection with the electric system a Willard 6-volt, 100-hr. battery is used, which is of such large capacity as to take care of the trying needs of the electric system adequately. Gasoline is supplied by a 15-gal. tank carried in the rear, from which the fuel is drawn to the carbureter by the Stewart vacuum system.

Throughout the chassis construction back of the motor, F. & S. ball bearings are fitted. The gearset is compact in form, and it as well as the multiple-disk clutch are well supported at the rear of the motor. Three speeds forward are supplied by the use of sturdy gears of 3½ per cent nickel steel.

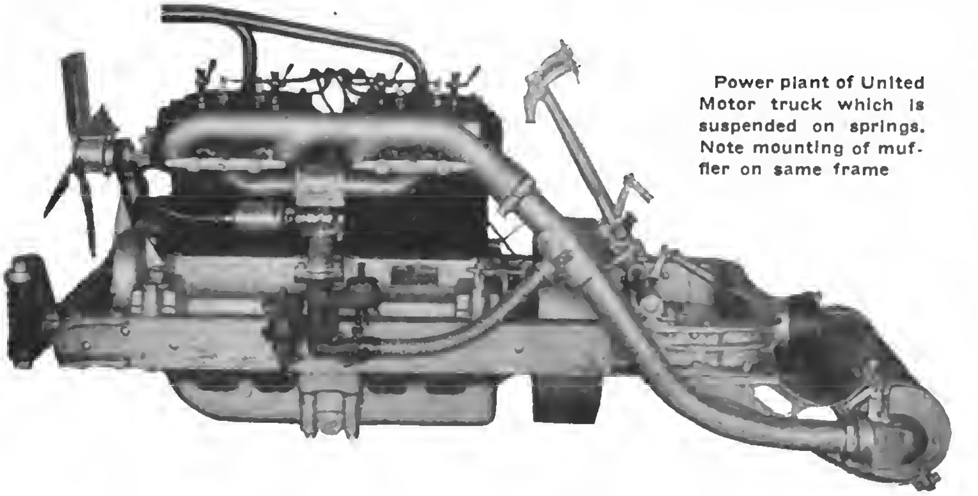
The drive from the motor unit to the rear axle is simplified by the employment of the Hotchkiss system of propulsion whereby both torque members and radius rods are eliminated by giving to the rear springs the added functions of drive and torque reception. The master leaf of each rear spring is made strong enough to do this efficiently, these leaves being 2 in. in width and almost flat.

New Trucks Show Progress

Some Late Models Announced in Past Few Months —Tractors Also Increasing Rapidly in Numbers

THREE new trucks have been brought out by the United States Motor Truck Co., Cincinnati. These are worm-driven models, which adhere to the design of the earlier chain-driven types in a great many ways. The capacities are 2, 3½ and 5 tons, with prices of $2,200, $2,850 and $3,600, respectively, which includes the chassis, driver's seat and standard equipment. The United States concern believes, as many other makers do, that the popularity of the worm-driven type of commercial vehicle is on the ascendancy, and, while it is the intention to make the chain-drive types as well, much attention has been and is to be put on the new models to meet varying conditions of service.

The engines used are of two sizes, of standard truck design. The 2-ton is fitted with a 4⅛ by 5¼, block-cast four-cylinder, L-head type, and the 3½ and 5-ton trucks have a 4½ by 5½ size, with cylinders in pairs. These rate at 27.25 hp. and 32.4 hp., respectively, and develop 40 and 47 hp. at 1500 r.p.m. They are made by Continental.



Power plant of United Motor truck which is suspended on springs. Note mounting of muffler on same frame

Other features include the Cotta type of gearset mounted amidships, this being a design in which the gears are always in mesh, with sliding clutches; Sheldon overhead-worm rear axle; semi-elliptic springs; and Hotchkiss type of drive through the springs.

Although not new to this make of truck, the method of mounting the motor and its allied accessories in a special subframe is none the less interesting. The motor itself is rigidly attached at four points to the subframe, but the latter is, in turn, carried in the main frame at three points to allow for frame weaving without putting any strain on the power unit.

The front end piece of the subframe has an arm extending out to the main frame, and the attachment is through a bracket riveted to the main member. Above and below this bracket is a coil spring that seats on the arm of the yoke end of the subframe member, a pin, running vertically through the yoke arms, the bracket and the coil springs, forming the union of the parts. Thus any vibration upward is taken by the lower coil, and downward vibration and weight through the upper. At the rear, a frame cross member cradles the center of the subframe in a 5-in. ball-and-socket support. This makes the rear of the engine free of the twisting movements of the frame, the front part being taken care of through the coil springs.

Frame Is Wood Filled

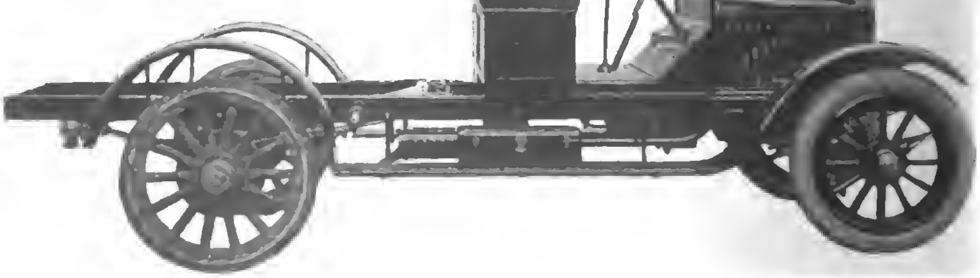
To further strengthen the subframe side rails, the channels are filled in with wood beams flush with the edges, affording a greater factor of safety against distortion at very little added cost or trouble in manufacture. Wood also plays a part in preventing overstraining of the subframe under severe motor twist either from dropping in the clutch suddenly or when the front wheel drops in a hole. Little hardwood bumpers are placed on the rear of the subframe and come in contact with the main frame when the twist gets beyond a certain limit, thus making the main frame assist in carrying the load.

The radiator is mounted in a steel cradle just inside the front frame member, suspended on springs to take care of vibration.

Another good feature which lends itself especially to assembly is the combining of the gasoline tank and control levers into one unit under the driving seat. That is, the brackets which support the tank also form the mountings of the levers and are put together before attachment to the truck frame.

Uses Hotchkiss Drive

The drive shaft between gearset and rear axle is of vanadium steel fitted with a universal at either end. These do not prevent it from being in correct line with the engine shaft except under frame distortion, however. Though unusual



Little Giant three-quarter ton truck which has pneumatic front tires and solids on the rear wheels in truck service, the United States Co. is having great success with the Hotchkiss type of drive, which eliminates any radius rods or torsion arms. The second leaf of each half-elliptic rear spring is made strong enough to take drive and torque, and it is the one that attaches to the frame. The top leaf acts as a rebound absorber, and has a tendency to hold the main leaf against buckling.

Sheldon supplies the over-head worm rear axles used on these trucks. These have substantial malleable housings, and the worm carrier bolts to the top, allowing for quick dismantling of the worm and wheel if necessary. There are also plates at front and rear of the worm carrier to give access to the adjustments of the bearings on either side of the worm. The design is such that there is a straight line drive when under rated load.

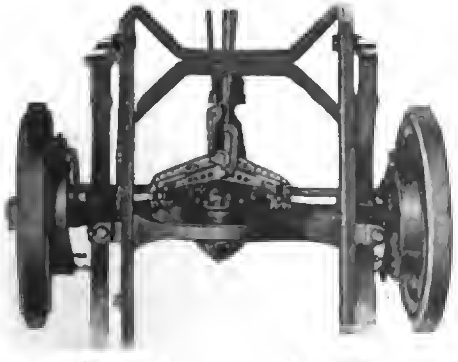
A clever method of equalizing the pull on the two brakes is employed. This is not new in these trucks, but it is worthy of special mention, in that a differential action is attained by the use of a bevel pinion and sector arrangement both on the service and emergency brake rods. A short cast-steel sleeve has an integral, toothed bevel sector. The sleeve carries the end of the shaft loosely, and is provided with a thrust arrangement. Keyed to the shaft is a second sector, so spaced as to match a bevel pinion which is carried on the upper portion of a lever that pivots loosely on the shaft between the sectors. This lever has the regular form of pull rod connection with the control up ahead, and on either end of the shaft assembly is a lever which connects to the brake on that side in the regular way. When force is applied to the brake, it acts upon the lever that carries the bevel pinion with sectors and shaft related, and this continues until resistance is effected by one or both brakes being engaged. But should resistance of one brake take place somewhat ahead of the other, motion through the bevel pinion is caused on the opposite sector until it is also engaged, when the differential movement ceases and equal force is applied to both brakes.

Three Menominee Models

Several features not found in ordinary motor truck construction are prominent in the Menominee, made by the D. F. Poyer Co., Menominee, Mich. Three models, one at $1,125, one at $1,575 and one at $2,240, make up this line, one of 1500-lb. capacity using the spiral bevel drive and the other two, of 2000-lb. and 4000-lb. capacity, employing the worm drive. One of the features is a new type of radiator support, which also acts as a shock absorber. This is a pneumatic device, which, together with the tie rod at the top constitutes a three-point suspension and guards against road shocks, vibrations and warping stresses. This pneumatic rubber sphere offers a cushion and acts as a pivot, incased to protect it against dirt. The headlights also are carried on this shock-absorbing bracket.

Menominee trucks have auxiliary springs, coiled and fitted with special brackets and plunger guides. These springs come into action when the main springs are about to be overtaxed. In addition to this function, the auxiliary springs displace the ordinary rubber bumper and do not allow the load to come in dead contact with the rear axle.

There is an automatic governor driven off the propeller shaft by a friction wheel in contact with the universal flange, acting on the intake manifold or through push rods.


Menominee brake balance gear


Menominee governor drive

All three models have Continental motors, Stromberg carbureters and Bosch magnetos. The Model E has a four-cylinder, 3¾ by 5-in. power plant, the Model FW, 1-ton, a four-cylinder, 3¾ by 5¼-in. and the Model D, 2-ton, a four-cylinder, 4⅛ by 5¼-in. In all models the motor is under the hood. The smallest type uses thermo-syphon cooling and the other two have gear-driven, centrifugal pumps.

The clutch is a Brown-Lipe, multiple-disk, in all three models. The transmission also is Brown-Lipe with three speeds. Timken roller bearings are used on the main shaft and Standard ball bearings on the countershaft. The steering gear is Gemmer, worm and gear type, and the drive is on the left. The rear axle on the Model E is a Timken floating. On the other two models, the Timken-David Brown worm type of rear axle is used.

Uses Radius Rods

The Menominee truck line has another feature not mentioned in the earlier part of this story, it being a tubular type of distance rods designed to relieve the springs of driving stresses. These distance rods are set at an angle so as to maintain uniform distance between the gearset and the rear axle regardless of spring action. This is said practically to eliminate all sliding action of the propeller shafts in the universal. These rods act on swivel attachments on a frame bracket and are provided with adjustments, making it possible to maintain the axle in alignment at all times.

The gear ratio of the Model E is 5 1/13 to 1, the Model FW, 8¾ to 1, and the 2-ton, 9¼ to 1. Semi-elliptic springs both front and rear are found on all models in addition to the auxiliary springs already mentioned. When the emergency is applied the service brake automatically comes in service.

The maximum speed of the Model E is given as 25 m.p.h., of the Model FW, 16 m.p.h., and of the Model D, 14 m.p.h., all these being controlled by the automatic governor. The wheelbases for the Model E, FW, and D are 124, 144 and 144 in. respectively. Tires are solid rubber demountable or pressed on. 34 by 3½ single front and rear on the Model E, 36 by 3½ front and 36 by 5 rear single on the Model FW, and 36 by 4 single front and 36 by 6 single or 36 by 4 dual rear on the Model D. The chassis equipment includes driver's seat, running boards, headlights, Prest-O-Lite tank, two dashlights, tools, and two front and two rear fenders. Special bodies are furnished at various prices for the different types of trucks. The trucks will be painted any color desired without extra charge when ordered with bodies, although the standard colors are yellow running gear and red body.

Gary Is Worm Drive

The Gary Motor Truck Co., Gary, Ind., has in its worm-driven truck line, four models, the Model E, being of 1500-lb. capacity, the Model F, 1-ton; the Model G, 1½-ton and the Model H, 2-ton. All models use four-cylinder, Buda motors, the smaller model having a bore of 3½ in. and a stroke of 5⅛ in., the next, 3¾ by 5⅛, the 1½-ton, 3¾ by 5½, and the 2-ton, 4¼ by 5½. The crankcase is aluminum and the valves are inclosed.

The ignition on all models is by Eisemann magneto, while the carbureter is a new type Stromberg. Lubrication is accomplished by the constant-level, splash system together with a pump. The gearset is of the selective type, offering three speeds forward and one reverse. The clutch is a multiple disk, having facing of Raybestos and running dry. The steel disks are hardened saw steel and all pins are hardened, this construction being designed to eliminate wear as much as possible.

The company advocates the use of the semi-floating type of worm-drive rear axle as against the full-floating for the reason that there are but fourteen parts to the former, whereas the latter has twenty, and thus it is argued that the former is more simple.

Goodyear, type S. V. solid tires are used on all models of the Gary, the ¼-ton using 36 by 3 in front and 36 by 3½, rear; the 1-ton, 36 by 3½ in front and 36 by 4, rear; the 1½-ton, 36 by 3½ in front and 36 by 5, rear; the 2-ton, 36 by 4 in front and 36 by 6 in the rear.

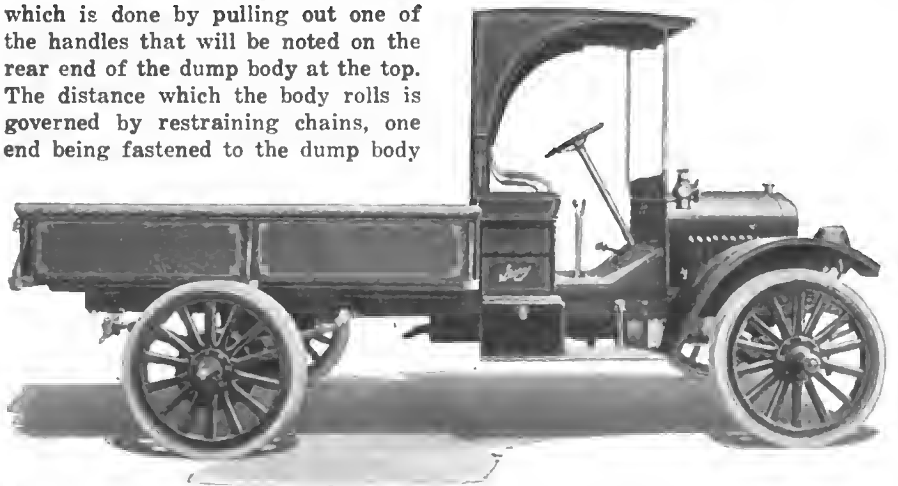
Springs are semi-elliptic, both front and rear and the steering gear is of the worm and split nut type, equipped with an 18-in. wheel on all models. Equipment consists of side oil lamps, tail lamp, horn, jack and tools. Regular express or stake bodies are furnished, although special styles to meet individual requirements are built to order.

These trucks are guaranteed for one year, from the date of delivery to the purchaser, this guarantee being limited to making good, at the factory, any part or parts, that are defective. The company stipulates, however, that the guarantee ceases on any truck on which the governor seals have been broken.

Jeffery Has New Tip Body

The Thos. B. Jeffery Co., Kenosha, Wis. has recently brought out a new two-way side dump hand operated body, to be applied to the Jeffery Quads. The body is secured in position by two catches, one in the front and one in the rear, and an eccentric stop on each side; as well as by three rails on which it rolls in dumping. Each of these rails slopes away from the center line of the chassis to each side and terminates in a hook which acts as one of the final pivoting points when the body is being dumped.

In performing the dumping operation the handle which will be noted in the brace just over the right rear wheel in the illustration is raised, thus releasing the eccentric stop at the upper end of this brace. When the handle is raised clear up this brace may be moved outward which leaves the body free to turn. Next the handle noted in the rear of the body is moved, the action releasing a catch at the top of the inverted V brace, just above the handle, and a similar catch in front to which it is connected by a longitudinal rod.



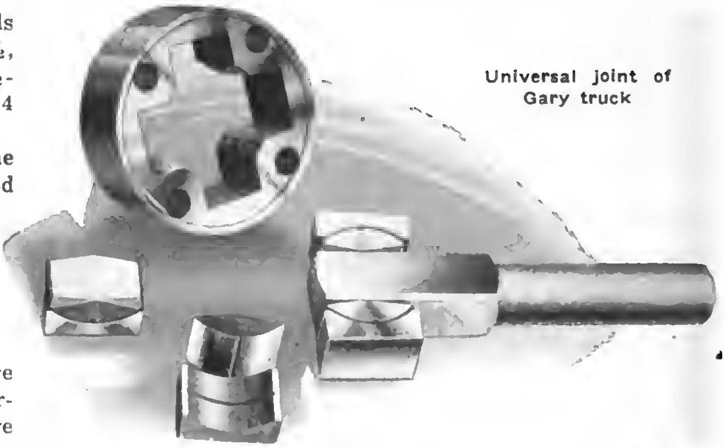
The Gary truck, a light type worm drive

The body now is ready to be dumped which is done by pulling out one of the handles that will be noted on the rear end of the dump body at the top. The distance which the body rolls is governed by restraining chains, one end being fastened to the dump body and the other to the bed of the truck. When empty, the dump body easily turns back into place.

In a series of tests at the Jeffery factory, it is said that an average driver could get down from his seat, dump the load, replace and secure the body and return to his seat in 30 sec.

Chase 1-Ton Worm Drive

The Chase Motor Truck Co., Syracuse, N. Y., has a new 1-ton worm-driven truck known as the model A and listing at $1,650, which employs a four-cylinder, L-head motor with a 3½-in. bore and a 5⅛-in. stroke. The carbureter is a Holley, and the ignition is by Bosch magneto. The gearset is a Brown-Lipe three speed, attached to the flywheel housing. The clutch is a dry-plate and the drive is through a David Brown worm in connection with a Sheldon rear axle.



Universal joint of Gary truck

The steering gear is of the worm and nut type and the wheelbase is 140 in. Front tires are 36 by 3½ single, solid Firestones, and the rear 36 by 5 single-solid. Springs are semi-elliptic front and rear. The tread is 56 in., and the weight on the rear axle is said to be 53 per cent. The fuel tank holds 18 gal., and the oil tank 1¾ gal. The loading space back of the driver's seat is 8½ ft.

Speed is regulated by an automatic governor entirely inclosed and sealed. Electric lighting and starting equipment and rear fenders are furnished but are not included in the price of $1,650. Where the cab and seats are not wanted, a reduction of $40 is made from the list price.

Little Giant Line Includes Light Worm Model

Another light truck with a worm rear axle is the Little Giant made by the Chicago Pneumatic Tool Co., Chicago. Two models, Nos. 15 and 16 of ¾- and 2-ton capacity respectively, have recently been added to the line, which also includes two chain driven models for loads of 1 ton and 1½ tons.

In general the chassis of the Little Giant is on conventional lines, the worm axles being Timken, with the Timken-David Brown worm. Both have Continental motors, the smaller 3½ by 5 in. and the larger 4⅛ by 5¼ in., each having Schebler carbureter, Eisemann magneto ignition and combination splash and force feed oiling, the pumps being of the plunger type driven from the camshaft. Speed is limited by governor to 15 m.p.h. on the large truck and 18½ on the smaller.

Special precautions have been taken to insure the strength of the frames, and the smaller details are all extremely robust in character.

On the smaller car the front tires are

pneumatic 34 by 4½ with single 34 by 3½ solid tires on the rear wheels, but the larger truck has 36 by 4 solid tires in front and dual 36 by 3½ at the rear. Equipment includes every necessary, the smaller car having a 50 amp.-hr. storage battery and lamps which can be used either with an electric bulb or with oil. The prices differ by $1,000 being $1,500 for the ¾-ton and $2,500 for the 2-ton.

Tip body on Jeffery Quad

Simplex Tractor Has Horizontal Motor

Designed to do the work of twelve horses, the Simplex tractor, made by the Simplex Tractor Co., Minneapolis, Minn., is equipped with a four-cylinder double opposed motor having cylinders with a bore of 5 in. and a stroke of 5 in. This motor is designed especially for tractor work developing 70 hp. at 750 r.p.m.

The master gear is of the internal type and is made in sections so that replacements are made easy if some of the teeth should become damaged. This gear attaches to and drives on the wheel rim. Self-lubricating steel pins are found in the master pinion, roller sleeves being substituted for the regulation teeth so that when the gears roll out of mesh friction is reduced. The intermediate gears are machine cut from solid steel and run in oil, which is also true of the transmission gears.

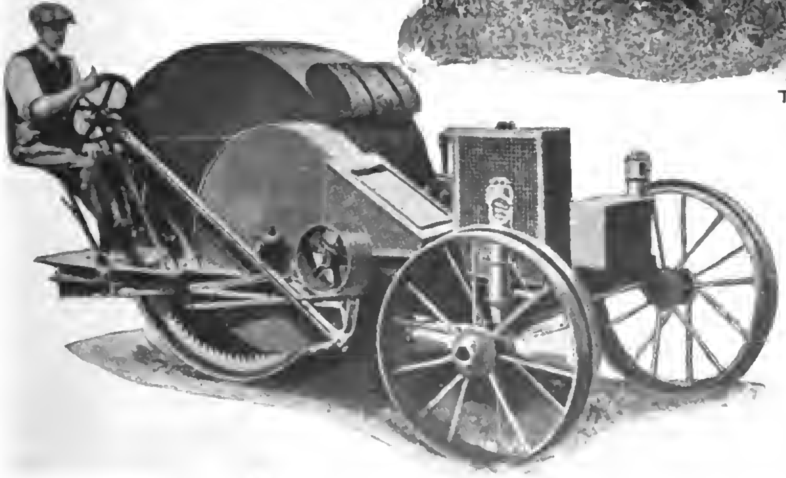
The transmission bearings are Hyatt rollers of the heavy duty type. A Kingston self-adjusting carbureter is used and also a Kingston magneto with impulse starter. Guiding is automatic when plowing, the right front wheel carrying a guiding rim which runs in the furrow and operates as a leader or guide.

On low gear the Simplex has a speed of 1.66 m.p.h., on high 2.32, and on reverse the same as on low gear. The clutch is an expanding two-shoe type lined with asbestos. A cellular radiator together with a 20-in. fan and centrifugal pump furnishes the cooling. The wheelbase is 90 in., and the length over all 12 ft. The turning radius is 17 ft., the weight is 5500 lb., and the price completely equipped for traction or belt work $825. The belt pulley measures 9¾ in. face.

Nilson Tractor Pulls Four Plows

In the Nilson farm machine, made by the Nilson Farm Machine Co., Minneapolis, Minn., and **listing at $1,485, f.o.b. the factory at Waukesha, Wis., one finds a tractor of unusual power, linked with light weight and flexibility. Control is simple, being like that of a truck. It is sold under a guarantee, covering the motor for one year, during which any part or parts of the motor that, under normal use, wear out or show defects will be replaced free of charge. The tractor is guaranteed, if maintained in proper order and operated by a thoroughly competent person, to pull four 14-in. breaking plows, 5 to 7 in. deep in sod or 7 to 9 in. deep in stubble soil; to haul a load of 7 to 8 tons on good roads; to operate a 30-in. separator and equipment, and other stationary equipment for farm work of a similar nature requiring equivalent power, such as seeders, drills, harrows, harvester and ensilage cutters.**

The Nilson farm tractor



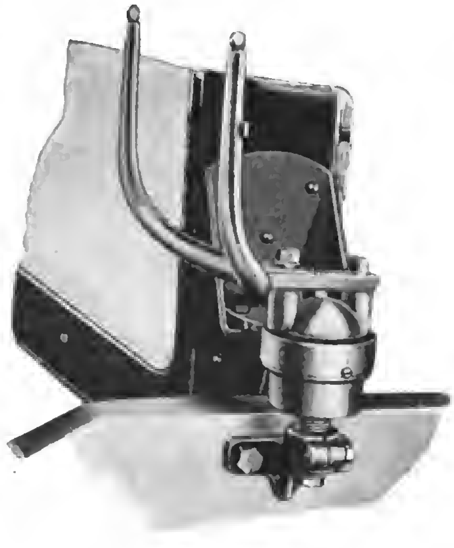
Simplex tractor costing $825

A Waukesha motor is used, having a bore and stroke of 4¾ by 6¾ in., cooled by centrifugal pump, and Perfex radiator, together with a fan. The speed of the engine is regulated by a governor which is adjustable, self-lubricating and non-heating. The engine is rated at 50 to 55 hp. and gives a drawbar pull of 25 hp., while the belt power pull at 800 r.p.m. is 35 hp. The engine is fitted with a Kingston carbureter, although a special combination kerosene and gasoline carbureter is furnished at an extra price. Ignition is by magneto together with a K-W impulse starter.

The gearset runs in oil, being incased in a heavy cast iron, oil- and dust-proof housing. Two speeds forward and one reverse are offered. The speed in **low is approximately 2½ m.p.h. at 800 r.p.m. of the** motor, while the same motor speed gives 6 m.p.h. in high, although both the high and low speeds can be raised or lowered at the option of the driver. Adjustments are possible in the clutch transmission bearings and driving chains to take up wear.

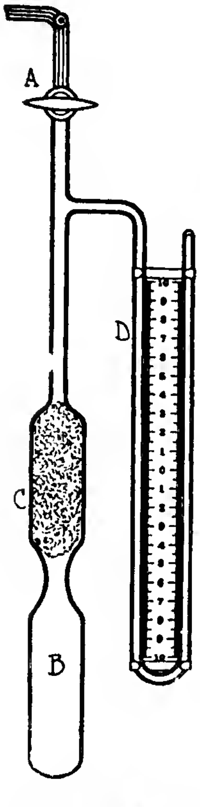
The engine and gearset are each mounted separately on the frame by three-point suspension, and are connected by a universal. Power is delivered to the bull wheel through double chains. The front springs are semi-elliptic and the rear springs are coiled with a special adjustment and equalizing feature. The steering gear is of the worm and sector type and is in an oil-proof case. The weight is approximately 5200 lb. exclusive of extension wheels. These extension wheels just mentioned are 52 in. in diameter and 9 in. wide, and when not ordered included with the tractor a reduction in price is $47.50 for the wheels and $7.50 for one shaft pulley.

The length over all is 13 ft. 9 in. The tread of the front wheels is 6 ft. 8 in. and the extreme width, 7 ft. 5 in. The height is 5 ft. 9 in., the wheelbase is 8 ft. 4 in., and the turning circle of radius 34 ft. The front wheels are 36 in. in diameter, and the traction or driving wheel 52 in. in diameter with a 23-in. base.


Menominee radiator mounting

Inflammability of Gasoline Vapor

UNDER the file number of technical paper 115, Petroleum Technology 26, the Department of the Interior Bureau of Mines recently issued a booklet entitled Inflammability of Mixtures of Gasoline Vapor and Air, prepared by G. A. Burrell and H. T. Boyd. It presents some valuable data on safety and efficiency in the use of fuels dealing specifically with the inflammable limits of mixtures of gasoline vapor and air and also the method of determining the content of gasoline vapor in such mixtures. These matters are of particular importance in the internal combustion engine and also in ascertaining the risks involved in the storage and use of the volatile hydrocarbon.



The detailed methods of carrying out the experiments can be obtained by applying to the Bureau of Mines, Washington, D. C., for a copy of the bulletin. The general results arrived at are first, a definite method of determining the gasoline vapor in gaseous mixtures and secondly, the limits of inflammability.

The method of determining gasoline vapor in gaseous mixtures is as follows: An apparatus similar to that illustrated is employed. The bulb C contains phosphorous pentoxide for removing water vapor. If the latter were not removed it would also be retained at low temperatures and would subsequently exert pressure when measurement was being made of the pressure exerted by the gasoline vapor.

To start a determination the apparatus is connected to a vacuum pump and its air exhausted. The mixture of gasoline vapor and air is then introduced at atmospheric pressure, the barometer is read, and the two bulbs are immersed in liquid air contained in a Dewar flask. After about 10 min. the air is removed from the apparatus with a vacuum pump. The stopcock on the apparatus is then closed, the liquid air removed, the gasoline allowed to vaporize, and its pressure read on the mercury manometer attached to the apparatus. The ratio of this pressure to the pressure of the atmosphere gives the percentage of gasoline vapor originally in the air.

The tests for the range of explosion were made in a Hempel explosion pipette. Combustion was deemed complete when upon ignition of the mixture, flame filled the vessel as far as could be judged by eye. Measuring the percentage of gasoline vapor in the mixture it was found that no visible results were obtained until somewhere between 1.9 and 2 per cent gasoline vapor. At 1.9 per cent there was no visible result, at 2 per cent there was complete inflammation. Experiments showed that complete inflammation resulted up to as high as 6 per cent after which only incomplete inflammation resulted.

Another set of experiments brought the figure at the lower limit down to 1.5 per cent gasoline vapor. This was for gasoline of 73 deg. Baume. A new set of experiments was made to determine if the low limit for 73 gasoline was different from that of what is known as cleaners' naptha which has a Baume rating of 59 or 60. It was found that complete inflammation started between 1.4 and 1.5 per cent gasoline vapor. Roughly, it may be stated therefore, that a mixture is explosive between the ranges of 1.4 and 6.4 per cent gasoline vapor as far as complete combustion is concerned.

Suit on Fire Policies

In Massachusetts it was recently decided that misdescriptions in applications for fire insurance on automobiles do not necessarily void the policies. Two actions were tried together on three polices of insurance. One policy had been issued in the sum of $1,500 by the Royal Insurance Co. on a Fiat automobile, and the other two had been issued in the sums of $1,800 and $650 respectively, on two Hotchkiss cars by the Columbian Insurance Co.

After the issuance of the policies all three cars were destroyed by fire. When the losses were not paid, suit was brought on the policies and the companies alleged that there had been a misdescription in the year model of the cars in the applications for the policies, though they conceded that the descriptions had been correct as regards the factory numbers of the cars, the types of body, the number of cylinders, the horsepower, etc.

The insurance companies further said that the Fiat car was a 1907 model, and the Hotchkiss cars were 1906 models. An expert who was put on the stand as a witness testified that the cars were all 1908 models; but that did not mean necessarily that they had been manufactured in 1908, as foreign manufacturers did not make yearly models as American manufacturers were accustomed to do, and at that time European cars were designated as 1905-1906, 1906-1907 models of each make.

The court decided therefore that the contract had taken effect, and as neither of the companies had been in the habit of charging greater premiums for 1907 cars than they did for 1908 cars the misdescription was immaterial and the insured was allowed to recover on the policies.—*Locke vs. Royal Ins. Co. and Locke vs. Columbian Ins. Co.*, 107 *Northeastern* (*Massachusetts*) 911.

Trying Direct Fuel Spray

A French Attempt to Use Kerosene By Spraying Into the Cylinders Proved Promising

By W. F. Bradley

SHORTLY before the war some very interesting experiments were carried out in France on a Bellem and Bregeras kerosene or crude oil motor, adapted to a passenger car. This motor has been in use for a certain time in France for big stationary and boat motors. One of the leading French engineering firms has adopted it for kerosene motors to be used as auxiliaries aboard French battleships; it is strictly forbidden to have any gasoline aboard these ships. Certain features of the invention appeared to be prejudicial to the adoption of this motor to private cars and commercial vehicles. The inventor recognized this and modified his design in consequence. For demonstration purposes he converted a Ford motor to his system and ran it on kerosene, starting from cold with no more difficulty than with gasoline. The experiments are one day to be continued with crude oil as fuel, no change whatever being made in the mechanism. To burn crude oil the motor must first be started on kerosene, and as soon as warmed up the crude oil turned on.

Spray Caused by Vacuum

The essential feature of the Bellem system is the spraying of fuel into the cylinder when a partial vacuum has been formed. For this purpose the intake valve is held down during a considerable portion of the induction stroke. During this time the fuel is very finely sprayed into the cylinder, a very small quantity of air being admitted at the same time. By reason of the partial vacuum the fuel is completely vaporized, the cold mist thus formed being as fine as the vapors obtained by heating kerosene. When the mixture is formed, it is diluted with pure air through the ordinary intake valve of the motor. This valve has a rapid opening and does not close until 45 deg. after lower dead center. Compression, firing and exhaust strokes are the same as on any ordinary four-cycle motor.

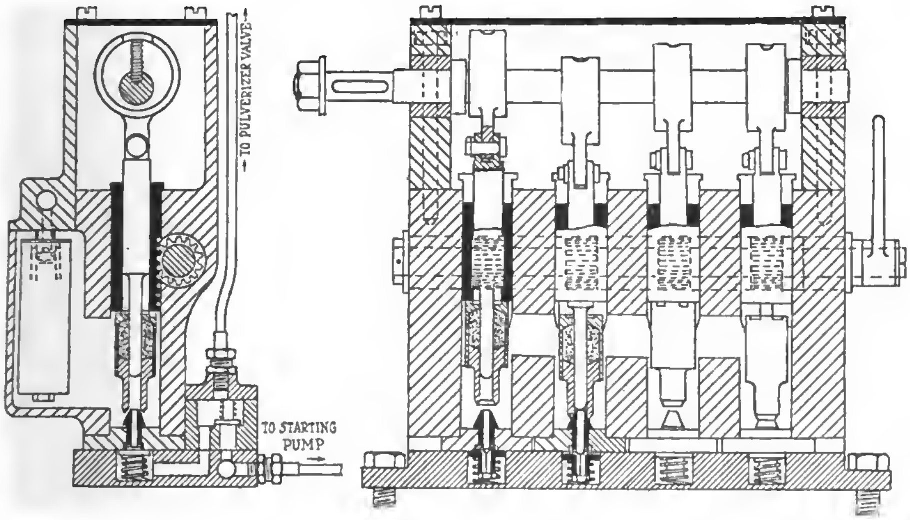


Fig. 2—Fuel pumps of Bellem and Bregeras motor

In the conversion, the Ford was fitted with a new camshaft, on which the intake cams provided for an opening 45 deg. before lower dead center and a closing 45 deg. after lower dead center. The exhaust cam was not changed. A vaporizer valve was mounted in the head of each cylinder by the side of the spark plug. In place of the carbureter, which was completely discarded, there was a metal box about the size of a magneto, within which an eccentric shaft drove the four pump plungers. This shaft operated at half engine speed by means of a chain from the front end of the crankshaft to a countershaft mounted in brackets from the frame member, and by a short chain from the countershaft. Connected up to the intake ports was a pure air manifold. This is nothing more than a brass tube with its ends closed, having a number of slots cut on its circumference. There was a sleeve within the tube capable of a sufficient movement completely to cover or uncover the intake ports, thus varying the amount of air admitted to the cylinders.

The action of the injector is as follows: the pulverizer valve is automatic in action, the fuel arriving through *E*, Fig. 1. On the valve being opened by aspiration, *A* is uncovered, and fuel is sprayed through *B* and *C*. On leaving *C*, it comes in contact with the air, having passed down the valve stem and entered the combustion chamber by *D*. The quantity of fuel sprayed is definitely determined by the pump, and is controllable while the motor is in operation by means of a lever brought up to the steering wheel.

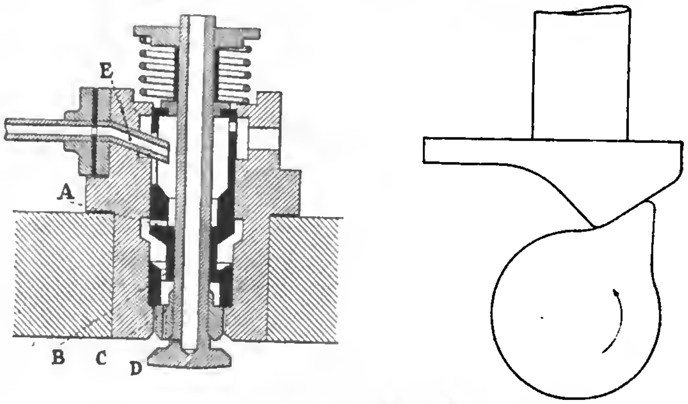


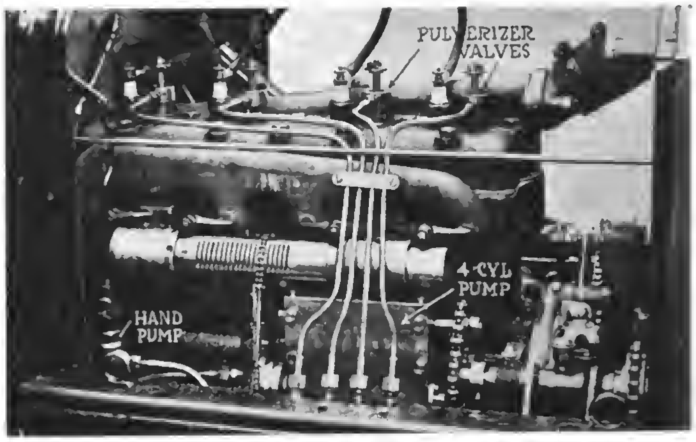
Fig. 1—Details of fuel valve and profile of intake cam

Control Is Effective

The ability to vary the quantity of fuel while the motor is in motion is the most important feature of the pump. The latest type of pump tried is shown in Fig. 2. A constant level is maintained by the usual expedient of a float. The piston, operated by an eccentric, has a prolongation which forms the plunger and passes into the pump cylinder through a stuffing box composed of compressed cork. This material was found to give excellent service. The end of the pump cylinder is conical and abuts against the pump cylinder. It will be seen that the guide can be moved up and down by means of a rack and pinion arrangement, the control for this being brought up to the steering wheel and taking the place of the usual throttle lever.

If the guide is raised by the operation of the steering wheel lever, a certain amount of space will be obtained between the bottom of the guide and the top of the stuffing box. On the upstroke of the plunger, the pump cylinder will first of all be carried along with it by reason of the adhesion of the cork. When the stuffing box abuts against the bottom of the guide, its movement is arrested and during the remainder of the stroke the plunger is moving alone, and drawing in fuel.

It is possible to raise the guide until the play between its extremity and the top of the stuffing box is equal to the stroke of the piston, in which case the cylinder moves up and down with the piston without drawing in or driving out any fuel. Very fine adjustment is obtainable between the guide and the stuffing box, thus giving very minute variations in the amount of fuel fed to the pulverizer valve. On the downstroke of the piston the conical joint is closed and the fuel is forced through the check valve to the pulverizer valve.



Ford motor converted to kerosene system

For starting up there is a small hand pump with control brought through the radiator, as in the case of a carbureter tickler. This allows fuel to be delivered direct to the pulverizer valves.

S. A. E. Appoints New Chairman of Standards Committee

AT the meeting of Council held in Chicago, Jan. 28, A. Ludlow Clayden (Engineering editor of THE AUTOMOBILE) was appointed chairman of the standards committee of the society. Mr. Clayden has been chairman of the foreign co-operation division of the standards committee since its creation early last year.

The resignation of Mr. K. W. Zimmerschied, who has been a most active and able chairman of the standards committee for the past year, was accepted with the deepest regret. Mr. Zimmerschied found that his work as metallurgical expert to the General Motors Co. was growing to such an extent that he could not give the time necessary to the increasing activities of the standardization work.

A. Ludlow Clayden

There is no member of the society who will not regret Mr. Zimmerschied's inability to continue the work which he has handled in so masterly a way; proving a very worthy successor to Henry Souther who was the first chairman of the standards committee, and largely the creator of the standards idea.

Mr. Clayden, who now succeeds Mr. Zimmerschied, was born in England in 1883. His training from the earliest commencement of his education was scientific and mechanical, being completed in the engineering department of Bristol University, England. His business existence commenced in garage and repair work, followed by several factory appointments in Coventry where he gained experience in the early development of both passenger cars and commercial vehicles.

In 1908 he turned to automobile journalism, joining the staff of the publishers of the principal British trade papers, notably *The Autocar*, and two years later founded *The Automobile Engineer.*

In 1911 he made his first visit to this country, and took part in the S. A. E. convention at Dayton, Ohio, that summer, being so impressed with what he heard there and, subsequently, saw in the manufacturing centers, that he set about to organize the visit which representatives of the British Institution of Automobile Engineers paid to the S. A. E. in 1913.

In 1914 he returned to America, and shortly afterwards became connected with the Class Journal Co. in the position which he now holds. He has read several papers before the society, of which he has been a member for six years.

Gasoline High in England

In commenting upon the price of gasoline *The Motor* (England) accuses distillers and importers alike of playing a game entirely to their own ends. In a recent editorial their opinion was expressed as follows:

"We understand that the big importers of motor spirit—other than one company which has not adopted the most recent and otherwise concerted advance of 2 cents per gallon—consider that they have been obliged, by force of circumstances, to follow the course which they have taken. It is represented to us, for example, on behalf of these acting-in-concert importers, that government demands have of late grown to such huge dimensions that it has become almost a matter of kind-heartedness on their part for them to keep up supplies to private car owners, to say nothing of prices.

"We are well aware that the demands of the Mechanical transport columns and units of the army service corps (inclusive of the motor ambulance branch) account for a monthly demand which, while a fluctuating one, is at all times large. We have reason to attach still greater importance to the volume of the demand by the admiralty in connection with the motor-boat patrol.

"We do not see eye-to-eye with price apologists concerning the high rates of freights which rule. It seems to us that the importers of motor spirit are also 'in clover' here, seeing that the freights are to a great extent merely paid out of one pocket into another, having regard to the community of interest which exists in the case of each of the two largest importing companies, between their motor spirit branches and their shipping branches. The net profits promise to be thoroughly well maintained."

The Rostrum

Short Circuit in Ignition Wiring

EDITOR THE AUTOMOBILE:—I have a model 42, 1915 Oldsmobile and at times, turning on the lights stops the engine. Then again, it will be running along all right and the engine stops. Other times, it will run all right for days. I have examined all the wiring and can find nothing loose or dirty or short-circuited. I had the Stewart vacuum gasoline system put on the car and thought perhaps when the engine stopped it was not feeding properly, but on examination, found plenty of gasoline. What do you think is the cause for this and can you give me a remedy?

2—How can I properly install an ammeter on this car?

South Bend, Ind. L. C. M.

—This trouble may either be caused by a poor connection on the ignition system or by a swinging ground somewhere on the circuit that causes the circuit-breaker to trip. It is suggested that you inspect the system and see if the lights go out when the ignition stops. You can test this by trying it on the battery ignition with the lights on.

It is possible that there might be a broken valve spring in the valve leading to the intake manifold on the vacuum system. If this valve spring were broken, occasionally a supply of raw gas would be drawn directly into the intake manifold. This would kill the motor although the gasoline supply in the carbureter would not be seriously affected by the broken spring.

2—In installing an ammeter on this car the instrument should be mounted at a convenient place on the dash and the wire running from the No. 1 post on the switch should be cut and the cut ends of the wire connected to each of the connecting posts on the ammeter.

Connecting Ammeter on 1914 Richmond

Editor THE AUTOMOBILE:—Please give me a drawing for connecting an ammeter to a 1914 Richmond car with Kingston electrical equipment.

Baltic, Ohio. P. S. G.

—The method of attaching an ammeter on a 1914 Richmond car with Kingston equipment is given in Fig. 1. The sketch shows the ammeter connected on the ignition wiring only. It would be operative only when the engine was running on the dry cells and would show the amount of current being drawn from the cells. Fig. 1 also shows a wiring diagram of the Jesco starting and lighting system made by the Jones Electric Starter Co., Chicago, Ill. It is this system which is used for the lighting and starting while the Kingston system is used for ignition. On this system the proper place to put the ammeter would be between the generator and the storage battery, as indicated.

Who Invented the Cord Tire?

Editor THE AUTOMOBILE:—In your article in the November 25 issue of THE AUTOMOBILE on the tire industry and its development in the United States, you make the statement that the Silvertown cord tire is the invention of John Palmer. This is incorrect as it was invented by Thomas Sloper, an Englishman, and the erroneous impression that it is John Palmer's invention springs, no doubt, from the fact that the company in London, England, with whom Mr. Sloper is connected, is known as the Palmer Tyre Co. This concern, although it derived its name, in the early days of the pedal bicycle, from the Palmer cycle tire fabric, owes nothing to John Palmer for the invention and development of the automobile tire made and sold in England and other European countries and known as the Palmer cord tyre which is the parent of the Goodrich Silvertown cord tire now so famous in the United States. That distinction belongs entirely to Thomas Sloper and I think it is due to him that the correction be made.

Akron, Ohio. A. E. C.

—A copy of this letter was submitted to John Palmer who replied as follows:

Editor THE AUTOMOBILE:—I have yours of the 10th inst. and welcome the opportunity for publishing a clear statement of the invention and development of the so-called cord tires, using the phrase as marking in the public mind a type of pneumatic tire in which the carcass consists of two or more independent unconnected layers of cord, insulated from each other by rubber with alternate layers laid at opposing angles without interweaving or other bond as between the two layers and with no consideration given to methods of attaching this structure to the wheel, to processes of manufacture or machinery therefor.

This is the tire as invented by me in 1892, patented in the United States and England in 1893. These English patents

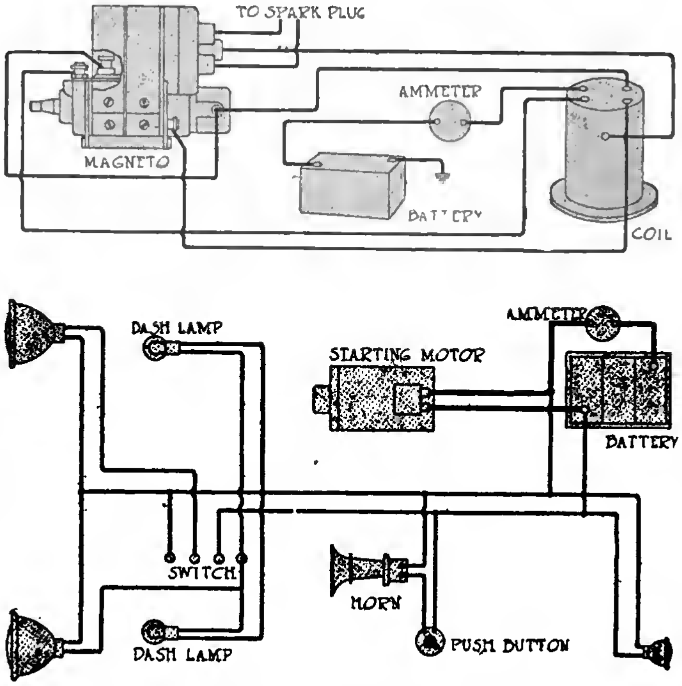


Fig. 1—Wiring diagrams showing connections of ammeters on circuits of the 1914 Richmond. This car has two independent sets of wiring, the Kingston system being used for ignition and the Jesco system for lighting and starting. The upper diagram is for ignition and the lower for lighting and starting

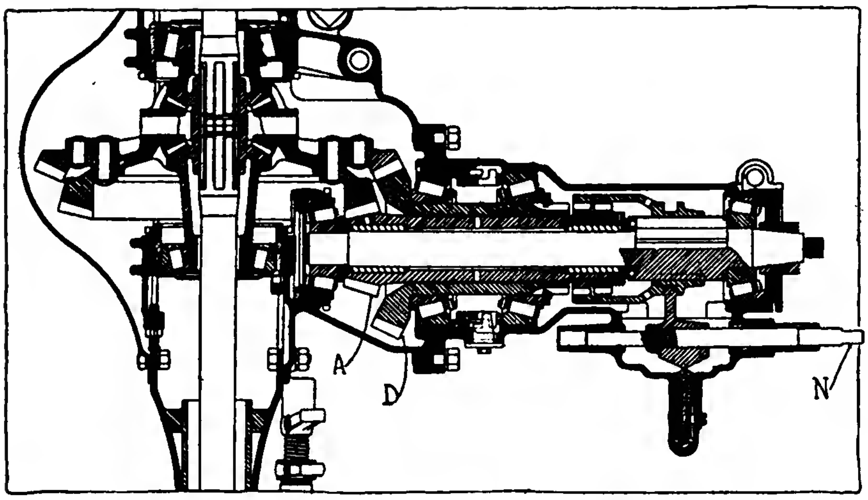


Fig. 2—Sectional view of the Cadillac two-speed rear axle.

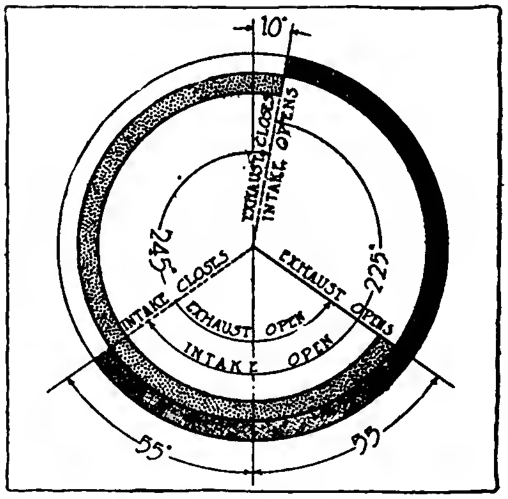


Fig. 3—Timing diagram of Stutz-Wisconsin racing motor

were sold in 1893 to the Palmer Tyre Limited of England, among the stockholders of which was the India Rubber, Gutta Percha and Telegraph Works Co., Ltd., of Silvertown, England, who manufactured the tires.

Thomas Sloper was an employee of this company in the capacity of experimental engineer and as such had much to do with the invention of the processes, devices and machinery that marked the development of the Palmer "cord" tire in England from its original form as a bicycle tire, both of single and double tube type, to what as made to-day for automobiles. I would here point out, however, that in principle and function, the only difference between the original tire and the tire of to-day is one of degree and not of kind.

The first patents covering the broad idea of the tire expired some years ago, and the Sloper patents referred to by your correspondent cover details of construction and machinery as used by the English company.

Concerning the U. S. patents of the original Palmer cord tire, they were purchased by the B. F. Goodrich Co., in 1898. After manufacturing the tire under license and for the Palmer Pneumatic Tire Co., from the beginning, they have manufactured the first Palmer cord tire made, as well as those tires that, carried by me to England in 1893, were used to annex all bicycle racing records from ¼ mile to 24 hr., enabling me to organize a company and sell the patents as previously indicated.

The foregoing is a brief, though accurate statement of the invention and history of the Palmer cord tire. It is not intended to deny credit to Mr. Sloper for anything he did. Much of modern practice and machinery as used by the B. F. Goodrich Co. in the manufacture of the Silvertown tire, is largely his work, as is evidenced by the United States patents, reference marks of which are molded on the tires; they also manufacture the original Palmer tire for bicycles, the first tire made of cord, each cord insulated by rubber and successive layers insulated from each other. In principle, functioning and efficiency, identical with the cord tire of to-day, differing only in those details made necessary by the heavier duty to be performed.

Riverside, Ill. J. F. Palmer.

Jet Velocity Has Indefinite Ratio

Editor The Automobile:—Will you kindly give me what information you can on the following:

Given—the bore, stroke, revolutions per minute for four or more points of an engine, the diameter of intake manifold on the carbureter—

To find—the diameter of jet, area of primary air passing by jet, amount of gas drawn out of jet by air with given velocity; the velocity of air passing jet. If venturi tube is used for primary air which increases velocity of air at jet 2:1 how much more gas drawn out—

To find—is amount of gas drawn out proportional to velocity of air past jet? If so, what constant is used?

U. of M. Ann Arbor, Mich. F. B. A. McD.

—Although from the data supplied the volume and velocity of the primary air can readily be determined theoretically, no practical calculation can be made due to the variation in volumetric efficiency of the motor and also due to the influence of the shape of the venturi and the shape of the jet. The results of practice are those obtained more by experimentation than by calculation. The amount of gasoline drawn through the jet does not bear a constant ratio to the velocity of air past the jet.

Two-Speed Axle Provided Two Ratios

Editor The Automobile:—Please explain the two-speed rear axle used on the Cadillac or any other car. Was it not a good thing? How much weight would it add to 20- or 25-hp. engine? Could it be applied to a Ford? Is it being used now and giving good satisfaction? Is it very expensive to build?

Fort Kent, Me. J. O. M.

—A diagram of the Cadillac two-speed rear axle as used on the stock models in 1915 is shown in Fig. 2. As a study of the axle will disclose, there were two sets of pinion and crown gear units, one pinion being at *D* and the other at *A*. Either of these could be thrown into engagement by means of the sliding jaw-clutch mechanism operated through the rod *N*.

Regarding whether or not it was a good appliance for the car is a matter of personal opinion, but it is greatly to be doubted if its use would be recommended on a small car such as the Ford. There is only one car at present using the two-speed rear axle and that is the Austin on which it is giving good satisfaction.

The expense of building would depend entirely on the quantity of production. If turned out in large quantities it would not be expensive, but for a few individual jobs it would be. The two-speed rear axle is covered very thoroughly by patents owned by the Austin company.

Timing of High-Speed Racing Motors

Editor The Automobile:—Please furnish us information on the timing of the high-speed motors such as the Stutz-Wisconsin, Peugeot, Mercer, Duesenberg and Maxwell.

Harrisburg, Pa. H. E. G.

—The timing on some of the motors you mention is kept a secret. On the Duesenberg motor the timing is as follows:

Exhaust valve opens 46 deg. before bottom dead center.
Exhaust valve closes 8 deg. after top center.
Intake opens 4 deg. after top center.
Intake closes 42 deg. after bottom center.
This is for the eight-valve motor.

On the racing Maxwell the intake opens at top dead center and closes 32 deg. past lower dead center. The exhaust opens 69 deg. before lower center and closes 13 deg. 45 min. after top dead center.

The timing of the Stutz-Wisconsin motor type JR 5 1/10 by 5½ is shown in the diagram given in Fig. 3.

Removing Clutch Spring of 1912 Westcott

Editor THE AUTOMOBILE:—Will you kindly show and explain by drawing how I could remove a clutch spring on a 1912 Westcott car, model R. The clutch has been slipping for some time, especially when I accelerate the motor while running on high speed. The leather was removed last spring and kept in good condition and I feel certain the difficulty is in a weak spring.

Buffalo, N. Y. K. J. S.

—To remove the clutch spring it is first necessary to remove the front universal joint and also the clutch cone sleeve. Then, by loosening the lock nut on the spindle or the shaft that goes through the clutch spring, access will be had to the large retaining nut that is also on the spindle of the shaft and controls the tension of the spring. By backing this large retaining nut off, the spring will gradually loosen.

It will be necessary to exercise a little care in this operation, as it is quite likely that due to the tension on the spring it might fly off and result in injury to the mechanic. When once the spring is removed, it is an easy matter to accomplish the taking out of the clutch proper.

The trouble you are having might very well be taken care of by simply increasing the tension on the spring through tightening the large retaining nut. It might also be well to note that the Westcott company figures the length of the clutch spring when compressed to be 2¼ in. from the inside flange of the clutch. This, of course, is measured less the distance of the face of the clutch outside of the edge of the flywheel.

Installing Dry Batteries on Detroiter 1914

Editor THE AUTOMOBILE:—I have a Detroiter, 1914 model, with an electric starter, but want to put dry cell batteries on for starting. Kindly give me a descriptive picture of the wiring and the necessary equipment needed for this job? Would like to take the starter off as it is always out of order.

Guilford, Mo. J. E. B.

—For your guidance in taking care of the electric system on your Detroiter, 1914 model, it is recommended that you secure a Remy instruction book from the Detroiter company.

It will not be necessary for you to make many changes in applying the set of dry batteries to the system. There is an extra pole on the ignition switch which takes care of the wiring of dry batteries. The system employed is low-tension and the circuit is opened by the use of the relay. As soon as the current is built up by the generator the relay is closed and the ignition is no longer taken from the battery but directly from the generator.

It is not evident why dry batteries should be installed, as it is hardly possible that the storage battery becomes so low that it cannot be used for ignition.

Switches Had No Idle Position

Editor THE AUTOMOBILE:—Why is the positive shunt lead carried all the way to the battery instead of grounded on the Bijur system on 1915 Scripps-Booth?

Newark, N. J. R. J.

—The wiring diagram for the Scripps-Booth is shown in Fig. 4—below—for all cars numbered from 1 to 1100, while above is shown the wiring diagram for cars numbered above 1100.

Referring to Fig. 4—below—the shunt lead is carried to the positive battery terminal instead of being grounded direct, so that removing the storage battery opens the shunt field circuit of the motor generator, which prevents any damage to this machine in case the gas motor is operated without the battery.

The starting switch, above, Fig. 4, has three positions, On, Off and Idle, and the field circuit of the motor generator is broken through this switch when the switch is moved to the Idle position, which would be the normal operating position when running the car without the storage battery.

Switches on cars from 1 to 1100 inclusive were not provided with the Idle position, hence the necessity of carrying the shunt field lead back to the positive of the storage battery.

Specific Gravity of Battery Electrolyte

Editor THE AUTOMOBILE:—If the specific gravity of the electrolyte in a storage battery has a reading of 1.250 at a temperature of 70 deg. Fahr., what should the reading be at a temperature of 60 deg., 50 deg. or 20 deg., assuming that the battery is in the same condition?

Stroudsburg, Pa. M. F. H.

—If the electrolyte has a specific gravity of 1.250 at 70 deg. Fahr. the reading will be 1.254 at 60 deg., 1.258 at 50 deg. and 1.270 at 20 deg. There is a variation of 0.0004 for each degree of temperature.

Outer Wheel Exerts Driving Power

Editor THE AUTOMOBILE:—How is the power divided on the rear wheels of an automobile going around turns at right angles? Is the power equal on both wheels or is there more on one wheel than on the other?

Lorain, Ohio. W. GEM.

—In turning a curve at right angles the power is exerted by the outside wheel while the inside wheel simply acts as a pivot point.

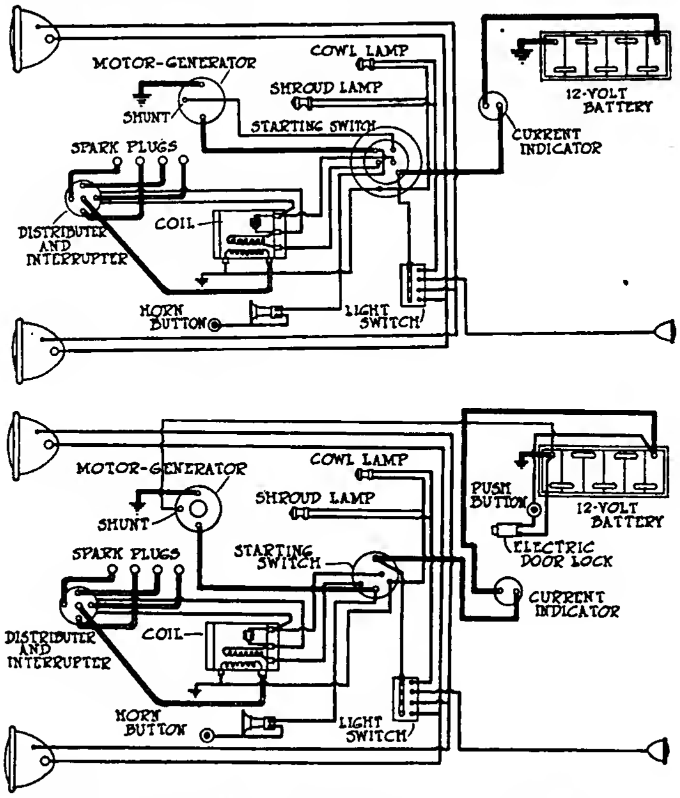


Fig. 4—Wiring diagram of Scripps-Booth cars. Upper for cars above No. 1100 and below from 1 to 1100

The FORVM

CHAS. E. DURYEA DISCUSSES POINTS IN STEERING GEAR LAYOUT—THINKS TILTED PIVOT IS A REAL ADVANTAGE—CASTOR ACTION IMPORTANT

Improving the Car's Steering

By Chas. E. Duryea

PHILADELPHIA, PA.—Editor THE AUTOMOBILE:—I trust A. L. Clayden will permit me to call attention to some errors in his article on steering in THE AUTOMOBILE for Sept. 2. This subject has been badly neglected by makers and yet is of vital importance to drivers if we may believe the published reports of accidents due to the steering going wrong. Good steerings can be had so easily and, as Mr. Clayden says, are so superior that any one who has had one will not be satisfied with any other.

With regard to Fig. 1, Mr. Clayden leaves the reader with the impression that faulty steering angles may cause the rear wheels to skid; or one of them to do so. This seems incorrect. The rears act just as the wheels of a hand cart and no manipulation of the front end of a hand cart will cause the rears to skid unless it be swung bodily to one side, a condition that cannot exist if one front wheel still rolls, as he rightly says it will. In other words the angle error of the front wheels gives rise to a powerful force parallel to the front axle but so nearly equal on both front wheels that the effect on the rears is negligible and skidding of the rears would not relieve the fronts for it would not change their angles.

Proper Castor Effect

The most important part about steering is the proper castor effect. The best steerings get the pivot line into the wheel contact line or near to it and so force the pivot to take the thrust and thus relieve the steering parts and the operator. Steering would be much safer if all cars were thus equipped and we should keep hammering at the matter till they are. While inclining the wheels outward is not the proper solution, as Mr. Clayden correctly points out, it is so much better than nothing that it is advised next to the proper arrangement. A trial will demonstrate this in spite of Mr. Clayden's mathematical demonstration.

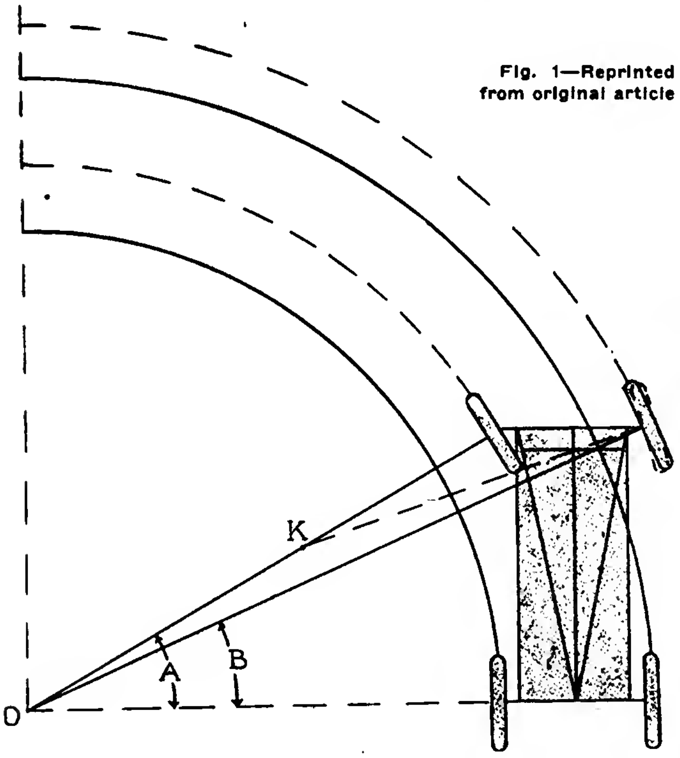


Fig. 1—Reprinted from original article

If the Tie Rod Breaks

He seems to be wrong in assuming that the driving thrust is applied "at the center of the wheel in the plane of the wheel." It is not necessarily so. The rear wheels push the front axle. If the tie bar holds, the front spindles are kept from turning by it and pushed by the front axle in the usual arrangement but what happens if the tie bar should break? With the usual arrangement the front wheel that is not connected also to the drag link will swing around across the car and an accident follows. If Mr. Clayden's arguments are correct this is what will happen with any arrangement except the one which has the pivot inside the hub and in the wheel plane. But the facts are not so. Mr. Clayden has driven Duryea cars and surely knows that they will run over a brick with the driver's hands off the control just as will a bicycle and everybody knows that a bicycle, having the pivot in the wheel plane, cannot be beaten for steering. With the inclined pivot shown in Fig. 10 the tie bar may be disconnected and the wheel will continue its course. This has been demonstrated many times and can be again when wanted. Mr. Clayden must therefore revise his explanation.

By inclining the pivot line slightly more so as to cross the wheel plane above the contact point we can make the wheel pivot resist such strains as that of running over a brick.

But there is another essential to good steering. Putting the pivot line into the contact line or near it is not enough. The castor effect must be introduced. Everybody knows the ordinary furniture castor. Its pivot and wheel plane are both vertical. Its essential feature is having the pivot line ahead of the wheel contact on the ground. It so happens

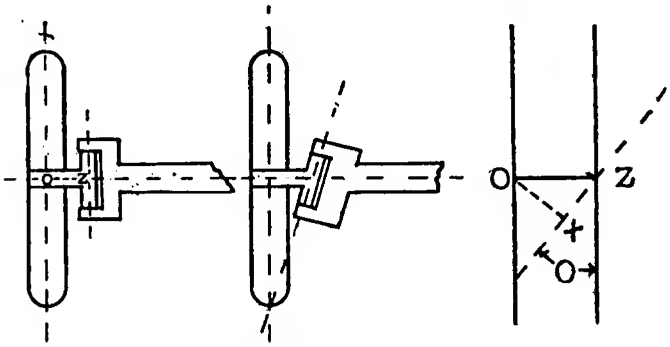


Fig. 10—Diagram of inclined pivot

that its pivot is in the plane of the wheel but this is not essential as Mr. Clayden thinks and states.

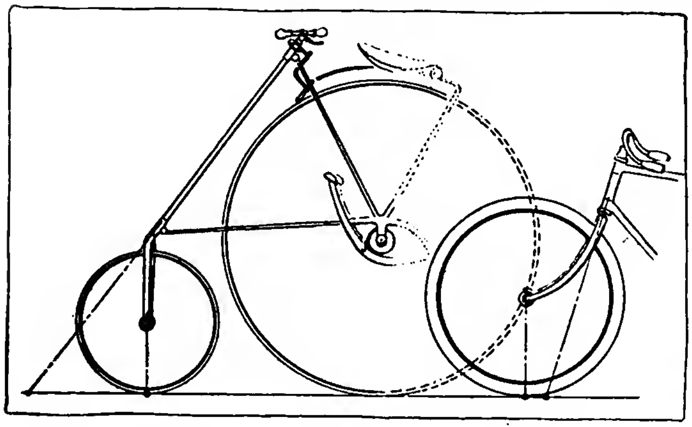
Push—Not Weight

The thing that makes a furniture castor operate is push; not weight as Mr. Clayden states. Lean a bicycle and the weight of the wheel in front of the pivot being greater than that behind the pivot, as seen in Fig. 13, makes the wheel turn to the lower side. But propel or push the bicycle and its steering wheel at once straightens up against the weight action and it travels in the line of the push. This is true castor action and just what is desired in an automobile. Why makers are so slow about incorporating it is one of the things no man can find out. Mr. Clayden will reply that he means vehicle weight and not wheel weight as the operating force. So I will be obliged to ask him to refer to the Star or Eagle cycles in which there is no question about turning the wheel lowering the weight. See the accompanying sketch. They were the best steerers ever made. When they were leaned it was the weight of the machine added to the weight of the wheel that caused the wheel to turn to one side. In some cycles there is a slight raising of the frame when the wheel is turned from its plane but this is so slight as to be negligible. It can be very much increased, however, by setting the steering pivot behind the contact point and if Mr. Clayden is correct this should render the steering more certain. It does just the reverse and most cycle riders have difficulty with such a device.

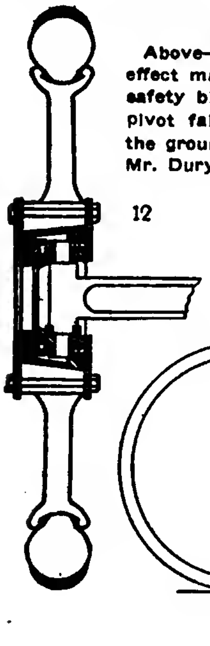
Weight Factor Unimportant

In most automobiles the load is carried by the top end of the forked front axle which is higher than the wheel axis and so the highest position of the load is when the contact is at the lower end of a line through the axis and carrying point. Most steering pivots are so nearly vertical that the deviation from this highest point is very slight. As a matter of fact, in automobile steering the weight has very little to do with the wheel position for one wheel turns one way and the other turns the other way and what one wheel loses by lifting the load the other gains by lowering it.

The castor effect is the only one responsible for the self-steering action. And this castor effect can be practically as well obtained by inclining the pivots as by more expensive methods. The inclined pivot costs no more than a vertical one and makers will use it if buyers demand it.—Chas. E. Duryea, Consulting Engineer.



Above—Star bicycle, showing how pronounced castor effect makes for good steering. Also—Badly designed safety bicycle where the prolongation of the steering pivot falls behind the wheel's point of contact with the ground. Below—Figs. 12, 13 and 14, referred to by Mr. Duryea



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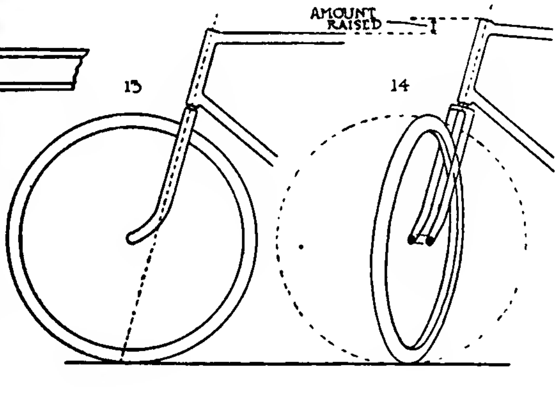


Mulholland Makes De Luxe Ambulance

WHAT has been described as the ambulance de luxe was shipped, recently, by the Mulholland Body Co., Dunkirk, N. Y., in connection with a Cadillac eight chassis, to the Houston Motor Car Co. of Houston, Tex. This car is probably one of the most completely equipped ambulances on the market, having a spring cot, seats for the doctor and nurse, compartments for stretchers, medicine cabinet and pulmotor. The car contains a heater operating from the exhaust, speaking tubes, electric fans, electric dome lights, sanitary waste container, hot and cold running water with washstand, water cooler, ventilators, silk curtains, plate glass sashless windows running in velvet covered grooves, and the body itself is designed with rounded corners within to avoid the necessity of cleaning dust.

The ambulance body has an ash frame with the paneling interior and exterior of Vehisote. The cowl and fore doors are of sheet steel and here also the corners are all rounded. The stretcher compartment measures 7½ by 8 by 46 in. It contains one stretcher and in order that this may be accommodated it is hinged in the center, allowing it to be doubled.

The medicine cabinet is a drawer beneath the spring cot and measures 8 in. by 9¾ in. by 25 in. The pulmotor is also in a drawer under the spring cot in a compartment which is adaptable to the pulmotor as regards size.

The car is heated by the Dunco heater made by the Dunkirk Corp. of this city. It is a hot air type with the register located in the front of the car and the heat is secured by placing a hot air jacket around one of the mufflers, this method providing ample heat for the purpose. The electric fan is located in front of the car directly in front of the washstand and the current for running it is secured from the storage battery which is part of the standard equipment.

In order to secure hot and cold water for the wash basin, two tanks were built under the driver's seat and into these tanks the regular air line was tapped. This is the line which provides the pressure on a gasoline tank. The hot water is secured by placing a copper waterjacket around one muffler and in this way with a two-way faucet arrangement either hot or cold water may be obtained at 2-lb. pressure.

Book on Lathes

THE South Bend Lathe Works, South Bend, Ind., has issued a useful booklet dealing with the practical problems of lathe operation in a practical manner. Not only is there a great deal of information given on the actual working of the machine, but its setting up, shop location, power drive and countershaft installation are covered in detail. Screw-cutting, taper turning, keyway and other special work, the use of the compound gearing, tool grinding, drilling, valve work, boring and tool tempering are a few of the many subjects treated. The booklet is of the genuinely helpful kind, and there are not a few things in it that may be of use to the old lathe hand.

The History of the American Automobile Industry—15

Early Development of the Gasoline Engine—Basic Ideas in Hot Air Engines Invented Centuries Ago —Tracing Their Evolution From the Days of Hero

By David Beecroft

THE previous chapters of this history have largely had to do with the development of steam vehicles, dating from the earliest times and including those developed up to 1890. Beginning with 1898, there was a very great development in steam vehicles which continued for eight or nine years, and which has continued itself up to the present in the Stanley steam car. Before taking up the history of this recent rise in steam, in which more than fifty different manufacturers were producing vehicles at the same time, it has been deemed better to leave this for later chapters, and to refer now to the early development of the gasoline engine as we know it to-day.

Gas Engine's Development

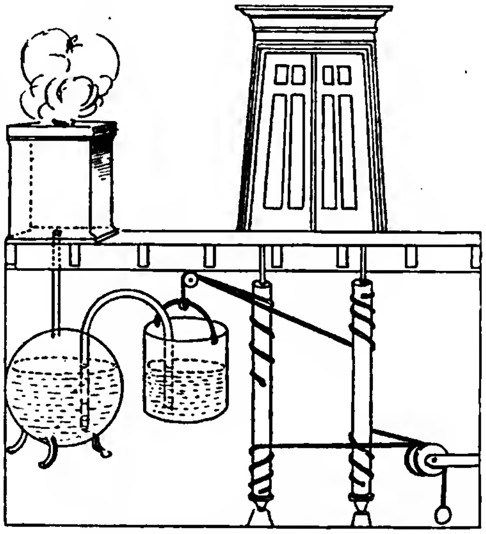
It is practically as difficult to trace the development of the modern internal combustion engine, in fact more difficult, than to follow the thread of steam evolution through the past centuries. The modern internal combustion engine, which we know to-day as the gasoline engine, did not start as an internal combustion engine. Some of the basic principles of it were discovered centuries ago before we had any of the modern hydrocarbon fuels such as gasoline or kerosene, so that those who expect the history of the gasoline engine to be a continuous chapter of development, with one kind of fuel, will be disappointed.

Hot-Air Engines First

The origin of the present-day gasoline engine started centuries ago in the form of hot-air engines. Here it might be added that an air engine is one in which the working medium is air, heated or compressed, as distinguished from steam in the steam engine, or a charge of explosive gas in an internal combustion engine, as we know it to-day. All three types, namely, air, steam and combustion engines, are heat engines. Heat is the great essential in all, and it is for this reason and because of this similarity existing among them that it is desirable to go back and carry the thread of development of air and explosive engines up through the centuries alongside of steam before entering into the history of the present-day automobile as dating from 1885 in Europe. All three forms of engines, air, steam and combustion, were developed very closely together under the same difficulties and for the same purpose. The inventors in one line have constantly made use of devices developed in another line, and in trying to give an accurate presentation of the facts as they occurred the difficulty is to show how closely they were related to each other in this early period rather than to attempt to separate them, as they have since in their respective growths separated themselves. It is particularly interesting to watch how the modern engine developed and how each step led to its successor.

Hero's Air Engine

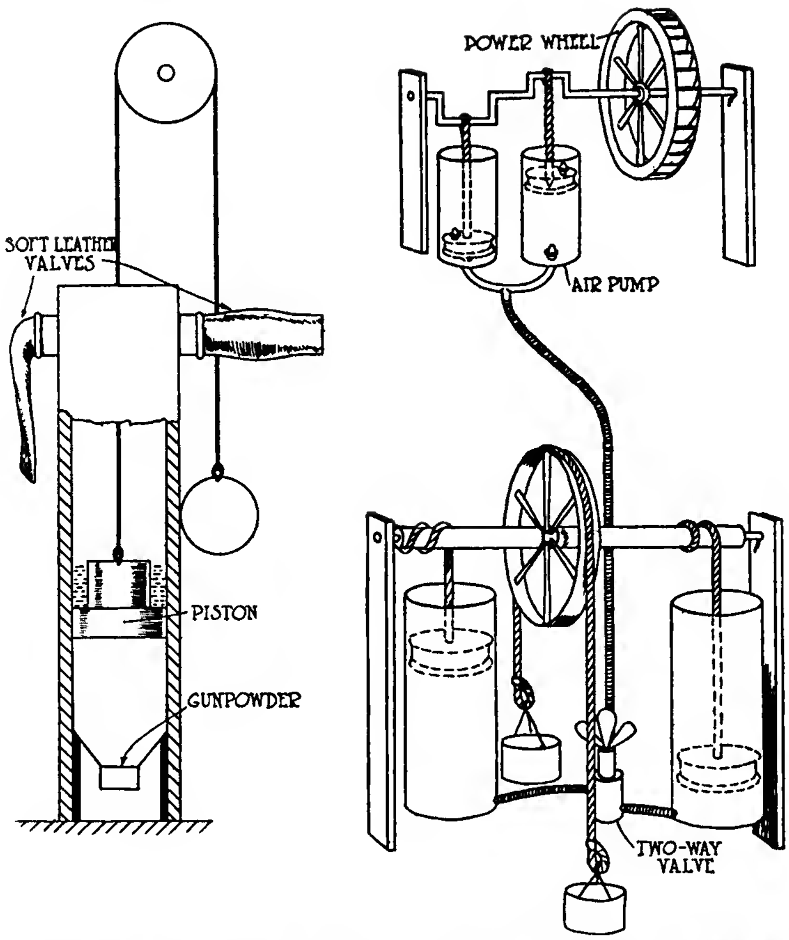
The first recorded use of expanded air to do mechanical work seems to be that of opening the doors of temples described by Hero, 130 B. C., in which a very simple contrivance accomplished the result. When a fire was built upon an altar the heat expanded the air contained in the hollow underneath the altar, which air forced water out of a bottle into an open pail through a curved pipe or syphon. The weight of the water in the pail opened the doors against counterweights. When the altar cooled the water syphoned back into the original bottle, lightening the pail and permitting the counterweights to close the doors.



Hero's device, the first known to do mechanical work with expanded air. It was used for closing the doors of temples. A fire on the altar heated the air in a hollow beneath it so that it forced water from a bottle into an open pail through a syphon, the weight of the water opening the doors against counterweights. When the altar cooled the water syphoned into the bottle and as its weight was removed from the pail. the counterweights closed the doors.

After the invention of gunpowder the Abbé Jean Hautefeuille of Orleans, France, in 1678, described a perpetual pendulum which was a sort of cannon in which gunpowder explosions were produced and which could be employed to raise water much as a modern pulsometer pistonless steam pump.

Two years later Huygens, Holland, described a gunpowder engine consisting of a cylinder open at the top and fitted with a screwed breech in which gunpowder could be placed and fired. The ignition of the powder filled the cylinder with flame and gases, driving the piston to the top and then escaping through exhaust valves formed of leather tubes. These tubes would flatten immediately and prevent air from entering until the piston had passed them on its downward movement, which movement was accelerated by atmospheric pressure, the gases inside cooling and condensing as the piston went downward. A rope over a pulley with a weight on the other end served to communicate power to the pulley shaft. This engine is, therefore, seen to be a complete device depending solely upon the means for introducing and firing the powder, and limited mostly by the cost of fuel. About the same time Papin, France, was working along much the same line, except that he gave preference to steam instead of powder.



Left—Huygens' gunpowder engine, in which the flame and gas of the explosion threw the piston upward, the leather exhaust tubes flattening as the piston dropped and preventing air from entering until the piston passed them. A rope, pulley and weight communicated power to the pulley shaft.

Right—Papin's engine, which was built along lines similar to the Huygens construction except that steam instead of powder was used. This engine was used or raising any sort of weight out of a deep mine.

John Barber's Patent

John Barber of England took out a patent in October, 1791, in which he shows two retorts to be used alternately, one being cooled and cleaned and refilled while the other is in service. These retorts, being heated gave off vapors that could be burned, and these vapors passed to a water-cooled holder. Air, water and gas from this holder were all pumped to an exploder chamber. When flame was applied to the outlet of this chamber a violent blast resulted, which, being directed against a multiplicity of vanes projecting from the rim of a wheel, caused the wheel to turn. His pumps seem to have been slow acting, and so this blast effect was most likely not continuous. His mechanism would undoubtedly have served much better if used with a piston and cylinder than with a turbine which could not have had much efficiency.

Another Englishman, Thomas Mead, in 1794, patented a very crude device for generating either vacuum or pressure by the use of heat. This was a large cylinder with cocks at top and bottom and a grate for carrying coals which could be introduced by removing the top head of the cylinder. When the top head was replaced the grate would be released and allowed to move downward as the air below passed through the grate, which passage heated and expanded it and created a pressure and volume that could be used to perform work. If not otherwise used this pressure would drive downward a piston fitted near the bottom of the cylinder. When the grate reached its limit of downward movement, opening and closing the top cock would reduce the pressure to zero, followed by cooling of the hot gases and a vacuum which would raise the piston. Then, opening both cocks, the grate would be raised, expelling the burned gas from above it and drawing fresh air in below. The operation would then be repeated until the coals were burned and the grate had to be taken out for recharging.

Robert Street's Heat Engine

In May, 1794, Robert Street, also an Englishman, patented an engine driven by the force of inflammable vapor produced from "liquid, air, fire and flame." It seems that he used the vertical cylinder with its bottom or head heated practically red hot. On this he dropped tar, turpentine, or some similar liquid easily and quickly vaporized, which vapors, mixing with air, drawn in by a short initial lift given the piston, drove the piston upward, possibly by a hand lever and ignited by a torch, escaping at the top of the stroke and followed by a return or downward movement of the piston, doubtless assisted by atmospheric pressure. That he understood and used the device is shown by his statement that ten or twelve drops of fuel should be used with each cubic foot of air drawn in.

Requirements of Tractor Design

Three Schools of Tractor Engineering Produce Different Machines—Tendency Towards Automobile Engineering Rather than Gas Engine Construction*

By C. M. Eason

Engineer Hyatt Roller Bearing Company

WHILE the detail of tractor construction is different from any other, yet it is possible to group tractors under three general classifications. First: the heavy type based on stationary engine practice; Second: the so-called automobile type, embodying a great many features found in present day automobile construction; and Third: a composite type, which, in a modified form, contains certain features common to either of the other two types. Back of every tractor design are certain specific reasons for the construction used. It will doubtless be of interest to present some of these reasons as advanced by the engineers responsible for the different designs.

The builders of the heavy type tractors declare that any machine to be a success at farm work must be made very heavy to stand the rough usage and continuous service. To this end they employ slow speed single or double cylindered motors having rather large cylinder dimensions. They make all of the bearing surfaces extremely large, using babbitt or bronze bushings practically throughout. The transmission systems of these tractors are usually rough cast gears of coarse pitch and large diameter. Owing to the difficulty of inclosing these large gears they are usually run in the open, and some mechanical means of lubrication for the gear faces is employed. Frames and wheels are also necessarily very heavy. The carburetion, ignition and cooling systems are usually reduced to the utmost simplicity, and, being designed for practically constant speed and load, there is very little necessity for fine adjustment or flexible control. They point to the fact that all other farm machinery is comparatively crude in design, cast and malleable iron, rough bar forgings and similar construction being used almost exclusively. They state that while this type of construction may be crude from a mechanical standpoint, that it is better understood and easier taken care of by the average farmer than a machine of higher mechanical refinement. They further state that a single-cylinder motor will give a farmer just half as much trouble as a two-cylinder, and one-fourth, as much trouble as a four, and being less sensitive to delicate adjustment will run for a greater length of time without proper attention than any other type.

The designers of tractors built along automobile lines claim that fundamentally the use of single or double cylinders or large diameters is incorrect for tractor duty, because it is necessary to make all of the design so extremely heavy to obtain proper wearing surface or bearing area. It is a well established principle of automobile motor design that the effective life is proportionate to the area of the uncooled parts (*i.e.* valves and piston heads), and to the weight of the reciprocating parts. Motors having small bores, small diameter valves, light pistons and light connecting-rods will show a greater effective life than motors of larger dimensions and heavier reciprocating parts. To substantiate this argument they point to the fact that automobile designers are working toward greater reliability with less attention and that this has led them to the development of six-, eight- and twelve-cylinder motors which have been proved to have a greater effective life than motors of equal horsepower by smaller number of cylinders. They further state that the life of a motor is dependent upon the ratio of bearing surface to piston area, and that it is possible to get a lower pressure per square inch on the crankshaft and connecting-rod bearings of a multiple-cylinder engine, than would be practical with single-cylinder motors of the same horsepower. It is also said that for a given power it is easier to build multiple cylinders than single cylinders due to the greater facility for handling small parts in duplicate. As to gears and shafts of the transmission system they point out that an alloy steel gear properly heat treated only weighs about 15 per cent as much as a cast iron gear for transmitting a given power, and that after taking into consideration the cutting, hardening and extra handling of the smaller piece they can actually be produced for the same or less money than the heavier gear of cheaper material. They also maintain that the only way to insure reliable operation in a transmission system is to absolutely protect same from dust and dirt and run it in a bath of oil. To accomplish this it is, of course, necessary to have dust proof and oil tight cases making self-contained units of the transmission system. This type of construction permits the use of some type of anti-friction bearing instead of plain babbitt or bronze and insures a high percentage of the motor power being delivered to the drive wheel.

Carrying out this type of construction to its logical conclusion will result in the production of a tractor weighing about one-third as much as a tractor built along the lines of the heavy single-cylinder, slow-speed motor. Whether this construction will be entirely too light for tractor service remains to be proved by actual experience in the field with tractors of each type working under similar conditions. So far there are, at least in fairly successful operation, tractors of both types. It would seem that an answer to the question as to which will predominate in the future must wait until more practical experience has been obtained.

Most of the experienced tractor designers of to-day have brought out during the past year, or are preparing to bring out next year, tractors which show plainly a combination of both the heavy type and the automobile type of construction. The arguments which they advance for this composite type are substantially the same as advanced by the advocates of the two extreme types. They qualify all of these arguments by saying that a tractor is neither a perambulating stationary power plant nor a pleasure car, and is unlike the motor truck, being a distinct and separate type of machine. Some of the tractors produced in this class have been developed from the stationary type as a basis and brought to their present form by cutting down sizes where permissible, using better materials where greater strength was required and applying anti-friction bearings at the points where the loads are heaviest. Others in this same class have been developed from the light weight construction, as a starting point, by building up and strengthening various parts as they have developed weaknesses in the field.

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*Extracts from a paper read by Mr. Eason at an agricultural engineers' convention held recently in Chicago.

ACCESSORIES

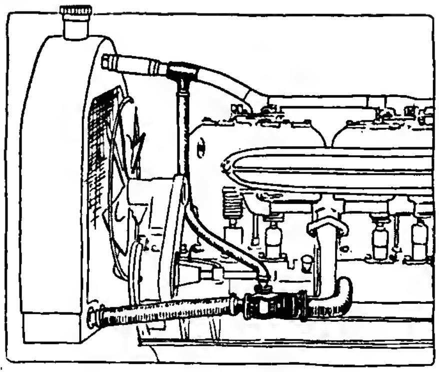
Sylphon Circulation Regulator

THIS regulator, which is already a standard feature of equipment with several car manufacturers, is designed to keep the temperature of the cooling water constant. When the engine is started the Sylphon device diverts the circulation until the temperature of the water in the cylinder jackets reaches a point at which the engine operates most efficiently, when it automatically starts a gradual circulation. The same temperature is maintained around the cylinders until circulation is complete. The device is a thermostatic arrangement using a metal coil which responds readily to changes in temperature.

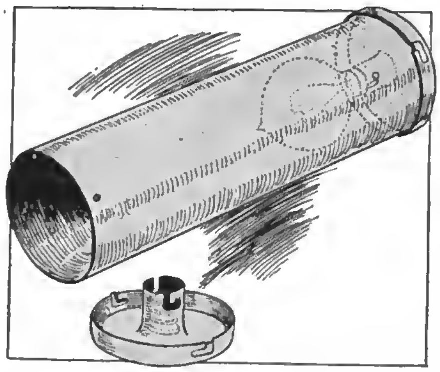
The regulator is claimed by the manufacturer to heat the engine to correct operating temperature 1 min. after starting, preventing backfiring due to cold cylinders; to render unnecessary carbureter adjustments due to weather changes; to promote lubrication; to reduce wear in cylinders and pistons by preventing inequalities of expansion and contraction; to prevent rapid cooling of the motor when not running, thus insuring quick getaway, and to reduce gasoline consumption and carbonization. The device is entirely automatic and is claimed to outlast the car on which it is mounted, no adjustments or repairs being necessary.—Fulton Co., Knoxville, Tenn.

Boyce Midget Model Motometer

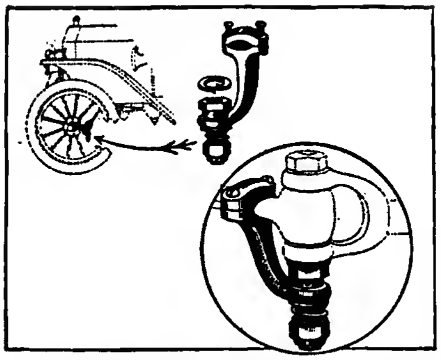
Similar in design and construction to the Standard and Junior models of the Boyce Motometer, the Midget is specially designed for use on small and light cars. It is accurate and well built, being 2¼ in. in diameter and finished in nickel with black dial. Like the Junior, it has no glass over the thermometer scale. A special center screw is required for mounting the device on Overland cars, this screw selling for 50 cents extra. The Midget model Motometer inserts through a ⅞ in. hole in the radiator cap and bolts in place. It sells for $2.50.—Motometer Co., Inc., New York City.



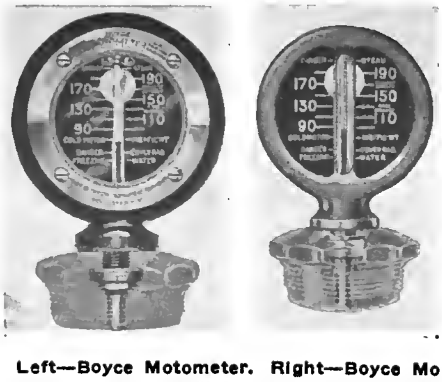
Sylphon circulation regulator



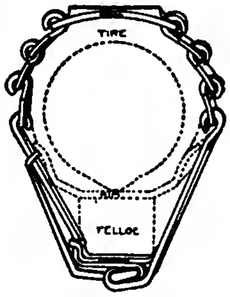
Dover electric bulb case



King anti-rattler for tie rods



Left—Boyce Motometer. Right—Boyce Motometer Junior



Kimball cam-locked non-skid chain

Kimball Skid Chain

Six clasps encircling the tire constitute the anti-skid provision for each wheel of the car. The clasps are locked by a cam device and when in place press into the rubber and stick to it. The clasp is flat steel ⅛-in. thick with a tread plate 3 in. wide and links 1¼ in. wide. A strip of leather prevents the marring of the varnish on the felloe. One or more of the clasps may also be used as a blowout patch.—Kimball Tire Case Co., Council Bluffs, Iowa.

Sapp's Accelerator for Fords

This foot accelerator is attachable to the Ford without machine work or fitting. The foot piece is attached to the top of the gearcase by two of the screws that hold the cover and connection with the throttle is made through a wire cable. A spring returns the throttle when the pressure of the foot is removed. The device does not interfere with the use of the hand throttle. The outfit weighs less than 1 lb. Price, $1.65.—Will A. Sapp, Elgin, Neb.

Dover Lamp Bulb Case

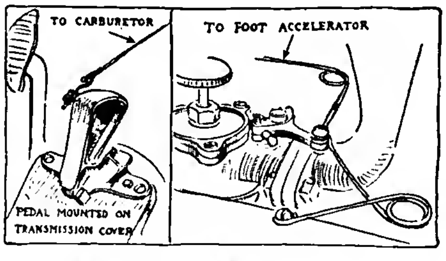
Two Ford headlight bulbs are contained in this 7½ by 2¼-in. cylindrical steel case, one bulb being held securely at each end of the case by spring-backed bayonet locks so that it can neither rattle nor work loose. The Ford bulb case, as illustrated, sells for 35 cents, without the bulbs. The company also manufactures cases for other assortments of lamps.—Dover Stamping & Mfg. Co., Cambridge, Mass.

King Anti-Rattler for Fords

These clamps are designed to prevent rattle due to a loose tie-rod on a Ford or Overland car. No machine work is required in installing a pair of the clamps and they may be attached in a few minutes. Price per pair, for Fords $1; for Overlands $1.50.—King Specialty Mfg. Co., Brookline, Mass.

Whitaker's Water Bags

Whitaker Egyptian water bags are woven of special flax and when filled allow a little moisture to exude, the evaporation of this keeping the water within cool despite hot weather. The tops are closed by a steel wire device which per-



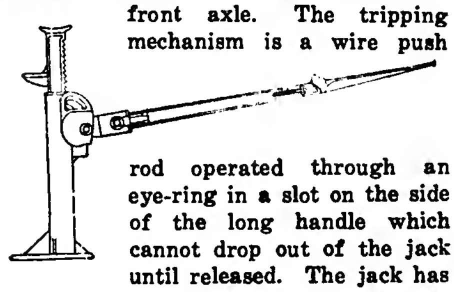
Sapp's accelerator for Fords

Whitaker's bag for cooling water

mits the bag to be turned inside out for cleaning and drying. The ½-gal. open top type bag sells for 95 cents, the 1-gal. for $1, 2½-gal. for $1.50, 3½-gal., $2, 5-gal., $2.50. Furnished with closed top, the ½-gal. size is listed at 85 cents, the 1-gal. at 90 cents, 2½-gal. at $1.35, 3½-gal., $1.85 and 5-gal., $2.25.—Whitaker Mfg. Co., Chicago, Ill.

Hartford Red Rack Jack

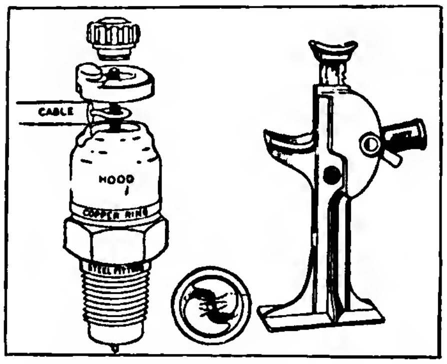
One of the main advantages of this jack is that it can be placed under the axle of the car and raised and lowered by the operator from a standing position, it being unnecessary to crouch under the rear of the car. This is accomplished by means of a 26-in. hinged extension lever handle which, when folded, is only 14½ in. long and which is easily detached by depressing a spring. The jack has heavy double ratchets and pawls and an extra step for use under a low front axle. The tripping mechanism is a wire push rod operated through an eye-ring in a slot on the side of the long handle which cannot drop out of the jack until released. The jack has a range of 11 to 18 in. on the head with a further minimum of 8⅝ in. for the front axle step. The jack weighs only 7 lb., although the ribbed base is very broad to give perfect stability. The name is derived from the red enamel finish of the toothed rack, the rest of the jack being finished in black. It sells for $2.50.



The company also manufactures the Hartford jack which operates by a ratchet, a pinion meshing with a large gear, the movement of the latter being directly communicated to a pinion engaging the rack on the moving upright. This jack is finished in black enamel and packed in a canvas bag. It lists at $6.50.—Hartford Suspension Co., Jersey City, N. J.

Hinckley Milling Attachment

A drill-press is converted into a milling machine by the use of this device and will cut straight, taper or Woodruff keyways, straight or curved grooves, finish semi-cylindrical bushings and the like, and so on. The attachment, which will go on any drill-press from 14 to 42 in., consists of a 12½-in. circular base with graduated circle carrying traverse slides moving 12 in. longitudinally and 7 in. across, and a vise opening 10 in. T-slots are also provided in the table for clamping work that the vise will not accommodate. The cutters used are regular stock sizes and do not have to be specially made. They fit in the taper drill sockets. Price, $48.—Hinckley Machine Works, Hinckley, Ill.



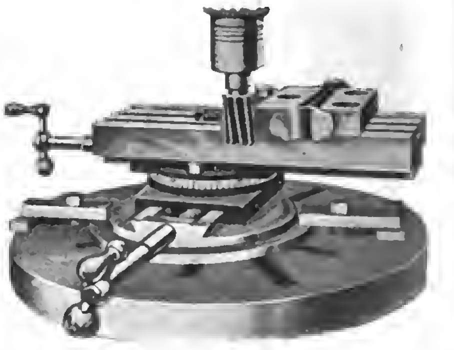
Left—Herz Pro-Mo-Tor spark plug for Fords. Right—Jiffy jack for garage use

Jiffy Jack for Garages

This new Jiffy jack is called the Indestructo and is intended especially for garage work. The short stroke permits the use of a long handle while the base is large. Its normal capacity is 2000 lb. though it will stand 100 per cent overload. The jack is 11½ in. high and the lift is 7 in., there being an auxiliary step 7 in. from the base. Price, $2.50.—Jiffy Jack Co., Cleveland, Ohio.

Herz Pro-Mo-Tor Spark Plug

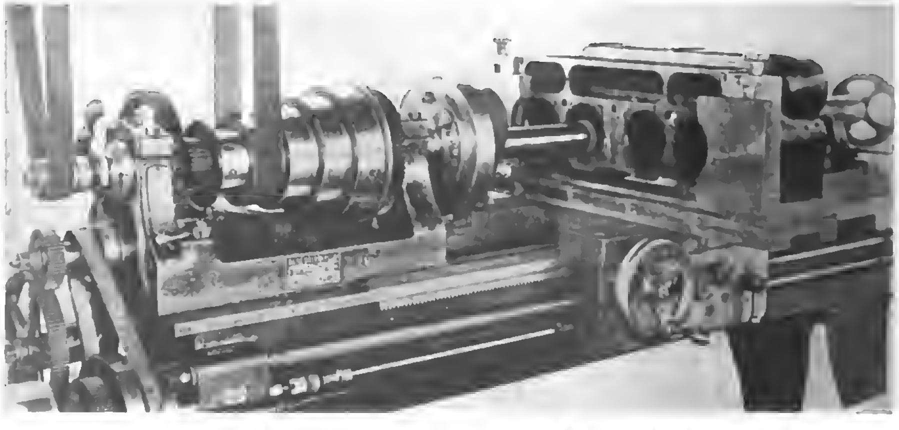
This plug, which is designed for Ford cars, is claimed to be self-cleaning, soot, water, dust and shock proof. A propeller-shaped disk forming the outside electrode is stated to prevent the settling of carbon and oil in the combustion chamber. This disk produces a whirling action which tends to keep the plug chamber clean. A rubber cap protects the high-tension cable terminal from water and dirt, fitting over the top of the plug as illustrated. The hood of the plug is stone with a copper ring fitted to its lower end. The plug sells for $1.—Herz & Co., New York City.



Hinckley miller attachable to any drill press

Woods Lathe Attachment

This boring and grinding attachment may be fitted to a 16-in. lathe and with regular equipment will bore and grind cylinders from 2⅛ to 5¼ in. in diameter and 11 in. deep. Both the grinder and the boring bar are attached to the lathe faceplate, the grinding arm outfit including the gearing for driving the two grinding wheels furnished, which are 2⅜ and 3½ in. in diameter, respectively. The spindle runs in S. K. F. double-row ball bearings and the drive shaft also runs on balls, all bearings being protected from dirt. An eccentric system is used for micrometer adjustments. The outfit includes the lathe attachment itself with grinding wheels and boring head, overhead countershaft, cross slide for the lathe carriage with two adjustable angle plates having vertical screw adjustment and T-slots for bolts, special faceplate, diamond grinding wheel, dressing tool and wrenches. The milling machine attachment is necessarily constructed to adapt the outfit to the miller.—Woods Engineering Co., Alliance, Ohio.



Woods boring attachment in place on 16-inch lathe arranged for grinding

The Automobile

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Driver's Comfort

IF comfort is defined as the state of being at ease, there is no doubt but that there is room for improvement in a great many cars, particularly as regards the driving seat. No criticism can be made of the room in the tonneau of the 1916 car, but it is a question if some of this room is not being obtained at the expense of the driving compartment, thus providing a superabundance of space in the rear while the occupants of the front seats, especially the driver, suffer.

There are many important details about the design of the driver's seat, and not only do these details affect the sitting posture but also the convenience of control. The handling of the steering wheel, gearshifter lever, instruments on the control board, brake, clutch and accelerator pedals keep the hands and feet of the driver of such a variable-speed vehicle as the automobile constantly on the move. The movements of driving amount to a material total after the end of a day's run and careful motion study on the part of the designer would certainly be thankfully received by the occupant of the driver's seat.

Probably the driver himself would not be able to tell why he left the seat of one car feeling fresh and fit to continue the journey after a run of a whole day, while on another car he was weary before half the day was over. The position in the seat, reach for the pedals, position of the feet and arms, all have their influence. It is an important matter to have the driver's seat correct. The man who foots the bills of motoring should receive careful attention, and since 90 per cent of the owners of cars drive, it behooves the manufacturer and designer to realize what an important personage the driver is after all.

The Agricultural Tractor

THE revolutionizing influence of the internal combustion motor is once more demonstrated by the fact that separate tractor expositions are being held in the Mississippi Valley. Minneapolis is holding one this week, Kansas City will hold one next week. It is surprising that exhibitions have not been held before this date.

The expositions have a suggestion for the automobile dealer, who up to the present has not taken the agricultural tractor seriously, but who during the past year has realized that a large source of revenue is within his reach through the tractor field. Automobile dealers are the logical persons to handle the tractor business. They are familiar with the internal combustion motor, and because of this are in a much better position to give real service to tractor owners than many implement dealers to whom the internal combustion motor is not so well known.

After-War Exports

IN considering the position of the American automobile industry at the conclusion of the war, there is one point that is liable to be overlooked and this is that the ability of the European manufacturing industry to compete with imported American vehicles may be greatly different from what it was before the war. Practically every factory in Europe is now much better equipped than it used to be because every available plant is operating on munition work and great quantities of new machinery have been bought to facilitate the production of articles needed by the armies. As soon as the demand for munitions ceases the automobile plants of Europe will find themselves much better supplied with tools than ever before while they will also have workmen who have been trained to operate modern American machinery at a higher speed than has previously been the custom in Europe.

The opinion is now being expressed fairly freely in England and France that manufacturers will be able to make automobiles for considerably less money and that therefore it will be easier to fight American competition. The moral is that American manufacturers must be ready to meet severe competition and prepare for a drop in the average selling price of European cars. At present, in regard to the abnormal cost of Atlantic freight there is ample margin between the factory cost here and the selling price in Europe. Economies can undoubtedly be effected between the American factory and the ultimate European owner. The object is one that should be given close attention so that plans may be laid beforehand.

260,000 See Chicago Exhibition

30,000 Were from Out of Town—Ticket Rebates to Pay for Dealers' Space

CHICAGO, ILL., Jan. 29—As near as could be estimated by Manager Samuel A. Miles, 260,000 persons entered the Coliseum during the week of the Chicago show. This is about 8000 greater than the New York attendance. Of these, 30,000 were visitors from out of town and included dealers, salesmen, owners and prospective owners. There were 3500 exhibitors and salesmen; there were 3000 dealers from all parts of the United States and Canada; even one from South Africa.

Based on the attendance figures it is estimated that the exhibitors will receive on rebate from the ticket sales enough to pay for the rental of their space. The increase in attendance is about 22 per cent over last year's figure, according to Miles. Last year the show paid back to exhibitors who are members of the National Automobile Chamber of Commerce and of the Motor and Accessory Manufacturers over 80 per cent of the amount paid for space rental. The indications are this year that they will receive nearly 100 per cent.

From a business standpoint, the exhibitors are almost a unit in agreeing that the show surpassed any previous records set up by earlier events at Chicago. Most of them have found also, that it was a better business show than the recent New York exhibition. This is the opinion of accessory exhibitors as well as car exhibitors.

In accounting for the statements that when the sales results are checked up, the Windy City show will outshine that of Gotham, a number of theories are given. It is the belief of most that the territory from which Chicago draws its dealer attendance is less restricted than that of New York, and consequently the dealers at the Chicago show represent a greater buying territory. Add to this the fact that many dealers visit the New York show for a general view of the offerings and have come to a decision and are ready to close at Chicago. A rather interesting explanation is that given by some of the accessory men that dealers and jobbers go to New York for a good time and come to Chicago for business.

Lee and Michelin Tire Prices Raised

NEW YORK CITY, Feb. 1—General advances in prices for tires were announced yesterday afternoon by the Lee Tire Co. The puncture-proof tires have been advanced 15 per cent, while all other grades are 10 per cent higher.

The Michelin company this morning raised its prices 10 to 15 per cent. Though the Nassau prices are as yet unchanged, it is expected that before the week is over this company will announce a new schedule.

On its plain tread types, the Lee company has advanced its prices in some cases over $2 a tire, for instance on the 28 by 3 the new price is $19.75 as compared with $17.15; the new price on the 34 by 3 is $23.65 as compared with $20.45; and on the 36 by 4, the new price is $42.75 against $37.15. On its puncture-proof non-skid type, some of the advances range from $3 to approximately $7, as on the 36 by 4, which has gone up to $47.15 from $40.95.

Michelin plain tread prices on a few of its popular-sized tires are as follows: 32 by 4, new price $23.40, old price $20.95; 33 by 4, new price $23.90, old price $21.50, and 36 by 4, new price $26.30, old price $23.75. On its non-skid or Universal type, the prices are as follows: 32 by 4, new price $24.90, old price $22; 33 by 4, new price $25.65, old price $22.50, and 36 by 4, new price $27.95, old price $24.75.

Within the past week Firestone has increased its truck tire prices another 10 per cent. This is in addition to the 10 per cent increase announced earlier.

Chalmers Plans Canadian Plant

DETROIT, MICH., Jan. 31—Another local automobile company has decided to start manufacturing in Canada. It is the Chalmers Motor Co., and a Canadian Chalmers company has been incorporated under the laws of Ontario with a capital stock of $1,000,000.

A plant will be erected either in Windsor or Walkerville. The reason for this action, according to Vice-President Clarence A. Pfeffer, is that the tariffs or customs duty on automobiles and parts are becoming prohibitive to American manufacturers, and that the only way to do business profitably in the Dominion is to establish a manufacturing plant there.

Willis Is Chalmers Sales Manager

DETROIT, MICH., Feb. 1—Frank B. Willis, who was assistant sales manager of the Chalmers Motor Co., has been promoted to sales manager by vice-president of the selling division Paul Smith. Mr. Willis has been with the Chalmers company for one and a half years, being district manager for the company for the Eastern district at the time he was called here to the factory.

Two other promotions in the Chalmers sales division are those of T. H. Smith and W. J. Drumpelman, special representatives who become assistant sales managers.

12,000 Carloads Shipped in Jan.

N.A.C.C. Traffic Dept. Reports—Expects 16,000 Carload Shipments in February

NEW YORK CITY, Feb. 1—Reports from the N. A. C. C. traffic department give some idea of the increased production of motor cars during the month of January. During the first three weeks of the month members of the Chamber shipped 12,000 carloads of motor cars, and it is expected 16,000 will be shipped during the month. Last year only 8300 cars were shipped during the entire month. In other words, shipments have practically doubled. This greatly increased production is naturally handicapping railroads which have not enough freight cars to take care of the requirements. The work the Chamber is accomplishing is demonstrated by the fact that such railroads as the Santa Fé are hauling complete trainloads of empty automobile cars from California and Texas in order to get them back to the factories as soon as possible. Ordinarily these freight cars would be held and brought back loaded. Many of the factories are being regularly held up on shipments, several not having available railroad cars to take care of more than 75 per cent of their daily production.

75,000 Maxwells for 1916

DETROIT, MICH., Jan. 31—Production facilities of the Maxwell Motor Co. have now reached a stage where considerably more than the output of 60,000 cars planned for the fiscal year 1916 will be made. Officials say that they expect 75,000 cars to be made by the end of July, 1916, and that in the enlarged plant an annual output of over 100,000 is possible.

Maxwell to Have Canadian Plant

DETROIT, MICH., Jan. 31—Maxwell cars are to be made in Canada within the next few months, according to Walter E. Flanders, president of the Maxwell Motor Co. They will be made in a large plant to be erected in Windsor, Ont.

Chicago May Have Truck Show

CHICAGO, ILL., Feb. 1—During the Chicago Coliseum Motor Show last week a movement started looking toward the possibility of a motor truck show to be held in Chicago next year during the week of the passenger car show. Six or seven different representative manufacturers met and formally discussed the question, and a committee of one was appointed to take up with the truck manufacturers their attitude on such an exposition.

94,437 Overlands Built in 1915

Increase of 45,969 Over Output During 1914—722 in Day is Record

TOLEDO, OHIO, Feb. 2—The Willys-Overland Co. made and sold 94,437 Overland cars in 1915. This is at the rate of 315 per day on the basis of 300 working days.

In 1914 the number of cars made was 48,468, or at the rate of 161 per day during 300 working days.

The increase during the past year was 45,969, or nearly double the 1914 output.

The way production is now going on even the great record of 1915 will be far outdistanced, as production is now already at the rate of more than 700 cars a day, the record to date being 722 in twenty-four hours.

Congressman Calls for Investigation of S. O. Companies' Methods

WASHINGTON, D. C., Feb. 1—*Special Telegram*—A board investigation to determine primarily whether or not the segregated Standard Oil companies are boosting the price of gasoline was proposed to the House in a resolution introduced by Representative Dowell of Iowa.

The resolution proposed a general inquiry into the production, transportation, refining and marketing of gasoline and other petroleum products to lay bare the causes for the recent advances in the prices of these commodities.

Dowell's resolution calls for the appointment of a select committee to be appointed by the Speaker of the House and to consist of nine members.

Permanent Automobile and Accessory Showroom for Wall Street

NEW YORK CITY, Jan. 29—Taking advantage of the recent boom in war stocks during which many fortunes were made by curb brokers and others connected with the Wall Street section, R. J. Adams, Edwin Robins, and W. T. Savage have leased 15,000 sq. ft. at 50 Broad Street, on the ground floor, where they will establish a permanent showroom for automobiles and accessories.

It is stated that this section of the city at the present time abounds in many opportunities for sales in automobiles and accessories. It is expected that about twenty-five automobile manufacturers will be represented at the showroom and an equal number of accessory makers will show their wares. Up to the present time the following automobile makers have inquired for space: White, Apperson, Stutz, Packard, Overland, Pierce-Arrow, Mitchell, Mercer, Studebaker and Cole.

The delay in shipping conditions has held up the opening of the exhibition, but it is expected that by Feb. 15 enough of the new cars will be on hand to warrant a general opening on that date.

Messrs. Johnson and Dimond of the White and Apperson companies have been largely instrumental in the planning of this new venture. Though no company has as yet been formed, it is stated that a holding concern will be organized in the near future under the name of the 50 Broad Street Exhibition and Salesroom Co., with Edwin Robins, president and W. T. Savage, secretary and general manager. Each automobile maker will have his own salesman on the floor of the showroom.

Studebaker Declares Extra Dividend

SOUTH BEND, IND., Feb. 1—The directors of the Studebaker Corp. to-day declared a quarterly dividend of 1½ per cent, and an extra dividend of 1 per cent on the common stock; also the regular quarterly dividend of 1¾ per cent on the preferred stock. The dividends are payable March 1 to holders of record Feb. 19. The previous distribution on the common issue was 1½ per cent quarterly and 1 per cent extra.

Knowles Is Saxon Chief Engineer

DETROIT, MICH., Jan. 29—W. K. Knowles has been appointed chief engineer of the Saxon Motor Car Co., to succeed R. E. Coles, resigned. A. H. DeWees, formerly in charge of the chassis purchasing department of the Packard Motor Car Co., has succeeded R. M. Wirth, resigned, as purchasing agent.

Gifford with Paige-Detroit

DETROIT, MICH., Jan. 31—R. F. Gifford, who during the past six months was secretary of the Foreign Trade Bureau of the Detroit Board of Commerce, has become connected with the Paige-Detroit Motor Car Co. and will devote his time to building up the foreign business of that company.

McCrickett, Russel Engineer, Dies

DETROIT, MICH., Jan. 27—Thomas F. McCrickett, who was chief engineer of the Russel Wheel & Foundry Co.; former president of the Detroit Engineering Society and a member of the American Society of Civil Engineers, died Jan. 26.

Malcolm Co. Has $1,000,000 Capital

DOVER, DEL., Feb. 1—The Malcolm Motor Car Co. has been formed to make and sell automobiles and trucks. Its capital is $1,000,000. The incorporators are F. D. Buck, G. H. Dillman and M. L. Horty of Wilmington, Del.

S. A. E. Council in Session

Committee Chairmen Appointed—Members To Be Approved Feb. 16

CHICAGO, ILL., Jan. 28—One of the most successful meetings of the council of the Society of Automobile Engineers was held in this city to-day, at which practically all of the members attended, including President Huff and Messrs. Van Dervoort, Dunham, Utz, Coombs, Rose, Beecroft, Chase, Foljambe, Hall and General Manager Clarkson.

The meeting was called to complete the general organization of the season, as well as the announcement of the committees appointed by the president. The most important change in the committees was the resignation of K. W. Zimmerschied, chairman of the standards committee, and the appointment of A. Ludlow Clayden, engineering editor of THE AUTOMOBILE, to this position.

President Huff announced the chairmen of various other committees, but the personnel of the different committees was not decided upon. Among the chairmen nominated are the following: Finance, H. M. Swetland, Class Journal Co.; Meetings, George Dunham, consulting engineer, Detroit; Members, R. H. Coombs, Prest-O-Lite Co., Indianapolis; Publications, Herbert Chase, laboratory engineer Automobile Club of America, New York. It is expected that the various members of the different committees will be approved at the next meeting of the council to be held in Detroit, Wednesday, Feb. 16.

Several applicants were approved for membership in the society, these including S. H. Page, assistant engineer, the Union Gas Engine Co., San Francisco, Cal.; Wallace W. Tuttle, factory engineer, Van Blerck Motor Co., Monroe, Mich.; Burns Dick, engineer, Wagner Electric Co., St. Louis; Benjamin F. Schooler, Briscoe Motor Car Co., Jackson; and Watson R. Smith, Jackson Cushion Spring Co., Jackson, Mich.

Brosseau Federal Truck Vice-President

DETROIT, MICH., Jan. 25—Beginning Feb. 1, A. J. Brosseau becomes vice-president of the Federal Motor Truck Co., of which he has been a director and stockholder. Mr. Brosseau has been general manager of the Gale Mfg. Co., Albion, Mich., for the past twelve years.

J. C. Wilson Raises Capital

DETROIT, MICH., Jan. 27—The J. C. Wilson Co., which makes the Wilson truck and is also manufacturing tops, has increased its capital stock from $20,000 to $225,000.

Foreign Trade Import and Export Is Serious After-War Problem

Many Interesting Opinions Given at Convention of National Foreign Trade Council—Expedients to Prevent Dumping Discussed from Many Angles

New Orleans, La., Jan. 29—The three-day convention of the National Foreign Trade Council, held in this city Thursday, Friday and Saturday of this week, has been one of the most valuable meetings for the consideration of sane problems in connection with foreign trade. Automobile interests have been directly and indirectly represented and all automobile concerns, hoping to develop their export trade, have lost a favorable opportunity of getting closer in touch with foreign business than they have had during the past year. While the convention did not discuss the automobile industry in general, there were many papers presented and discussions carried out that had a direct bearing on the subject.

Team Work Required

The problems of what conditions American manufacturers will face at the conclusion of the war were discussed from many angles. Alba B. Johnson, president of the Baldwin Locomotive Works, declared that a truly foreign trade policy on the part of the United States is necessary to meet conditions after the war. In the words of President Johnson, "It will be necessary for us to learn team work, by which is meant corelation of the efforts of the manufacturer merchant, banker and investor. Hitherto our bankers have been reluctant to enter the field of foreign finance; commission houses have too frequently been free lancers, pushing trade along the lines of least resistance or not in such a way as to create permanent and reliable trade. Our manufacturers have to fight single handed for their foreign trade and it is wonderful how well they have succeeded in view of the conditions of competition which they had to meet."

In referring to the possible trade conditions when the present war is ended, President Johnson said, "When the first peace negotiations begin, the uncompleted portions of all the vast volume of foreign war contracts, which are being executed in this country, will be suspended. Thousands of men will be deprived of employment, numberless inflowing streams of gold and profit will be stopped, and business of every kind will suffer a dislocation. In Europe the return of men now under arms, together with cessation of work on arms and munitions will alike affect the belligerent countries as well as ourselves, and great numbers of men will be forced to seek employment.

"Except in war stocks and automobile finance, there has been no undue financial expansion in this country. A guarantee of safety is to be found in continuing this conservative course. There can be little danger of a shortage of money after the war, because the money now employed as working capital in filling war orders will be released, and because the demands from Europe for war loans will cease. The amount of idle money will be large, until reabsorbed in legitimate enterprises at home and abroad."

The policy of selling merchandise in foreign countries at a lower figure than sold in the home market, a situation which the automobile industry has had to face for several years, was defended by Henry C. Emery, former chairman of the United States tariff board. Mr. Emery declared that selling goods in one market, such as South America, cheaper than in the home market was economically sound and that the United States Government should not hastily adopt any anti-dumping policy which might lead other nations to retaliate against the American foreign trade in manufactures, many of which are sold cheaper abroad than at home.

Dumping Not Sporadic

In his defense Mr. Emery referred to common misconceptions regarding the general policy of manufacturers in selling products lower on the foreign market than on the home market. The practice of dumping, he said, is as old as the world market, and is continuous rather than sporadic. The real danger which threatens us after the European war is not that European manufacturers will sell goods in our market below their own cost production, but that they will sell goods below our cost at home.

After pointing out several common fallacies regarding dumping, and showing that it was a natural and unpreventable form of trading as long as the world markets remained much as at present, Mr. Emery expressed disbelief in the effectiveness of most of the schemes suggested for the prevention of dumping in America after the war. He said that in his opinion the only plan was to institute a "bargaining tariff" scheme adaptable to meet constantly changing conditions. He stated that the foreign manufacturer could often get around an anti-dumping clause of the sort that have met with a good deal of favor, and that the foreign manufacturer would generally prefer a 25 per cent tariff plus an anti-dumping clause to a straight tariff of 35 per cent.

Prices in foreign markets are so low that the American exporter is largely driven by the sheer force of international competition to sell his surplus at some reduction. For this reason, the movement for an anti-dumping law will prove dangerous.

In speaking on this same subject of foreign countries selling abroad at lower prices then at home, M. A. Oudin, manager of the foreign department of the General Electric Co., said that this policy is generally followed out by foreign concerns. Export co-operation on the part of American manufacturers will lower the cost of distribution. The actual situation confronting American exporters is that there exists on our statute books federal laws which prohibit co-operation, although intended solely for the prosecution of the export trade of this country. In other words, the existing anti-trust laws enacted primarily for the benefit of the domestic consumer, by prohibiting monopoly and restraint of trade, and by increasing competition between manufacturers and producers at home, are equally applied to the regulation of our foreign commerce.

The net results are an impaired efficiency of our exporting methods and the creation of destructive competition among American manufacturers in their foreign trade. The foreign buyer is favored by frequently obtaining unnecessarily low prices; the American exporter is often injured by losses in his business, and finally our competitors have a freer field in which to operate.

Co-operation Helpful

Co-operation among manufacturers selling small articles such as automobile accessories in foreign fields was advocated by H. C. Lewis, general manager, National Paper and Type Co., New York. He referred to small accessories manufactured by a number of different manufacturers, none of which may be in sufficient demand to warrant the establishment of individual selling agencies, and all of which must meet with keen foreign competition. Such articles of constant consumption, sold at low prices, and at small profit, with prompt and regular deliveries must be the ultimate basis of the great and permanent foreign business which is desired.

Speaking on this Mr. Lewis said: "To sell our staple articles abroad and with profit requires the greatest possible efficiency and economy of operation. Competition among ourselves will necessarily increase expense and reduce profits, while co-operation in the proper spirit will give us larger business and increased profits. It must be recognized that an efficient selling organization can only be maintained at great expense, and that it must have the benefit of substantial capital to perform its functions. A small organization is not only less efficient but it necessarily has greater difficulty in raising capital needed. We are a big country and we need big business organizations to represent us abroad."

Speaking on this same subject of co-operation of smaller manufacturers in pursuing their export trade, L. S. Smith of the American Laundry Machine Co., Cincinnati, was convinced that the smaller American manufacturers should be allowed to combine to create a demand for their products in the foreign market. The smaller manufacturer will be at a decided disadvantage so long as we have to depend on the carrying of our cargoes by steamship companies owned in countries which are our most active rivals.

Gilbert H. Montague, counsellor at law, New York City, drew a vivid picture of the handicap which American manufacturers are working under because the present laws do not afford co-operation among manufacturers, with the result that American exporters are competing among themselves in foreign markets, whereas the great object should be co-operation among themselves and competition against other countries.

Here is Mr. Montague's picture: "Imagine a squad of recruits responding patriotically to the country's call for the foreign service, paying out of their own pockets for their equipment and training, studying in solitude the use of their equipment, with no assistance from the government except a correspondence course of instruction, being sent to the front with the plaudits and best wishes of their grateful country, and with a warning that if they ever fight or even drill as a co-ordinated army, or in any way accept as unrelated individuals, they will be liable when they return home to court martial and public disgrace. That is the position of our exporter to-day."

Purchasing Agents Assn. Formed

DETROIT, MICH., Jan. 26—The Purchasing Agents Assn. has been formed here, the members being purchasing agents in local manufacturing concerns. its object is both business and social. Dinners and meetings are to be arranged at which matters concerning the agents' duties and business will be discussed, such as good management of purchasing departments, scientific buying and co-operation with salesmen.

The officers elected are: P. E. Stroup, Dodge Bros., chairman; T. W. Tracy, Paige-Detroit Motor Car Co., vice-chairman; T. F. Thornton, Detroit Steel Products Co., secretary; F. W. Boynton, Packard Motor Car Co., treasurer.

Ford Detroit Plant to Be Doubled Within the Next Two Years

$10,000,000 to Be Spent on Buildings and Equipment in That Time—Output of 1,000,000 to 1,500,000 Cars a Year Is Plan—Payroll Will Approximate 100,000

DETROIT, MICH., Jan. 27—Ten million dollars, possibly a little less, probably a little more, will be expended by the Ford Motor Co., in doubling its plant here. The erection of duplicates of most of the present buildings is part of the plan, while many of the structures of the present factory will be considerably extended. New buildings and additions will cost probably more than $2,000,000, and for new machinery, tools and equipment in general, an expenditure of from $6,000,000 to $8,000,00 is expected.

If the water problem, about which the village of Highland Park must first be consulted, is solved satisfactorily, and a duplicate of the present, as yet unfinished power plant is put up, it will mean an additional expense of at least $1,800,000 which is not considered in the above figures. A working force of at least 60,000 men, and very likely 75,000 will be on the company's payroll when the revised and modernized Ford plant is in full operation. An output of not less than 1,000,000 Ford cars annually and more likely 1,500,000 will, according to officials, be a fact within a few years.

This factory extension program is entirely independent from the big Ford plants to be put up in the River Rouge and Dearborn districts where the Ford tractor plant, the steel mills and possibly the tire plant are to be located, which will require another army of at least 25,000.

Plan Well Matured

As was reported in THE AUTOMOBILE during the past year whenever purchases of land or property had been announced by the Ford company, they were the beginning of this contemplated enlargement plan. These plans might have been announced several months ago had it not been for several acres of land adjacent to the present Ford plant, concerning which negotiations had been going on for a very long time, and which were absolutely necessary to make the Ford project a possibility. These few acres of land were finally bought last December and the documents were duly signed only recently so that no announcement was possible until this matter had been settled.

The most important feature in connection with the new buildings will be the erection of a foundry in which castings for an output of at least 5000 Ford cars per day will be made.

The architects and draftsmen are still working on the plans for the many new structures, and information is thus only of a general nature at present.

The first new building to be started will be a duplicate of a six-story structure, 245 by 945 ft. on Manchester Avenue, this addition being rather an extension to this structure, its total length will thus be 1890 ft. At the end of this avenue, right near the boundary line of the Ford plant's property, another six-story building, 245 by 945 ft. is to be erected. On the Woodward Avenue side of the Ford plant, the factory building right behind the general office building, is to be extended 800 ft. to the north, giving the plant a width of about 1650 ft. on the avenue. In front of this factory extension there will be a duplicate general office building, four stories high. All the present one-story shops which extend hundreds of feet into the yards are to be enlarged so that their total length will probably be about 1650 ft., and all will be made into four-story buildings.

Price to Be Cut

Although Henry Ford did not say that there will be a great reduction in the price of the Ford car when the new plant is in operation, he let it be known in a roundabout way that the new manufacturing system, the increased production, the purchase of larger quantities of materials and other necessities, will contribute in reducing manufacturing cost and that both the company and the Ford purchaser will benefit by it.

Just how much land Mr. Ford or the Ford Motor Co. purchased in recent years is not known to outsiders. It is estimated that land purchased within the vicinity of the present parent plant totals more than 200 acres, the last of the purchases being made in December, 1915, consisting of about twenty acres and costing, it is said, about $500,000. In March, 1915, the Ford company purchased 56.7 acres of land on Woodward Avenue, almost directly opposite its plant, from the Chevrolet Motor Co., the price paid being, it is said, $580,000. Other purchases were made, it is claimed, in the vicinity. In an entirely different section of the city, or rather far from the Highland Park plant, between 700 and 1000 acres of land were purchased last year for the new steel mills, tractor plant, tire plant and workmen's city.

November Exports Are $8,322,601

5243 Cars and Trucks Shipped Abroad—1553 Trucks and 3690 Passenger Cars

WASHINGTON, D. C., Feb. 1—The tremendous increase in the export trade in automobiles in November last as compared with the corresponding month of 1914 is vividly shown in the figures just released by the statistical bureau of the Department of Commerce. Looking over the figures one finds that in November last 1553 commercial cars, valued at $3,837,307, were shipped abroad, while in November, 1914, the number was 842, and the value $2,244,518.

The passenger cars exports in November last amounted to 3690 cars, valued at $2,791,507, while in November, 1914, the number was 776, and the value $634,659. The exports of parts, not including engines and tires, amounted to $352,567 in November, 1914, and to $1,693,787 in November last.

These are the figures for the eleven months' period of 1915: Commercial cars, 20,418, valued at $55,913,713; passenger cars, 38,205, valued at $32,334,734; parts, not including engines and tires, $14,508,596. For the corresponding period of 1914 the figures are: Commercial cars, 2151, valued at $5,598,027; passenger cars, 21,038, valued at $18,523,010; parts, not including engines and tires, $5,208,090. The exports by countries are shown in the accompanying tabulation.

McLean Tire Elects Officers

CLEVELAND, OHIO, Jan. 31—The organization of the McLean Tire & Rubber Co. was completed Saturday by the election of the following officers: President, J. C. McLean; vice-president, W. B. Davis; secretary, G. W. Stewart; treasurer and general manager, T. J. Holmden. Most of the men interested in the new company are connected with the M. & M. Co., wholesale and retail dealer in accessories.

The old Morgan & Marshall Tire & Rubber Co.'s plant at East Liverpool, Ohio, purchased some time ago by the new company, will be put into operation about Feb. 15, with G. W. Greene as factory manager. It is the intention of the management to turn out about 500 complete tires per day.

R. S. Drake, Formerly Editor of "Motor World," Dies

NEW YORK CITY, Jan. 29—Roy Stannard Drake, editor of *Automobile Topics*, died yesterday morning at his home in this city of pneumonia. He was born in Cleveland and was in his thirty-sixth year. His activities in automobile journalism followed some years of work for the Cleveland *Plain Dealer*, Cleveland *Press* and the Washington *Press*, where he reported Senate affairs.

Mr. Drake later joined the advertising department of the Winton Motor Car Co., Cleveland, and following this connection he became advertising manager for the Post & Lester Co., Hartford, Conn. His automobile journalistic career began when he joined the editorial department of the *Motor World*, this city. Afterward he became editor of the *Bicycling World*. When *Automobile Topics* was purchased by F. W. Roche, Mr. Drake became its editor. He is survived by his mother and an aunt.

Packard to Boost Citizens Only

DETROIT, MICH., Jan. 31—Beginning to-day the cosmopolitan population of workers within the plant of the Packard Motor Car Co. is being told through posters and hand bills that their future advancement or promotion to any position of responsibility or trust, in fact, practically any kind of better position than that of mere factory or shop worker, will depend first of all as to whether they are or have started to become American citizens.

83,128 Cars i
Canada

1915 Registration 22,070 Mor
Cars Than in 1914—Ontario Has 36,300

OTTAWA, ONT., Jan. 31—Registratio
in Canada up to Nov. 9, 1915, amount
to 83,128, or 22,070 more than tho
registered in the same period in 191
which was 61,058. This is an increa
of 36 per cent. Ontario leads with 3
300 with Saskatchewan second, havi
11,966. Toronto leads in the cities, reg
trations with 8815, and Montreal secor
having 3917. Vancouver is a close thi
with 3719.

Last year Ontario also led with 25,0
followed by Saskatchewan with 8415 a
Manitoba with 7148.

Provinces	1914	1
Alberta	4,2f8	5,
British Columbia	6,387	9,
Manitoba	7,148	7,
New Brunswick	1,269	1,
Nova Scotia	1,701	2,
Ontario	25,020	36
Quebec	6 850	8
Saskatchewan	8,415	11,
Total	61,058	83

New Knox Tractor at $5,000

SPRINGFIELD, MASS., Jan. 31—
Knox Motors Associates have produ
an entirely new type of Knox trac
although mechanically it is practic
identical with the standard chassis.
new tractor is designed to operate as
independent unit, to haul four-whe
trailers and is equipped with a wincl
exceptional power. The new produc
called the Knox towing winch trac
and is intended, according to the K
company, for special service, such
pulling loads of lumber up onto t
ers, subsequently to be hauled
the tractor, where the tractor may
only haul heavy loads of equipment,
with its winch assist in erecting the
tops. It is especially adapted to app
tion where the roads are unusu

Exports of Automobiles, Trucks, Parts and Tires for November and 11 Previous Months

	November				Eleven months ending November			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	V
Commercial	842	$2,244,518	1,553	$3,837,307	2,151	$5,598,027	20,418	$55.9
Passenger	776	634,659	3,690	2,791,507	21,038	18,523,010	38,205	32.3
	1,618	$2,879,177	5,243	$6,628,814	23,189	$24,121,037	58,623	$88.2
Parts (not including engines and tires)	......	352,567	.....	1,693,787	......	5,208,090	......	14.5
Total	......	$3,231,744	.....	$8,322,601	.....	$29,329,127	......	$102.
BY COUNTRIES								
France	695	$1,714,145	698	$1,848,965	1,847	$2,510,830	5,881	14.
Germany	......	....	.....	....	1,063	799,552	4	
Italy	2	8,360	16	9,973	235	160,058	226	
United Kingdom	404	683,496	1,534	1,706,832	5,949	5,794,504	22,989	33.
Other Europe	22	24,256	520	1,054,410	2,758	3,381,664	8,022	21.
Canada	105	133,103	210	209,684	4,086	5,158,081	5,448	4.
Mexico	8	14,300	21	18,261	81	101,684	109	
West Indies and Bermuda	84	63,004	315	201,808	550	457,346	2,940	1.
South America	100	47,380	322	221,252	1,063	822,884	2,786	1.
British Oceana	115	113,638	832	662,124	3,190	2,732,850	4.426	3.
Asia and other Oceana	67	69,428	491	491,891	1,362	1,309,764	3,736	5.
Other countries	16	8,067	284	203,614	1,005	891,820	2,056	1.
Total	1,618	$2,879,177	5,243	$6,628,814	23,189	$24,121,037	58,623	$88.

bad, so that with wheel traction alone the **vehicle** is apt to become mired, when the **winch** may be used to extricate it.

It has a very large sprag which is intended to be dropped when the winch, **which** is placed on the rear deck, is in **use.** Between the cab and the winch **there** is a short body designed to carry a **load** up to 3 tons to aid in securing traction. The usual Knox spring suspension **is** departed from, since the frame extends back as in an ordinary truck and **is** suspended on half elliptics.

It may be equipped with either standard wood wheels and dual solid tires or **with** steel wheels with diagonal lugged **treads.** It is priced at $5,000, f.o.b. Springfield.

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Chalmers 6-40 to Sell for $1,450 After March 1

DETROIT, MICH., Jan. 26—Because it now costs $118.22 more in raw material to build the Chalmers 6-40, the Chalmers Motor Co. decided to-day that the price of this model, which now is $1,350 f.o.b. Detroit, will be $1,450 beginning March 1. All orders received up to midnight, Feb. 29, will be filled at the old price, or $1,350.

To illustrate the increase in price of materials the Chalmers company says that high-speed steel which formerly cost $1.05 per pound is now quoted at $3.35 per pound. Vanadium steel which sold at $1.85 per pound a year ago now costs $8.50 per pound. Aluminum selling at 19 cents per pound three months ago is now quoted at 53 cents; copper has nearly doubled in price, selling at 24 cents or more now as against 14 cents per pound some time ago. Leather, which formerly cost 20 cents per foot, has been selling at 33 cents per foot, etc.

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Harroun to Make Aero Motors

CHICAGO, Jan. 31—Ray Harroun, who has been identified with the motor car industry as a race driver, inventor of a kerosene carbureter and chief engineer of the Maxwell Motor Co., is about to put his versatility to a further test. During the week of the Chicago motor show, Harroun announced that he had severed his connections with the Maxwell company, with which he has been identified for the past two years, and that he would open a shop in Detroit where he will develop and ultimately manufacture on a commercial basis a popular-priced aviation motor. Richard Miles, who has been assistant to Harroun on the Maxwell staff, succeeds him in the position of chief engineer.

In addition to his aviation motor work, Harroun will construct a special racing car that he guarantees will cover a lap of a 2-mile speedway in less than 1 min. It will be a stunt car and not eligible for the regular speedway events, having a piston displacement of over 300 cu. in.

Liberty Motor Car Co. Incorporated

Secures Plant of R-C-H Co.—Percy Owen President and General Manager

DETROIT, MICH., Feb. 1—Several men of prominence in the motor car industry here have incorporated the Liberty Motor Car Co. with a capital stock of $400,000 to manufacture a low-priced car. Negotiations have progressed to the extent of securing the plant formerly occupied by the R-C-H Corp.

Percy Owen, who until recently was vice-president and sales manager of the Saxon company, and prior to that held the position of general sales manager with the Chalmers company, heads the new Liberty organization, and is also the general manager, and he has associated with him James F. Bourquin as vice-president. The latter was formerly general manager of the Paige-Detroit company and previously was superintendent of manufacturing of the Chalmers company. The Liberty engineer is R. E. Cole, who was the Saxon engineer, and H. M. Wirth, also a former Saxon man in the capacity of purchasing agent, will have similar duties with the Liberty. There are said to be several other men well known in the trade interested in the new concern.

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Goodrich Statement Shows Good Profits—Officers Elected

AKRON, OHIO, Jan. 29—The directors of the B. F. Goodrich Co. at their annual meeting yesterday declared a quarterly dividend of 1 per cent on the common stock, payable Feb. 15 to stock of record Feb. 5 and a dividend of 3½ per cent on preferred, payable 1¾ per cent on April 1 to stock of record March 21, and 1¾ per cent on July 1 to stock of record June 20. No dividend has been paid on Goodrich common since the close of 1912.

B. G. Works was re-elected president of the corporation, W. O. Rutherford, formerly assistant sales manager, goes up a step higher, being made sales manager, succeeding H. E. Raymond, who becomes a vice-president. Mr. Raymond's position as second vice-president was abolished and he becomes a vice-president. He will continue in charge of sales, advertising and selling policy. The office of general manager, held by A. H. Marks, has also been abolished and he becomes a vice-president, but retains his duties as works manager. The duties of Mr. Marks are confined to general supervision of costing, compounding, development and construction. E. C. Shaw, formerly second vice-president, becomes another of the vice-presidents.

The net profits for 1915, after making proper provision for maintenance, charges, depreciation, bad debts and other items, amounted to approximately $12,200,000. This amount, added to the surplus carried over as of Dec. 31, 1914, of $3,100,000, shows undivided profits of approximately $10,500,000 after deducting the four quarterly dividends of 1¾ per cent on preferred stock outstanding, together with a provision of $1,100,000 for the redemption of preferred stock, and a further amount of $1,700,000 set aside for various reserves, which are shown in detail in the annual report.

In its statement the company claims an improvement during the past year in its financial position, as the amount of quick assets over current liabilities shows a gain of approximately $8,100,000. The current assets amount to approximately $31,250,000, and the current liabilities to $4,200,000.

The directors voted to retire 7000 shares of preferred stock prior to July 1, 1916. This makes a total retirement of 27,000 shares, covering the charter provision for retirement of preferred stock up to July 1, 1916. In regard to its sales in 1915 the company states: "While the directors are highly gratified over the results of 1915, they have taken into consideration that a part of the increased earnings for the year were due to causes which may not be permanent.

The preliminary statement appears herewith.

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Knight Re-elected President

CANTON, OHIO—J. F. Knight was re-elected president of the Knight Tire & Rubber Co. at its annual meeting, held recently.

C. H. Knight was re-elected treasurer and C. T. Carlson was re-elected secretary. The balance of the board members remains the same as last year with the exception of Howard Fawcett, who was elected a director.

B. F. Goodrich Co.'s Preliminary Statement for 1914 and 1915

	1915	1914	Changes	
Net profits	*$12,200,000	$5,440,427	Inc.	$6,759,573
Preferred dividends	2,000,000	2,068,500	Dec.	68,500
Balance	$10,200,000	$3,371,927	Inc.	$6,828,073
Per cent on common stock	17.00	5.62	Inc.	11.38
Preferred stock redemption	1,100,000	900,000	Inc.	200,000
Various reserves	1,700,000	......	Inc.	1,700,000
Previous surplus	3,100,000	705,982	Inc.	2,394,018
Total surplus	$10,500,000	$3,177,910	Inc.	$7,322,090

*Approximately.

F. W. D. Capital To Be $500,000

Increase from $250,000—100% Stock and 30% Cash Dividends

Clintonville, Wis., Jan. 31—Prosperous conditions were reflected in the annual report made to stockholders of the Four Wheel Drive Automobile Co., Clintonville, Wis. Although more than $100,000 was invested in buildings, additions and equipment during 1915, the company declared a stock dividend of 100 per cent and a cash dividend of 30 per cent. The capital stock is to be increased at once from $250,000 to $500,000, and the additional issue distributed among present stockholders. The 30 per cent cash dividend is based on a capitalization of $250,000. The Four Wheel Drive company now has an investment of approximately $200,000. A large amount has been set aside for further purchases of equipment and additions as necessary.

At the annual meeting, W. A. Holt, Oconto; A. W. Priest, Appleton, and J. Kalmes, Clintonville, were re-elected directors. Officers were re-elected as follows: President, W. A. Olen; vice-president, John Kalmes; treasurer, David Rohrer; secretary, Frank Gause. The directors presented a check for $1,000 to President Olen as an appreciation of his services during the past year.

Another Price Control Bill

Washington, D. C., Jan. 29—Accessory dealers will be interested in a bill introduced in Congress by Senator Ashurst of Arizona to protect the public against dishonest advertising and false pretenses in merchandising. One provision of the bill is that in any contract of sale by a producer of articles to any wholesale or retail dealer, where the contract constitutes interstate commerce, the producer shall have the right to prescribe the uniform prices and manner of settlement at which the different qualities and quantities of each article covered by the contract may be sold. Special provision is made, however, against monopoly or the control of the market for articles belonging to the same general class. The producer or vendor must file with the federal trade commission a statement regarding his contracts for sale and the scale of prices, and he must pay a fee of $10 for registration of such contracts with the commission. The bill was referred to the committee on interstate commerce.

Four Shares Chevrolet Equals One General Motors

New York City, Jan. 29—The Chevrolet-General Motors Syndicate announces that the offer of exchange on the basis of five shares of Chevrolet for one share of General Motors common was closed on Jan. 25. Offerings will be considered hereafter at not to exceed four shares of Chevrolet for one share of General Motors common. General Motors common is earning about $140 per share, and Chevrolet at the rate of $25. The additional Chevrolet shares which will be issued will pass into the strong interests which at present control General Motors, and little, it is stated, is likely to find its way to the market.

Republic Tire Prospers

Youngstown, Ohio, Jan. 28—Republic tire sales increased 69 per cent in 1915 over the previous year, according to a report from the Republic Rubber Co., this city, which held its fifteenth annual meeting last week. Taking all departments into consideration, the company had more business on its books Jan. 24 than on any date in its history and prospects are good. The usual cash dividends at regular rates were declared. The old officers were re-elected as follows:

President, T. L. Robinson; vice-presidents, L. T. Petersen and J. H. Kelly; secretary, C. F. Garrison; treasurer, M. I. Arms, 2nd.

There were two additions to the board of directors, as follows: H. M. Garlick, president of the Standard Oil Cloth Co., and R. E. Cornelius, president of the Mahoning National Bank.

David Tod, who has been on the board for some years was not re-elected, at his own request. The board of directors is as follows:

M. I. Arms, Robert Bentley, C. H. Booth, J. H. Kelly, L. T. Petersen, T. L. Robinson, John Tod, H. K. Wick, J. C. Wick, H. M. Garlick and R. E. Cornelius.

Rubber Prices Are Lower

New York City, Feb. 1—Tire prices are higher, while crude rubber quotations are lower. Yesterday fine up-river Para dropped 6 cents a pound to 73, as did Ceylon, first latex pale crepe, which closed at 75. The market as a whole is weak and quiet. Prices have fallen sharply from the recent high level, but manufacturers show no disposition to purchase any more than they are compelled to. A considerable increase in the arrivals of crude rubber was reported last week, and in the absence of any improvement in the demand the market weakened.

Notwithstanding the rise of 1 cent a pound in copper yesterday, the producers were not inclined to sell, as higher prices, it is stated, are in view. Lead has risen to $6.15 per 100 lb., and predictions are made that it will advance to $6.25 before the end of the week. Aluminum remained constant throughout the week at 53 cents a pound.

Steel prices remained unchanged. It is stated that automobile manufacturers are holding off orders under the present quotations. Bessemer is quoting at $32 a ton, while open-hearth is at $33. The makers are fighting for lower quotations. It is said that contracts placed last year by the automobile builders were exceptionally large, and some of this stock will tide them over.

A rise in petroleum again occurred last week. On Wednesday Kansas crude rose 5 cents a barrel to $1.30, and on Friday Pennsylvania crude rose 10 cents a barrel to $2.35. Gasoline prices are still quoting at 22 cents.

Sterling Motor Capital $705,000

Detroit, Mich., Jan. 29—The Sterling Motor Co., which makes the Sterling four and eight-cylinder motors, has increased its capital stock from $310,000 to $705,000.

Ford Opens Sales Convention

Detroit, Mich., Jan. 31—The most important convention of assembling, service and sales branch managers and assistant managers of the Ford Motor Co., began to-day at the parent plant. It is expected that about 100 or nearly

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.53	.53	.53	.53	.53	.53	...
Antimony	.42½	.42½	.42½	.42½	.42½	.42½	...
Beams and Channels, 100 lb	2.17	2.17	2.17	2.17	2.17	2.17	...
Bessemer Steel, ton	32.00	32.00	32.00	32.00	32.00	32.00	...
Copper, Elec., lb	.25	.25	.25	.25	.25	.26	+ .01
Copper, Lake, lb	.25	.25	.25	.25	.25	.26	+ .01
Cottonseed Oil, bbl	9.50	9.20	9.15	9.18	9.17	9.15	— .35
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.51	.51	.51	.51	.51	.51	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.22	.22	...
Lard Oil, prime	.94	.94	.94	.94	.94	.94	...
Lead, 100 lb	6.10	6.10	6.10	6.10	6.10	6.15	+ .05
Linseed Oil	.73	.74	.74	.74	.74	.74	...
Open-Hearth Steel, ton	33.00	33.00	33.00	33.00	33.00	33.00	...
Petroleum, bbl., Kansas, crude	1.25	1.30	1.30	1.30	1.30	1.30	+ .05
Petroleum, bbl., Pennsylvania, crude	2.25	2.25	2.25	2.35	2.35	2.35	+ .10
Rapeseed Oil, refined	1.00	1.00	1.00	1.00	1.00	1.00	...
Rubber, Fine Up-River, Para	.82	.79	.78	.79	.79	.73	— .09
Ceylon, First Latex Pale Crepe	.88	.87	.80	.81	.81	.75	— .13
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	42.38	42.00	41.88	41.75	41.75	41.88	—.50
Tire Scrap	.05¼	.05¾	.05¼	.05¾	.05¼	.05¼	...

all of the higher officials having charge of sales and service of the Ford company throughout the country will take part in the week's proceedings.

There will be addresses, talks and discussions, on every subject which has some bearing on the Ford business. The men will be given particulars about the project of enlarging the plant, the question of increased output, the situation of the trade in general. The views of the branch mangers will have much to do with possible changes in selling policies, service matters, etc.

Maccar Directors Elected

SCRANTON, PA., Jan. 31—The annual meeting of the Maccar Auto Co., this city, was held yesterday, at which the following directors were elected: Worthington Scranton, C. H. Genter, Oscar Kleeman, A. B. Warman, W. E. Bittenbender, George Stevens, W. M. Gardner, W. A. Christ, E. S. Williams, P. L. Sylvester and L. M. Connell, who acted as secretary of the meeting.

New Starter Co. Formed

GRAND RAPIDS, MICH., Jan. 31—The Wolverine Starter Co. has been organized here with a capital stock of $10,000. A starting device attachable to any machine will be manufactured. J. Frank Carter, patentee, is president of the company.

Dividends Declared

Avery Co.; 7 per cent on preferred, payable Feb. 1 to stock of record Jan. 26. This cleans up four accumulated quarterly dividends of 1¾ per cent and leaves back dividends of 5¼ per cent.

Security Prices Drop

General Motors Goes Down 26 Points—Overland Drops 20 Points—Reo Higher

NEW YORK CITY, Feb. 1—A general decline in automobile and accessory issues occurred in the local Stock Exchange last week. Only a few of the issues showed substantial gains, these being Reo truck and car, with gains of 3¼ and 1½ points respectively, and Miller Rubber common, with 10 points. The rest of the gains were for the most part fractional.

General Motors Weak

The declines ranged from 1 to 26 points. General Motors, after showing a flash in the pan last week with a 21-point gain, dropped this week 26 points. Chevrolet sympathetically dropped with General Motors 7 points to 125. Maxwell was steady during the week. Studebaker common dropped 8¾ points. Willys-Overland common dropped 20 points. Incidentally this stock, after reaching a high mark of 268 in 1915, has shown no further tendencies to rise, but has gradually gone down, after the announcement of a new stock issue for the Studebaker company. Shortly afterward came the announcement of a new issue of Overland preferred stock. At the early part of this week the stock went below the 200 mark, or about 69 points below the high mark. Three-quarters of the $15,000,000 issue of convertible 7 per cent cumulative preferred stock has been subscribed for. The balance of the new issue is now being offered to the public at 106 and accrued dividend. These notes are preferred as to both assets and earnings and are redeemable as a whole or in part at the option of the company on 60 days' notice at 110 and accrued dividends on April 1, 1917, or any dividend date thereafter.

The Chalmers company has offered to shareholders the right to subscribe at par to $500,000 new 7 per cent cumulative preferred stock. The company had $2,000,000 preferred stock authorized and $1,500,000 was issued, of which somewhat more than $300,000 had been retired by sinking fund. The offering has been underwritten.

Detroit Exchange Makes Record

Quotations on the Detroit Exchange last week were higher. With the exception of a 22½-point drop in General Motors common and a 6¼-point drop in Studebaker common, the general tone of the market was better than in previous weeks. Continental Motors rose 25 points, as did Packard common.

On the Detroit Stock Exchange all previous sales records were broken Wednesday, when a total of 9850 regularly listed shares of stock, also $13,000 of listed bonds, were sold. Of the 9850 shares which changed hands, 4018 were Reo Motor Truck Co.'s shares, 2780 were Reo Motor Car Co.'s shares and 1585 were Maxwell Motor Co.'s common shares. The active transactions in the Maxwell shares was due to a rumor that a dividend would soon be announced for the Maxwell second preferred stock.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	69½	70	—1¼
Aluminum Castings, pfd	95	100	..	..	..
J. I. Case pfd	79	81	86	88½	..
Chalmers Motor Co. com	..	96	120	150	..
Chalmera Motor Co. pfd	90	93½	100	102	..
Chevrolet Motor Co	..	..	125	126	—7
Electric Storage Battery Co	..	..	61	63	—2
Firestone Tire & Rubber Co. com	370	375	730	..	..
Firestone Tire & Rubber Co. pfd	109	111	112	..	..
General Motora Co. com	92	93	460	480	—26
General Motors Co. pfd	93	95	111½	112¾	—½
B. F. Goodrich Co. com	31½	32	69	70	—2⅛
B. F. Goodrich Co. pfd	114	114½	111½	113	+1½
Goodyear Tire & Rubber Co. com	190	195	337	341	—1
Goodyear Tire & Rubber Co. pfd	101½	103	115½	116½	+1½
International Motor Co. com	..	1	22	26	—1
International Motor Co. pfd	..	10	38	45	..
Kelly-Springfield Tire Co. com	99	101	288	290	—8
Kelly-Springfield Tire Co. com. (new)	..	..	72	73	—2⅝
Kelly-Springfield Tire Co. 1st pfd	82	82½	95	97	..
Kelly-Springfield Tire Co. 2d pfd	115	117	72½	73	— ½
Maxwell Motor Co. com	17	17⅜	67	69	+ ½
Maxwell Motor Co. 1st pfd	54½	55	87	88	—1¼
Maxwell Motor Co. 2d pfd	20¼	20¾	51½	53	—1½
Miller Rubber Co. com	158	163	270	275	+10
Miller Rubber Co. pfd	102	103	113	115	..
New Departure Mfg. Co. com	..	..	176	182	..
New Departure Mfg. Co. pfd	..	..	111	..	..
Packard Motor Car Co. com	..	100	157	170	—5½
Packard Motor Car Co. pfd	93	..	102½	104½	+ ½
Paige-Detroit Motor Car	..	..	..	700	..
Peerless Motor & Truck Corp	..	..	27	28	—11½
Portage Rubber Co. com	30	36	70	72	..
Portage Rubber Co. pfd	80	85	102	106	..
Regal Motor Co. pfd	..	..	11½	..	..
*Reo Motor Truck Co	12	12¾	28¼	29	+3¼
*Reo Motor Car Co	25	25¾	33½	34½	+1½
Splitdorf Electric Co. pfd	69	71	..	..	..
Stewart-Warner Speed. Corp. com	50	50½	88	90	..
Stewart-Warner Speed. Corp. pfd	100	103	108	..	..
Studebaker Corp. com	40½	41	145	146	—8¾
Studebaker Corp. pfd	93¼	95	110	112	..
Swinehart Tire & Rubber Co	69	71	87	89	..
Texas Co.	131	135	196	198	—13
U. S. Rubber Co. com	56¼	56½	49	51	—5½
U. S. Rubber Co. pfd	101¼	102	106½	108	+ ¼
Vacuum Oil Co	195	198	223	227	—7
White Motor Co. (new)	..	..	50¾	51	+1¼
Willys-Overland Co. com	91	93	201	203½	—20
Willys-Overland Co. pfd	94	96	104½	106	—5½

*Par value $10.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Chalmers Motor Co. com	..	94	..	145	..
Chalmera Motor Co. pfd	90	93½	100	102½	..
Continental Motor Co. com	175	200	..	300	+25
Continental Motor Co. pfd	80	..	91	..	..
Ford Motor Co. of Canada	475	..	400	415	+5
General Motors Co. com	92	94	445	475	—22½
General Motors Co. pfd	92½	96	111	114	— ¾
Maxwell Motor Co. com	16	18	66½	69½	+1½
Maxwell Motor Co. 1st pfd	53½	55½	86	89	— ½
Maxwell Motor Co. 2d pfd	20	21	52	55	+1
Packard Motor Car Co. com	..	100	165	..	+5
Packard Motor Car Co. pfd	93	..	..	104½	..
Paige-Detroit Motor Car Co	..	..	..	700	..
*Reo Motor Car Co	24½	25¼	33¾	34½	+1½
*Reo Motor Truck Co	11½	12⅛	27	28	+ ¾
Studebaker Corp. com	41½	43½	146	150	—6¼
Studebaker Corp. pfd	92½	94½	110	114	..

INACTIVE STOCKS

*Atlas Drop Forge Co	..	25	32⅛	..	+ ¼
Kelsey Wheel Co	185	..	300	..	+5
*W. K. Prudden Co	19	19¾	32½	..	— ½
Regal Motor Car Co. pfd	..	25	11½	..	+1½

*Par value $10.

Buffalo Show Indicates Prosperity

Expanding Industries In and Near Buffalo Foster Strong Demand for Automobiles

BUFFALO, Jan. 28—The show which closed Saturday night was the fourteenth annual affair and was staged by the dealers' association which is composed of some twenty-eight members who represent the cream of the industry in the city. It was strictly a business show and was very largely attended by dealers from Western New York, many of whom brought their prospects with them and closed sales on the floor.

In general, business is in a flourishing condition throughout the Buffalo territory and this is particularly the case in Buffalo itself. As an example in point, industrial deals closed within the past thirty days indicate, on conservative estimates, on four projects alone a total expenditure of nearly $9,000,000 for building operations. During the past five years there have grown in Buffalo an average of ninety-five new industries per year, or 475 for the period. For comparison, the total increase in new industries in Albany, Syracuse and Rochester combined for the same five-year period is given as 128. All this industrial development in Buffalo has taken place since 1910, for, prior to that year, the city gained only twenty-seven new industries per year. Furthermore, this great growth has been solely within the city limits and does not take into account a number of large industrial interests which have located just without the city border.

As indicating the financial importance and buying power of the city, the latest United States census figures are illuminating. The capital invested in 1914 was $243,311,000, a gain of $50,270,000, or 26 per cent, over $193,041,000 in 1909. The value of products is given as $251,103,000 in 1914, as against $218,804,000 in 1909, the increase being $32,299,000 or 14.8 per cent. A comparative summary for the city for 1909 and 1914 is given in the accompanying table.

Bank Deposits High

The purchasing power of the city is well indicated by the bank clearings for the past five years when the total for all banks was $2,825,000,000, an average of $565,000,000 a year. In the preceding five years the average per year was only $411,000,000. The total deposits in Buffalo banks in the past five years has averaged $220,000,000 per year as against $154,000,000 per year for the preceding five years. In other words, the average annual increase in deposits during the past five years has been $66,000,000 as compared with the previous five years.

That portion of New York State which is controlled by Buffalo dealers is an important agricultural center, the principal products being fruit, mixed farming and dairy products. Grain also constitutes a fairly large portion of the State's agricultural productions, though the totals, of course, are not as impressive as those for some of the Western States. A comparison of the productions for the years 1913 and 1914 is given in the accompanying table.

Big Grain Receipts

The total amount of grain receipts coming into Buffalo in 1915 was 210,000,000 bushels. Of this amount 29,641,000 bushels is at present in storage in 100 ships in the harbor. The industrial importance of these grain shipments becomes apparent when it is stated that the item of labor alone for unloading these ships amounts to $1,795,500. Of this amount $745,500 goes directly to labor and the balance to the elevators. Another important feature is that in the spring there will be a total of from 150 to 160 ships in Buffalo harbor which will fit out there at an average outlay of $5,000 per boat, giving a total expenditure of $750,000. This is a conservative estimate in view of the fact that for the past three years ship owners have kept down outfitting expense to the minimum owing to lack of business, but 1915 having been a prosperous year more money will be spent this year.

A Navigation Center

How the importance of Buffalo, as a navigation center, has increased is shown by the fact that the number of ships arriving and departing from the port in 1905 was 8200 with a tonnage of 12,000,000. In 1910 the total number of ships dropped to 7400 but the tonnage went up to 14,000,000. In 1913 there were upwards of 10,000 ships with a tonnage of more than 19,000,000 and in 1915 the number of ships was 7255 and the tonnage had gone up well above 19,000,000.

The average Buffalo dealer covers eight counties in Western New York, including Genesee which, in the majority of cases, is the Eastern boundary. This territory has a total population of 1,008,572 and includes Niagara, 108,419; Erie, 567,347; Chautauqua, 116,575; Cattaraugus, 68,477; Alleghany, 40,216; Wyoming, 33,082, Genesee, 40,296; Orleans, 34,160. Some of the larger distributers have several other counties in addition and in some cases territory extends into Pennsylvania, including several counties across the border.

Buffalo, which is in Erie county, has a population of 454,630, according to the 1915 state census, and population figures have shown a consistent increase as follows:

1865	94,210
1875	134,557
1890	255,654
1892	278,727
1900	352,387
1905	376,587
1910	423,715
1915	454,630

According to the Secretary of State's office, there are at present about 13,250 cars in Buffalo. Registration figures for the 22 counties west of Onondaga show that for 1915 there were 72,874 cars in this territory. Up to Jan. 24, 1916, there had been registered 13,842 cars, and, as compared with the same period last year, this represents a gain of about 33 1/3 per cent.

According to some of the larger distributers, Buffalo dealers are taking cars freely at the present time, though there seems to be some hesitation in some quarters to stocking them during the winter months. This is being overcome, in some cases, by the distributer financing the dealer. One distributer, for example, agrees to carry his dealers for one car for every one they will buy, and this seems to be working out well.

It is stated that the rise in cost of gasoline—the present retail figure in Buffalo is 23 cents—has had a noticeable effect on the used car market, which is described as being very tight. It is hoped that there will be little, if any, effect on the new car market.

Electrics are selling more freely now than has been the case for several years, though the buying is confined almost entirely to pleasure cars. There are very few electric commercial vehicles in use in Buffalo, and there has been little, if any, attempt to push their sales.

One noticeable feature of Buffalo conditions is the marked tendency toward the use of trailers, particularly by the farming communities within a radius of 50 or 60 miles of the city.

Exact figures on the attendance at the show are not available, though it is estimated that the total probably will exceed 60,000 for the week.

Anderson Returns from Norway

CHICAGO, Jan. 31—Gil Anderson, winner of the Vincent Astor cup race, returned unexpectedly last week from Norway, where he has been for the last two months visiting relatives and touring his native land, and Sweden and Denmark as well. Anderson has made no racing plans for this season and if Harry Stutz sticks to his determination not to compete, the Norseman probably will be a spectator instead of a contender. He is now back at work in the Stutz factory.

To Build Premier Racers

Two Cars to Be Made for Hoosier Speedway Owners —Make Peugeot Parts

INDIANAPOLIS, IND., Feb. 2—The Premier Motor Corp. of this city will build this season two racing cars for the owners of the Indianapolis Speedway.

Although it was announced last week that the local speedway magnates would add two American-built mounts to their stable of four Maxwells and two Peugeots, the Hoosiers at that time refused to reveal the identity of the maker.

The arrangement with the Premier company was made possible by the fact that the concern has just been reorganized and is not ready as yet to start quantity production. Until plans for a manufacturing and merchandising campaign are completed, the company will have sufficient time to work on the special racing jobs.

In addition to building the two new cars, the Premier plant will turn out spare parts for the Peugeots, driven by Howdy Wilcox and Johnny Aitken in the Vincent Astor Cup event at New York in October. Several replacements are to be made in the French mounts before they can be campaigned, and it is impossible to obtain parts in war-ridden Europe.

Tractor Shows for Minneapolis and Kansas City

CHICAGO, ILL., Feb. 1—For the first time agricultural motor implement manufacturers are going to exhibit during the same week of the automobile show in Minneapolis and Kansas City. At Minneapolis a tractor exposition is being held this week across the street from Frederick Murphy's Mitchell agency. In Kansas City the exhibition next week is known as the first annual tractor show and will be staged under a huge tent placed in the Union Station Plaza. In this tent, 365 ft. long and 75 ft. wide, are twenty-six exhibition spaces, all of which have already been taken, and it is expected that thirty different makes of farm tractors will be on exhibition. In addition there will be a good exhibit of accessories for tractors.

The tractor show is being staged by the Tractor Club.

Indiana Service Managers Meet

INDIANAPOLIS, IND., Jan. 31—The midwinter meeting of the Indiana Automobile Service Managers' Association was held at the Severin Hotel Saturday, Jan. 15.

Papers were presented by F. E. Moskovics, commercial manager of the Nordyke & Marmon Co., on The Effect of the Service Department on Eventual Motor Car Design, and by Mr. Fox of the Cole Motor Co. entitled Automobile Electric Systems.

During the business portion of the meeting it was voted to amend the constitution so as to provide for a committee of standards, something along the line of the standards committee of the S. A. E. Three lines of work were recommended:

First, the adoption of a standard form for reporting complaints.

Second, the standardization of the size of information books and parts lists, both of automobile manufacturers and accessory manufacturers, so that the books which go out with the cars shall be of uniform size and shape.

Third, the recommendation to the N. A. C. C. with regard to a system whereby the N. A. C. C. shall make a list of accredited garages throughout the United States for the benefit of motor car manufacturers as well as owners.

The standards committee appointed is as follows: H. W. Cotton, McFarland Motor Co.; Mr. Blywise, Premier Motor Corp.; R. J. Elston, Wescott Motor Car Co.; J. D. Hopper, Remy Electric Co.; G. C. W. Breithwaite, Apperson Automobile Co.

San Francisco Has First Truck Show

SAN FRANCISCO, CAL., Jan. 25—San Francisco's first motor truck show opened to-day. The large Palace ballroom floor space was all taken by northern California truck dealers and factory representatives. Space has been taken by practically every truck now being sold on the Pacific Coast.

Among the power wagons on exhibit is the new Doane truck, a power vehicle of local manufacture which has but recently made its appearance. This truck is a low hung type which has attracted a great deal of attention locally already. The new Golden West Quad designed and built at Sacramento, Cal., is another feature card at the show. This four-wheel-drive and steer commercial car is expected to make great progress in California, where the excellent highways are proving daily the efficiency of the modern motor truck.

The Moreland Distillate truck of Los Angeles manufacture is well represented, a full line being on display. The Moore, built at Torrance, Cal., is also shown at the exhibit. Among the trucks of Eastern manufacture is the Denby, G. M. C., Reo, Dart, Metz, White, Hewitt-Ludlow and others. The railroad companies have granted excursion rates and the truck show is considered a real success. The truck dealers have agreed that if the show is a success, it will become an annual affair.

Shorter Races for Sioux City

300-Mile Contest Replaced by 50 and 100-Mile Events —Prizes $15,000

CHICAGO, ILL., Feb. 2—The 300-mile race, which the Sioux City Speedway Association has promoted for the past two years, will be abandoned this season and two events, one of 100 and the other of 50 miles, will be substituted. There will be no cut in the total prize money, however, as $15,000, the amount hung up last year, will be offered again in 1916.

The Sioux City promoters have come to this decision because they believe that the spectators demand more action than is provided by a 300-mile event.

Sioux City plans to stage two meets for non-professionals later in the season. One meet will be for small cars, such as Ford, Maxwell and others, while the other will be a free-for-all. The races will be run under rules similar to those drafted for the amateur drivers' event to be run on the Chicago speedway May 20.

Stutz in Corona Race

CHICAGO, ILL., Feb. 1—Earl Cooper will drive the fastest of the four Stutz cars, in the Corona grand prize that will be run on the circular asphalt course of the California city March 17.

Although Harry Stutz, the builder of the mounts, announced in the fall that he would not permit any of the cars to compete this season, it became known to-day that Cooper made a secret trip to Indianapolis three weeks ago to secure a Stutz for the Corona race and that he was successful. The car has been overhauled and tuned up and now is en route to the Pacific Coast.

Bob Burman will be another contender at Corona. He arrived from Los Angeles last week to attend the Chicago show. With the assistance of Harry Miller, he has overhauled his Peugeot on the pacific Coast and says that the French car is now in the pink of condition for a hard campaign.

Portland Concludes Successful Show

PORTLAND, ORE., Jan. 29—The seventh annual dealers' show closed here to-night, having been visited by about 20,000 persons during the week. Ninety-one passenger cars were exhibited in addition to a number of trucks and a good range of accessories. Simultaneously with the show, two dealers who had opposed the show idea at its commencement, staged a "salon" at the Multnomah Hotel, exhibiting fifteen passenger cars. As a special attraction they had the original Packard built sixteen years ago.

N. A. T. A. Formed By Dealers

New Body Succeeds Associated Garages of America—Has Strong Financial Plan

CHICAGO, Jan. 27—For the purpose of promoting better conditions in the automobile trade field, the National Automobile Trade Association was formed in this city to-day. Its membership is made up of automobile dealers and garagemen, and it also provides for the membership of those who operate repair shops, automobile machine shops, supply stores, tire stores, tire repair shops, and other similar businesses.

It is a successor to the Associated Garages of America, which was formed a year ago by leaders of the garage trade in Illinois. The latter organization did not move forward rapidly because of a lack of finances; the new organization, however, has a strong financing plan, and with a corps of about twenty organizers, will be able to establish a strong membership in a comparatively short time.

Robert A. Wilson of this city who has been engaged in insurance work has been made Secretary and takes full charge of reorganization. The president is Robert Bland of Evanston, who was elected one year ago to serve two years. The treasurer is F. A. Bean of Detroit.

The Associated Garages of America whose name has just been dropped had a membership of 1420, made up as follows: Iowa Retail Dealers' Association, 800; Garage Owners' Association of Illinois, 300; Garage Owners' Association of Michigan, 150; Garage Owners' Association of Ohio, 100; San Francisco Garage Owners' Protective Association, 70. Aside from these there are throughout the country scores of local and territorial associations which may later become interested in the new national body.

The new association proposes to extend its co-operation to the National Automobile Chamber of Commerce, the Motor and Accessory Manufacturers, the National Association of Automobile Accessory Jobbers, and the various car owner organizations throughout the country, in an effort to promote the best interest of the automobile industry from top to bottom. As a first step in its work the convention to-day was visited by a committee from the jobbers' association. The jobbers and the retail organization discussed one or two points of difference and it was discovered instead of being points of difference they were points of misunderstanding, and harmony prevailed at the close of the conference. Henceforward each organization will have a committee for co-operative work of this kind.

The retail association voted a protest to manufacturers against the practice of selling automobiles to consumers at the dealer's price in localities where the manufacturer has no dealer. This practice is said to be common with several manufacturers and the matter will be taken up with the National Automobile Chamber of Commerce.

Another practice condemned is the appointment of one-car dealers, men who are sold one car, given a dealer's contract, but who never buy any more cars. A vote of thanks was extended to those manufacturers who have announced that they will discontinue bringing out their new models in the middle of the summer. The next national convention will be held in Cincinnati in March, 1917, but in the meantime several State conventions will be held as the organization work progresses.

Newark Stamping Co. in Merger

NEWARK, OHIO, Jan. 29—The Newark Stamping Co., manufacturer of Thompson hose clamps, will merge into a new corporation to be known as the Newark Stamping & Foundry Co., taking over the Moser Pattern & Foundry Co. and the Huffman Plating Works, all of this city. The company will be capitalized at $50,000. It will manufacture accessories, pattern work, casting and plating and polishing and also metal stamping and spinning.

Officers of the company are: Chas. F. Sites, president; Fred W. Moser, vice-president; H. W. Alexander, secretary; E. F. Ball, treasurer and general manager. Mr. Ball has been actively connected with the automobile industry for fifteen years.

New York State Gets Automobile Fines

ALBANY, N. Y., Jan. 31—Fines collected by cities for violation of the motor vehicle act must be turned over to the State, according to a decision handed down Jan. 24 by the Supreme Court Justice, Chester. The cities, may, however, retain money collected in fines and penalties for violations of various city and park board ordinances, so far as they regulate the use of motor vehicles in the city.

The decision is the result of a test case brought by the State against the city of Buffalo.

Safety-First Show for Washington

WASHINGTON, D. C., Jan. 31—There will be a "safety-first" exhibit in which all of the government departments are taking an active part, from Feb. 21-26. Manufacturers and operators from all over the country are invited to be present, in order that they may see what the Government of the United States is doing in "safety-first" work.

Woods Co. Plans Gas-Electric

To Produce Coupe at $2,700—Deliveries by April—Four-Cylinder Engine Used

CHICAGO, ILL., Jan. 30—The Woods Motor Vehicle Co., Chicago, expects to announce next week a car of distinctly new type which combines all the ease of manipulation that has characterized the electrics it has been building for years with the speed and touring radius possibilities of the gasoline car. The combination also permits the dual power plants such that should either system get out of order the car may proceed on the other independently. The combination also is designed to give flexibility.

At the present moment it is expected to produce only the coupé as the first model this will sell at something under $2,700, and deliveries are expected on this by April. That the Woods company expect to produce a quantity of the new car may be taken from the fact that they are coming through the factory in lots of 250 as compared with the lots of 50 in which the present electrics have been produced. The car has been undergoing road tests for a year. The wheelbase is 105 in., which is 5 in. greater than that of the present electric model.

The design is based upon the provision of a gasoline motor and electric generator to provide current for the electric motor, either direct or through the intermediary of a storage battery. It includes a four-cylinder gasoline engine of Woods factory manufacture, an electric motor generator directly connected to the engine and a 20-cell storage battery of electric vehicle type.

At speeds below 10 to 15 m.p.h. the gasoline engine idles, being driven by the electric motor which drives the car and which receives its current from the storage battery. When it is desired to travel at higher speeds, the gasoline engine is brought into play and can be used either in conjunction with the storage battery or to supply current direct to the electric motor from the generator. The connections are such that when the engine is generating more than sufficient for running the car it automatically keeps the storage battery charged. The automatic cut-outs are arranged so that the battery charge is kept within the limits of dangerous undercharge, and sufficiently high charge to cause gassing.

Control of the whole car is by means of two small levers on the steering wheel which give all the forward and reverse speeds. the forward speeds being practically infinite in number. These controls also throw the gasoline engine into and out of play and also operates the electric brake. The 20-cell battery has sufficient capacity to run the car without the assistance of the gasoline motor for 35 miles, so that it is independent to a certain extent of the gasoline power unit. The battery is approximately one-half the size of the average electric vehicle battery which usually has approximately 40 cells.

The addition of the gasoline engine and its accessories is more than offset by the reduced size of the battery and other weight economies and the new car weighs considerably less than the present purely electric Woods of the same model.

St. Louis Plans Traction Show

ST. LOUIS, MO., Jan. 28—The National Tractor Manufacturing Association will give a demonstration with 100 tractors representing thirty-three factories in St. Louis July 31 to Aug. 5, 1916, it was announced here to-day by Frank E. Goodwin, chairman of the executive committee of the St. Louis Tractor Farming Association who was principally instrumental in bringing the demonstration to this city. Plans are being made for the accommodation of 50,000 persons.

Ford Interests in Highland Park Bank

DETROIT, MICH., Jan. 29—The Highland Park State Bank of Detroit has filed its incorporation papers. Its capital stock is $500,000, and among those interested as stockholders are some of the best known men in the local automobile industry. Among them are: Henry Ford and his son, Edsel B. Ford; James Couzens, Frank L. Klingensmith, Horace H. Rackham, Walter L. Dunham, Henry S. Morgan, Charles A. Dean, John W. McMeans, James T. Whitehead and George R. Andrews. Mr. Couzens owns 3909 of the 5000 shares of the bank. The latter is in reality a branch of the bank of the same name in Highland Park, just across from the Ford Motor Co.'s plant. Most of the stockholders are the same in both banks.

Detachable-Rim Inventor Dies

NEW YORK CITY, Jan. 31—Richard S. Bryant, factory manager of The Standard Welding Co., died recently, of cancer at the Post-Graduate Hospital.

He was one of the first to design a quick-detachable rim—a type still used to a large extent. He organized the Bryant Rim Company of Columbus, Ohio, which was later bought out by the Diamond Rubber Company of Akron.

National Completes New Offices

INDIANAPOLIS, IND., Jan. 31—One of the two new buildings recently erected by the National Motor Vehicle Co. of Indianapolis was their new office and engineering building. This has been completed.

Anti-Trust Law Involves Dealers

Attorney General Sues to Prevent Manufacturers from Limiting Territory

DALLAS, TEXAS, Jan. 30—Alleging violation of the Texas anti-trust laws, the Attorney General's department for the State of Texas Thursday afternoon filed suits in the Fifty-third Texas District Court at Austin against the Munger Automobile Co. of Dallas, the Olds Motor Works et al. of New Jersey, the Cadillac Motor Co. of Michigan and the Houston Motor Car Co. of Houston, Texas.

It is alleged by the State that the Olds Motor Works and Davis and Turney, its distributors in this State, violated the anti-trust statute by virtue of a sales contract made by them, which limited and restricted the right of Davis and Turney to sell the cars purchased from the Olds Motor Works to a certain fixed territory. Similar allegations formed the basis of the suit against the Cadillac Motor Car Co. and its distributors or dealers, the Houston Motor Car Co. and the Munger Automobile Co.

The relief sought by the State is an injunction permanently restraining defendants from further carrying out alleged illegal contracts and from hereafter making similar contracts. No moneys or penalties are prayed for, because, in the opinion of the Attorney General, the facts fail to show any intention on the part of the parties involved to violate the law. The contracts containing the alleged illegal provisions complained of were prepared by the general attorneys of the foreign companies and were believed by the parties operating under them to be in compliance with the law.

Similar suits, it is understood, are to be filed against a number of other concerns. If the district courts sustain the State's contention in these cases, it means that a dealer cannot be restricted to sell automobiles in any territory set out by contract, but that he has the right to sell and distribute cars to any point in Texas.

Page Buggy to Build Front-Drive Truck

MARSHALL, MICH., Jan. 30—The Page Bros. Buggy Co., of this city is said to be perfecting the organization of a new company which will make a front-drive truck designed by E. H. Oversmith. The truck is to be assembled at the Page plant and a selling organization will be formed in Detroit from where the product is to be disposed. It is also stated that the new concern will be capitalized at $100,000 all of which has been subscribed.

20,000 Chandlers for 1916

CLEVELAND, OHIO, Jan. 30—The Chandler Motor Car Co. has begun the construction of another large building adjoining the present factory buildings, in order to enlarge the various departments sufficiently to meet the needs of the increased output for 1916. It will have 25,000 sq. ft. of space and will be one story in height for the present, but the foundation and walls will be heavy and it will probably be increased to five floors later on, as the space is needed.

This company will produce 20,000 cars this year, which means an increase of more than 100 per cent over the output of 1915. Last year the increase was from 2000 to 8000. At the present time the factory is turning out fifty machines per day and through February it will complete 100 machines per day.

National Acme Capital Now $9,000,000

CLEVELAND, OHIO, Jan. 30—At the annual meeting of the National Acme Mfg. Co. Thursday the stockholders authorized an increase of capital stock from $2,500,000 to $9,000,000. Of the new stock $1,500,000 is 6 per cent preferred, while the remainder is common. The Cleveland Trust Co. purchased the entire block of preferred stock and disposed of it in a very short time at 102 to local investors. This stock is to be retired in ten equal installments of $150,000 each, beginning Jan. 1, 1917. A sinking fund will be established and the redemption price has been fixed at 103, or the entire issue may be called in at any time on proper notice at 105. President Alexander said that a substantial stock dividend will be announced later.

The stockholders formally authorized the purchase of the property and business of the Windsor Machine Co., Windsor, Vt., the consideration being $3,575,000. This company has been one of the strongest competitors of the local company and last year paid large dividends to its stockholders, who realized a handsome price in the deal just closed. The Windsor plant will be operated under its present management and its principal output will be single and multiple spindle screw machines.

New Igniter for Fords to Be Made

DETROIT, MICH., Jan. 29—The Detroit Engineering Products Co., with a plant in South Bend, Ind., and the selling end of the business here in Detroit, was incorporated this week, the capital stock being $60,000. Among those interested in this concern which will make a new ignition system for Ford cars, are Earle Welborn, now assistant to Henry B. Joy, president of the Packard Motor Car Co., and formerly commercial car manager of the Dayton Engineering Laboratories Co.; Austin F. Bement, formerly advertising manager of the Electric Auto-Lite Co., Toledo, and now in charge of the national headquarters of the Lincoln Highway Association, Detroit; Charles A. Mattison, formerly of South Bend, Ind., an accessory salesman of many years of successful experience, who will be in charge of the active management.

The new product or rather the first of several new products will be an ignition system for Ford cars, utilizing the current from the Ford magneto and breaking it in such a manner, it is claimed, as to give the same effect as though a high tension magneto had been installed on the car.

Allen to Manufacture Pressure System for Garages

NEW YORK CITY, Jan. 30—Wm. A. Allen, head of the Allen Auto Specialty Co., has formed the Allen Pressure System Co., with a capital of $10,000, to produce gasoline and oil-storage equipment for garages. Mr. Allen's latest product is called the Apsco system and is applicable in the pumping of gasoline or other liquids on any floor of a garage by means of pressure. This means that by leading pipes from the main tank under the garage to any part of the building, gasoline or any other fuel may be had at any time.

95,000 Cars for Minnesota

MINNEAPOLIS, MINN., Jan. 31—Hennepin county leads in Minnesota for automobile registrations, with a total of 14,111. The second county is the one in which this city is situated, with 6135. The county of which Duluth is the seat, St. Louis, has 2747 cars. The Secretary of State estimates there are 95,000 cars in the State with the close of the old year, or nearly 40 per cent gain over 1914 when there were 68,500 cars registered.

74,123 Cars Registered in Kansas

KANSAS CITY, MO., Jan. 29—Final figures for the car and truck registration in the State of Kansas for 1915 show a total of 74,123, of which about 4000 are trucks, and 8260 motorcycles. This means there is a car for practically every fourth family in the State. The licenses for these cars turned $331,812.75 into the road funds of the counties.

Brazilian Exports Increase

NEW YORK CITY, Jan. 31—R. S. Noxon, manager R. G. Dun & Co., Rio de Janeiro, considers that Brazil at present has considerable prosperity in certain lines of business. He states that during the severe trade depression of the past two or three years—a depression contributed to by a certain degree of overtrading, by financial stringency, by the fall in the price of the two great exports, coffee and rubber, and, lastly, by the effects on Brazil of the European war—the commercial houses of Rio de Janeiro have shown a remarkable power of resistance against such unfavorable forces, and have withstood the severe strain in a most praiseworthy manner. Although weakness has resulted in some cases, for the most part the importing houses have consolidated their positions by reducing stocks, husbanding their resources, and restricting credits throughout the interior both in regard to amounts and time. These houses now give evidence of a very pronounced degree of solvency.

Official statistics of the exports of Brazil during the first ten months of 1915, as compared with the same period of 1914, show certain increases and decreases in total value. The exports of cotton declined $7,725,000; of rubber, $1,520,000, and of tobacco, $2,950,000. These declines, however, were more than offset by the following increases: sugar, $2,310,000; cocoa, $4,800,000; coffee, $17,675,000; hides, $4,320,000; yerba matte, $1,040,000 and pelts, $680,000. The total net increase in the value of exportations during the first ten months of 1915, as compared with a similar period in the preceding year, was $18,735,000. The total value of exports during the first ten months of 1915 was $209,235,000.

The importations of merchandise during the above ten months aggregated $124,905,000 in value, therefore, the favorable trade balance that Brazil has accumulated in the above period amounts to nearly $85,000,000.

Rock Island Plow Buys Heider Mfg. Co.

ROCK ISLAND, ILL., Jan. 31—The Rock Island Plow Co. closed a deal this week by which it secures control of the Heider Mfg. Co. of Carroll, Iowa, including the Heider tractor and all rights connected with the patent and manufacture. The special machinery, patterns, templets, and all raw material owned by the Heider company is now being shipped to Rock Island. H. J. Heider, the designer and inventor, will be retained by the Rock Island company, and he and a number of his employees will remove to Rock Island and be placed in charge of the construction of this machine at the Rock Island plant. The Heider tractor was invented seven years ago, develops 10 hp. at the drawbar, sufficient to pull three 14-in. plows in any soil, and can haul two to three farm wagons to market. The tractor develops 20 hp. at the pulley, enabling it to run a threshing machine or other work designed for a 20-hp. gasoline engine. The Rock Island company marketed the Heider tractor last year in a jobbing way and largely oversold the output of the plant. The Carroll plant was handicapped by lack of space, shipping facilities and skilled labor, and a proposition to merge into the Rock Island company was favorably received.

Velie Ships Trucks to France

MOLINE, ILL., Jan. 30—The Velie company this week shipped forty car loads of auto trucks to New York, for Havre, France, the largest single shipment of the kind ever made from this territory. A special train was required. The value of the consignment was $155,000. The company is maintaining a service station at Havre, in charge of James Gillespie, formerly connected with the Moline plant. A number of mechanics were sent abroad to be utilized in assembling the various parts. The Velie company reports an increase of 400 per cent in December business, as compared with the same month in 1914, due to a large extent to the war orders, although domestic consumption has also greatly increased.

Body Plant for Lansing

LANSING, MICH., Jan. 28—The Gier Pressed Steel Co., which will place on the market a new one-piece metal car body, has contracted for the erection of a new factory building, 160 by 600 ft. which will be one of the largest body making plants in the country. The company will spend at least $150,000, it is said, on the new building and its equipment. There will be several new presses, one of which specially constructed for the Gier concern, will cost between $18,000 and $20,000. Provisions have been made for a large increase in the production of light sheet metal products which have contributed in making the concern. During the past year the business increased nearly 150 per cent over that of 1914, and the orders now on hand are at the rate or on a basis of nearly double the business of 1915.

Addition Made by Standard Motor Truck

DETROIT, MICH., Jan. 31—An addition three stories high will be put up by the Standard Motor Truck Co. which will provide 60,000 sq. ft. of additional floorspace. Business during 1915 was more than double that of the preceding year.

Rochester to Have Radiator Plant

ROCHESTER, N. Y., Jan. 31—With a capitalization of $200,000, papers for the Unitube Auto Radiator Corporation have been filed with the County Clerk. The company will occupy the building in University Avenue formerly used by the Jenkins Motor Co., and will manufacture a new type of radiator. The directors are: C. S. Cook, Fairport; H. F. Beardslee, E. M. Sparlin and D. S. Crawford, all of Rochester.

Factory Miscellany

Hall Lamp to Add—The C. M. Hall Lamp Co., Detroit, Mich., maker of automobile lamps, has increased its capital from $150,000 to $300,000. An addition to its factory is in course of erection.

Knapp Adds—The A. C. Knapp Co., automobile top builder, Mt. Elliott Avenue, Detroit, Mich., has arranged for the erection of a one-story addition to the plant which will almost double its present floor space.

Murphy Brass Specialties Co. to Move—The G. W. J. Murphy Co., Merrimac, Mass., maker of brass automobile specialties, will remove to Amesbury and occupy a plant on Carriage Hill, where 200 men will be employed.

Hoover Ball Adds—The Hoover Steel Ball Co., Ann Arbor, Mich., has let contracts for additions to its forge and tempering department and to its grinding department, and will also build an office building, all of concrete and brick.

Price Electric Devices to Build—The Price Electric Devices Corp., Waynesboro, Va., will establish a plant at Basic, Va., for the manufacture of lighting and ignition generators, starting motors and other automobile equipment. E. L. Eakle is general manager.

Detroit Parts Co. to Build.—The Turner & Moore Mfg. Co., Detroit, Mich., which makes automobile parts, has contracted for the erection of a factory building, 75 by 300 ft., on Addison Street, between Junction and McKinstry Avenues, near the M. C. R. R.

Gilmer Completes First Unit—The L. H. Gilmer Co., Philadelphia, Pa., maker of belts, has completed the first unit of its new factory and moved its office and manufacturing departments to the new site in Tacony, Philadelphia. It is arranging to break ground immediately for a second unit to be 50 by 200 ft.

Columbia Truck Starts New Plant—The banks in Pontiac, Mich., are now offering for sale $100 6 per cent debenture certificates to the amount of $6,500, which is the amount guaranteed as a loan to the Columbia Motor Truck Co., when this concern decided to move from Kalamazoo to that city. The raising of the money is now necessary as the real estate has been purchased and the new plant's steel works erected.

To Make Bumpers—The Booth Bumper Co., 1714 North Twelfth Street, Toledo, Ohio, has been incorporated by W. S. Booth, G. E. Smith and F. H. Greer. The authorized capital stock is $10,000. The purpose of the concern is to make wooden bumpers for automobiles after a patented design for which Mr. Booth is sponsor. A plant will be erected.

To Make Bodies—Enlargement of the scope of the business has been decided upon by the directors of the Excelsior Seat Co., Columbus, Ohio. For many years it has been engaged in the manufacture of seats and bodies for horse-drawn vehicles. Now it will add automobile bodies to the line. The special machinery is being bought and is to be installed at once.

Detroit Twist Drill Doubles Capacity—The large additions to the plant of the Detroit Twist Drill Co., 634 West Fort Street, Detroit, Mich., was completed Feb. 1. Beginning that date, the production of the company was doubled.

The Automobile Calendar

Jan. 29-Feb. 5	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Show Co.
Jan. 29-Feb. 5	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.
Jan. 31-Feb. 5	Fall River, Mass., Show, State Armory, R. C. Borden, Mgr.
Feb. 1-5	York, Pa., Show, York Auto Dealers' Assn.
Feb. 2-5	Buffalo, N. Y., Show, Auditorium, Buffalo Automobile Mfrs. and Dealers' Assn.
Feb. 2-5	Poughkeepsie, N. Y., Show, State Armory.
Feb. 7-12	Kansas City, Mo., Show, J. I. Case, T. M. Bldg., Kansas City Motor Dealers' Assn.
Feb. 7-12	Duluth, Minn., Show, Armory, Duluth Automobile Dealers' Assn.
Feb. 8-11	Grand Forks, N. D., Show, Auditorium.
Feb. 8-12	Freeport, Ill., Show. Freeport Auto Dealers and Garage Owners' Assn., Henney Buggy Plant.
Feb. 9-12	Peoria, Ill., Show, Coliseum. Peoria, Automobile and Accessory Assn.
Feb. 12-19	Albany, N. Y., Show.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Nashville, Tenn., Show. Hippodrome. J. A. Murkin, Mgr.
Feb. 14-19	Des Moines, Iowa, Show. Des Moines Auto Dealers' Assn.
Feb. 14-19	Winnipeg, Man., Show. Ford Plant, Winnipeg Motor Trades Assn.
Feb. 16-19	Rockford, Ill., Show. Coliseum, Motor Car Dealers Assn.
Feb. 17-19	Racine, Wis., Show, Lakeside Auditorium.
Feb. 19	Newark, N. J., Show, First Regiment, Armory, C. G. Fitzgerald, Mgr.
Feb. 19-26	Harrisburg. Pa., Show, Emerson-Bruntingham Co.'s Bldg., Capital City Motor Dealers' Assn.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory. B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 22	Los Angeles, Cal., Speedway Race, Ascot Speedway Assn.
Feb. 28-March 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Paterson, N. J., Fifth Annual Show, Auditorium.
Feb. 29-March 4	Ft. Dodge, Iowa, Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
March 8-11	Mason City, Iowa, Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 15-18	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 10-15	Seattle, Wash., Show, Arena.
May	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 30	Indianapolis Track Race.
June 10	Chicago Track Race.
June 28	Des Moines, Iowa, Track Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Minneapolis Track Race.
July 4	Sioux City Track Race.
July 15	Omaha, Neb., Track Race.
Aug. 5	Tacoma Track Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Track Meet.
Sept. 4	Indianapolis Track Race.
Sept. 16	Providence Track Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Track Race.
Oct. 14	Chicago Track Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.

The Week in the Industry

Torrey Detroiter Assistant Sales Mgr—Alfred O. Dunk, president of the Detroiter Motor Car Co., this city, announces the appointment of D. H. Torrey as assistant sales manager of his company, the appointment effective at once.

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Dealer

Denby Salesmanship Course Winner—The Denby Motor Truck Co., Detroit, Mich., has awarded first prize to A. W. Boulden, Seattle, Wash. The award is the first in a series of monthly contests to extend over the year covered by a course of instruction in salesmanship and truck operation furnished free to owners and their employees of that company.

Trade Items from Minneapolis—The Northwestern Automobile Co. began this week construction of a $75,000 service and sales building. It is to be two stories with full basement.

The Whitcomb-Littlewood Auto Co., 30 Eighth Street N., has been formed to handle the Davis car by J. C. Littlewood, formerly sales manager for the Winton Co. branch here, and F. B. Whitcomb, for 30 years in the hay and feed business. Mr. Littlewood for 8 years was district representative and branch manager with the F. B. Stearns Co.

L. E. Rice of Cedar Falls, Iowa, has been transferred to take charge of the new branch of the American Tire & Rubber Co. at 41 Eleventh Street S.

Atlanta Trade Items—The new building of the Goodyear Tire & Rubber Co., Peachtree Street just north of Baker, Atlanta, Ga., is nearing completion and will be ready for the occupancy of the concern within the next few days. J. T. Taylor, manager of the Atlanta branch, is completing preparations to remove his stock and equipment as soon as the new building is turned over to him.

That the Reo company is negotiating for a site for a plant at this city is a rumor which has created a great deal of interest in automobile circles of the city. It is stated that representatives of the concern have held a number of conferences with local real estate men within the past few days with a view of securing information as to the possibility of purchasing a suitable factory site here.

R. N. Matin, general manager of the Oakland Southern Co., announces that his headquarters will be removed from 45 Auburn Avenue to 453 Peachtree Street. The retail sales of Oakland are to be handled by Boykin and Gilbert from the same Peachtree location.

Motor Men in New Roles

Beck Leaves Chicago Chalmers—G. V. Beck has resigned as district sales manager in Chicago, Ill., for the Chalmers Motor Co., Detroit, Mich.

James Keys Ring V.-P.—L. S. James, formerly manager of the Hood Tire Co. of St. Louis, has become vice-president and sales manager of the Keys Piston Ring Co. of that city.

Ferwin New York Oil Rep.—H. S. Ferwin has been appointed representative in eastern Washington for the New York Lubricating Oil Co., with headquarters in Spokane, Wash.

Porter Heads Braender Branch—The Braender Rubber & Tire Co., Rutherford, N. J., has opened a new branch in Philadelphia, Pa., at 1327 Race Street, in charge of W. L. Porter.

Gartley Maxwell Rep.—P. C. Gartley of the Maxwell Motors Corp. is now located in Seattle, Wash., and will act as factory representative and cover the States of Washington and Idaho.

Smith Lee Tire Superintendent—F. H. Smith, formerly with the Federal Rubber Co., Milwaukee, succeeded A. J. Pennington recently as superintendent of the Lee Tire and Rubber Co., Spring Mill, Pa.

Weaver Goes to Sun—H. G. Weaver, formerly sales manager of the Newell Motor Car Co. of St. Louis, has been appointed assistant general sales manager of the Sun Motor Car Co. of Elkhart, Ill.

Conn Joins Cassidy—C. F. Conn, well known throughout the automobile accessory trade in northern and central New York, on Feb. 1 became associated with the Edward A. Cassidy Co., Inc., sales managers for the Long Horn G-P Muffler cut-out and Cassco engine-driven tire pump.

Parsons Takes on Stutz—The Washington state distributing agency for the Stutz car has been taken by J. W. (Jim) Parsons, well known automobile racer, and his brother, G. M. Parsons, who have established headquarters in Seattle under the name of the Stutz Motor Car Co. of Washington.

McKay Back on Seattle Row—W. O. McKay is again on the Seattle automobile row, during the past week having assumed the management of the Newton Foster Co., distributor of Paige and National cars. Mr. McKay some four years ago was managing partner of the Thomas-McKay Co., distributor of the Locomobile.

Whittaker Dyneto European Rep.—Benjamin Whittaker has been appointed European representative of the Dyneto Electric Co., Syracuse, N. Y. His headquarters are at 2 Norfolk Street, Strand, London, W. C.

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Dealer

Continental Motor Truck Opens Office—The Continental Motor Truck Co., Detroit, Mich., has opened an export office at 17 Battery Place, New York City.

Represent Acme Die Castings—Weidermiller and Ewald, Detroit accessory sales agents, are distributors for the States of Michigan and Ohio for the Acme Die Castings Corp., Brooklyn, N. Y.

Hodgman Rubber Offices Moved—The Hodgman Rubber Co. has moved its general offices, located at 806 Broadway, New York City, to Tuckahoe, N. Y., where its factory is located. The New York sales offices are at 8 West Fortieth Street.

Denver Trade Happenings—Tom Botterill, 1272-1278 Broadway, Denver, distributor for the Pierce, Hudson and Dodge in a large section of the mountain territory, has planned a new building for increased serve. It will be 50 by 125 ft. He will extend from his present building the remainder of the block over to Lincoln Street.

Ford's Wis. Convention March 1—Although the new Milwaukee plant of the Ford Motor Co. opened for business on Thursday, Jan. 27, the formal and official opening has been scheduled for March 1, when Henry Ford will come to Milwaukee. On this occasion all Ford dealers in Wisconsin will be invited to a convention. It is stated that the entire output will be for Wisconsin distribution only.

Milwaukee Changes—The Hoppe-Hatter Motor Co., 543 Broadway, Milwaukee, has been appointed city agent for the Buick in Milwaukee. The appointment is a new departure, the Milwaukee branch of the Buick Motor Co., 160 Wisconsin Street, having handled retail business in the city of Milwaukee since its establishment. G. G. Lund has been appointed agent for Wauwatosa and other suburban points in Milwaukee county. The Hoppe-Hatter Co., long agent for the Rauch & Lang-Baker electric, has also been appointed distributor of Owen Magnetic cars.

The AUTOMOBILE

Vol. XXXIV,
No. 6

NEW YORK, FEBRUARY 10, 1916

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80% More Power

Marks the Wonderful Supremacy of the

HUDSON
SUPER
SIX
TRADE NAME REG.

$1375
at Detroit

Patented by Hudson
December 28, 1915.
Patent No. 1165861

Hudson Super-Six

Eights and Twelves Defeated by a Six

THE facts about the Super-Six seem almost like fiction.

Think of increasing motor efficiency 80 per cent at one jump without adding size or cylinders.

Think of a small light Six—cylinders 3½ x 5—developing 76 horsepower.

Think of that Six, in official tests, breaking all stock-car records.

Think of a simple, light-weight Six outmatching Eights and Twelves.

And think of a $1375 car proving itself, beyond possible question, the best performing car of the day.

MEN WILL HAVE THAT 80%

This motor's capacity is 288 cubic inches. The best former motors in that size delivered about 42 horsepower. The Super-Six delivers 76 horsepower.

Any motor which shows about half that efficiency will have no attraction now.

This extra 80 per cent means more than added reserve power. It comes through ending vibration. All this super-efficiency comes through saving power which former motors wasted within themselves.

So it means vast economy. It means such smoothness as you never have known before. It means matchless flexibility. It means, as shown by official tests, record quick response.

Every quality men prize in a motor has been bettered vastly in this Super-Six.

EXCLUSIVELY HUDSON

Now, for the first time, a premier attraction is found in one car only.

The Super-Six is a Hudson invention controlled by Hudson patents. So no other car will have it. And any like performance is impossible without it.

Eights and Twelves of the finest types have been utterly defeated. Every reason for a double motor, with its extra weight, has vanished. Not a Six of the old type has any chance in comparison.

So this invention gives the palm to Hudson, over all cars in the field. One ride in the Super-Six will convince you of that.

$42,000,000 OUTPUT

We have doubled our factory because of this invention. And we shall build this season $42,000,000 worth of these Super-Sixes.

They come equipped with most luxurious bodies. All that we save by this doubled production has gone into extra elegance.

So the Super-Six will stand supreme both in motor and in looks. Any Hudson dealer stands ready to prove that to your fullest satisfaction.

7-Passenger Phaeton, $1375 at Detroit.

Five Other Body Styles.

Super-Six Catalog Is Ready.

HUDSON MOTOR CAR COMPANY, DETROIT

World's Record Breaker

All Records up to 100 Miles

These tests were made at Sheepshead Bay with a 7-passenger Super-Six—a touring stock car—under official supervision of American Automobile Association.

100 miles in 80 min., 21.4 sec., averaging *74.67 miles per hour,* with driver and passenger.

75.69 miles in one hour with driver and passenger.

Two laps made at 76.75 miles per hour.

Standing start to 50 miles per hour in 16.2 sec. A new record in quick acceleration.

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You don't have to "push" Stewart Products—they move easier than any accessories on the market—they are half sold to the public before they reach you.

Then why gamble with other goods, when you know Stewart Products are wanted?

Why risk your reputation in handling inferior goods when you know the demand is for Stewart Products?

Can be installed on any car—old or new

$10

Stewart Vacuum Gasoline System

Any dealer can put this system on any old car and thereby bring it up-to-date. It has put back into the running more old cars than any other feature ever offered the automobile public.

Stewart-Warner Speedometer Corporation, Chicago, U. S. A.

Vol. XXXIV New York—Thursday, February 10, 1916—Chicago No. 6

The Automobile

British armored cars at a depot in France

British Use Many Armored Cars

Varied Chassis With All Degrees of Armament Tried—How French Army Service Affects Trucks—Detail Design Could Be Stronger

By W. F. Bradley

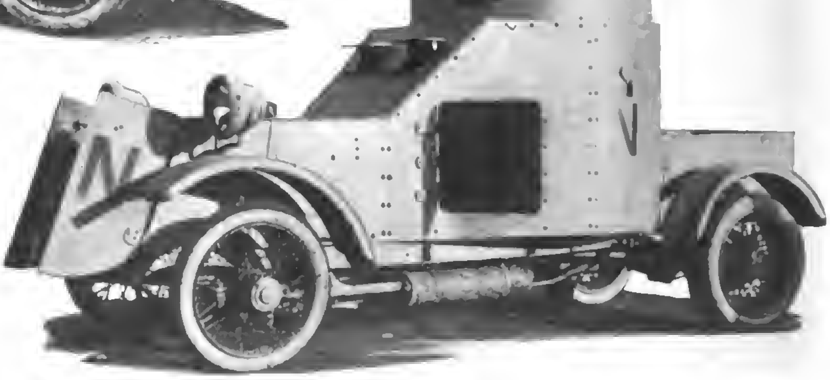
Special European Representative of The Automobile

THERE are few types of automobiles which have not been made to carry a gun or guns. The range varies from a motorcycle sidecar with a light machine gun, to a 5-ton truck with a marine weapon aboard. They all look good in maneuvers, and they all appear convincing on specially selected ground, but when they are submitted to the crucial test of war, there are some deceptions. There is no necessity to argue the value of automobile guns, for everybody is convinced on that point; the problem is to arrive at the most suitable type, or types, for it is obvious that one machine cannot meet all the varied conditions of war.

The motorcycle with a third wheel attached so as to make it possible to carry a gun and an extra passenger, has the advantage over the unmounted machine gun sections of greater speed and less visibility. They are of necessity limited to two men, who are a more difficult target than the half dozen in the unmounted sections. Their ability to operate away from made roads is not very much greater than that of a car, and under present conditions of trench warfare there is not great scope for them, for they cannot get into positions attainable by the man-carried guns. Probably owing to this, and to the fact that they cannot give the men the advantage of armor plating, they are not used to any great extent by any belligerents in the field.

Every type of touring car, up to the 60-hp. semi-racer, has been made to carry a gun. In the early stages of the war numbers of ordinary touring cars were taken out of private service, equipped with a machine gun and sent to the front without any plating being added. It is hardly necessary to explain that such a machine could not go into an exposed position with any reasonable hope of returning in safety.

As soon as it was possible to do so, these cars were armor-plated, although not very effectively at first. It is a rather curious fact that when the war broke out no armored cars existed in the Allied armies, although Germany appears to have had some. On page 260 is a good example of one of the earliest armored cars to be put into service by the British. This is a standard Rolls-Royce, which had been used for touring purposes by the officer in charge of it. A louvred guard was built in front of the radiator; a steel windscreen replaced the usual glass appliance, and a machine gun was mounted in the tonneau in such a position that it could be raised above the pointed steel stern. By crouching low, the



Left—A familiar type of armored car used by the Royal navy in France

Below—One of the earliest types of armored cars to be used in France. It has a Rolls-Royce touring chassis

driver and gunner could get a certain amount of protection, but there was always a certain amount of danger of the driver being winged. In this car no attempt was made to protect the tires or the motor. Although this type of car did good service in the hands of a daring crew, it would not be considered a safe or up-to-date machine at the present.

A further development is shown on page 261. This is also a Rolls-Royce chassis, but unlike the earlier car, is completely armor-plated, the side panels being flush with the outside of the wheels and the upper portion of the body being the frustrum of a pyramid. The upper base of the frustrum is hinged so as to allow a machine gun to be raised above the top of the body, and there are hinged doors in the sides of the pyramid. Two hinged panels are carried in front of the radiator, and capable of being opened or closed from the driver's seat. With this amount of plating it became necessary to fit twin pneumatic tires on the rear wheels. It is worth noting that no armored car has been able to work successfully with single pneumatics on the rear wheels. Some protection is given front tires by steel fenders which tend to deflect bullets. This type of car trails a special gun carriage and a naval gun, the carriage having automobile-type wheels and twin tires. This is a development of particular interest. An automobile of this type is quite capable of dealing with the extra load.

Four Cylinders Adequate

Most high-grade automobiles with four-cylinder motors of 4 by 6 in. bore and stroke, or the equivalent, have proved satisfactory for armored-car work. With an adequate front radiator and good capacity pump overheating troubles are not experienced, despite the plating. Many cars have gone into service without other mechanical modifications than the reducing of the gear ratio; double steering is a refinement, though not always adopted. Armament generally consists of a machine gun, and sometimes of a 1-in. gun in addition, mounted in a turret and capable of being fired without the gunners exposing themselves. Best results have been obtained when these cars have worked together in squadrons.

It was to be expected that attempts would be made to use comparatively heavy guns on automobile chassis. In the early stage of the war the London motorbus B-type chassis was made to carry a powerful naval gun, the car being without any armor plating. This experiment was a failure, the springs being unable to withstand the recoil of the gun. It is doubtful if any other bus or truck chassis would have proved any better.

Probably the only really successful use of an automobile for carrying a field gun is the special De Dion Bouton chassis with the famous 75-mm. gun. The chassis approximates the firm's 3-ton truck model, but the feature is the system of jacks allowing the entire load to be taken off the springs, and giving the vehicle the same amount of rigidity as the ordinary gun chassis. This is a type of automobile developed before the war and used very extensively and very successfully at the present time. These cars carry sufficient armor plating to protect the crews against rifle bullets, and each gun car is served by 3-ton trucks carrying ammunition. These ammunition cars have armor plating for the motor and have the gasoline tank set within a steel box between the rear of the frame members. Thus the tank is incased on all sides and along the bottom, while the body prevents it being hit from above. No armor plating is used for other parts of the truck.

On certain portions of the front numerous Pierce 5-ton trucks, with heavy armor plating are fitted with anti-aircraft and other types of guns. One disadvantage experienced with heavy armor plating is the extreme rigidity imparted to the chassis. It appears necessary to secure a method of attachment which will allow the chassis to maintain the degree of flexibility for which it was originally designed.

Green drivers are not the only enemies of the automobile. Many engineers and experts in various branches of military operations when allowed to apply their special knowledge to the automobiles can ruin a car before it ever goes into service. Naval engineers, for instance, have a lot to do with armored automobiles and almost invariably fail to realize that weight is an important factor on the road. This is doubtless due to the fact that aboard ship they are not usually restricted in any way by considerations of weight.

Overloading Common

There was a good example of failure to appreciate this important factor in two special armored cars which were sent from England to France, recently, for experiments at the front. The standard Pierce-Arrow 5-ton chassis had been transformed into an armored car to carry a 6-pounder gun. Each chassis was fitted with a big bed plate, about 4 ft. 6 in. in length, the full width of the frame, and 1 in. deep. Under this was a very heavy structure of I-beams, placed about 1 ft. apart, and below this another heavy bed plate, similar to the upper one. It was intended that when the gun car had taken up a suitable position big wooden, metal-faced wedges should be driven between the lower bed plate and the ground, thus providing an absolutely rigid mounting for the gun, and of course relieving the car springs of any reaction. In this car the interesting feature for the automobile engineer is that the naval officers appeared to have failed to realize that they were piling up weight in an extraordinary manner. The armor plating weighed between 3½ and 4 tons, the mounting 2½ tons, the gun about the same; the weight of ammunition, stores, supplies and accessories, is not known. But when the truck was put on the scales, without its full equipment, it was found to weigh more than 12 tons.

Under such conditions it was to be expected that there would be trouble from the first. All the springs flattened; one of the cars had a ¼-in. twist in every universal coupling back of the transmission, and the main shaft was sprung ⅛ in., so that it was impossible to move first or reverse without a heavy hammer. It is surprising there were no broken teeth in the transmission or rear end. Before the car could go into service it was necessary to hack away a lot of metal which at one time had been considered necessary and to reduce the weight to a reasonable quantity.

Trucks Need Protection

The most obvious defect of automobile trucks put into military service is the lack of protection against collision. In many of the repair shops at the front about 50 per cent of the truck casualties are caused by trucks bumping into the machine ahead, when operating in convoy formation. Usually the officer in charge precedes the convoy in a light touring car, and unless he is a really experienced man he will set up too fast a pace. Each driver tries to keep as close as possible to the man ahead, with the result that when a sudden stop has to be made radiators are smashed in and sometimes damage is done as far back as the third cylinder.

It is not every officer who is capable of handling a big convoy in a satisfactory manner—maintaining a reasonable average, insisting on the regulation space between each truck, and at the same time being prepared if any man falls out owing to mechanical trouble. The officer who knows his business puts a skilled driver on No. 1 truck—a man who can differentiate between 12 and 14 m.p.h.—and a good mechanic on the last unit of the convoy. As it is forbidden to pass the truck ahead, the correct average can be relied on whether the officer remains in front or falls behind; if there is a breakdown the last man is often able in a few minutes to give assistance which will save hours.

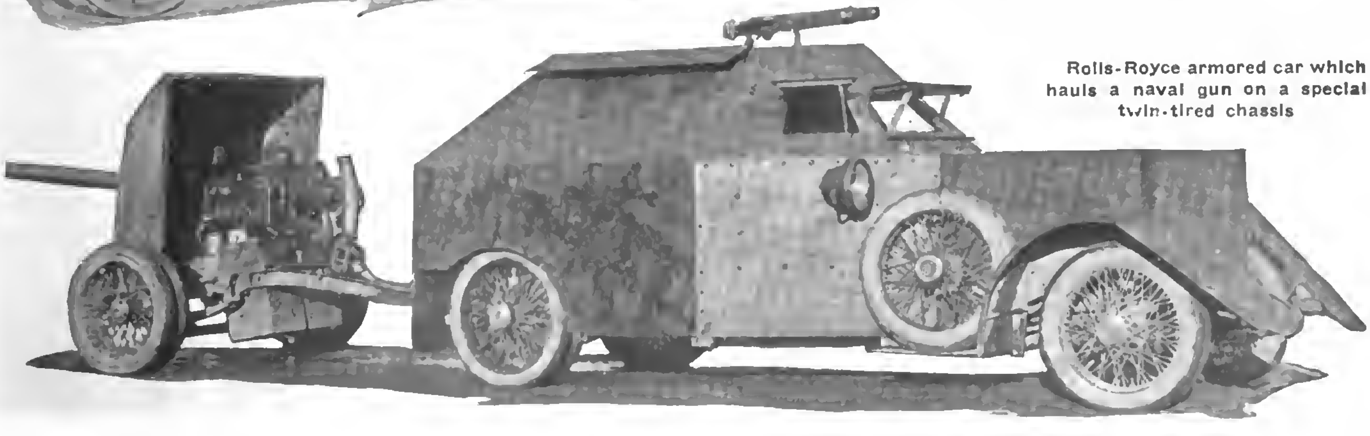
American Trucks Protected

Some of the American trucks sent into France looked as if they had all the radiator protection that could be desired. Packards, for instance, have a very substantial buffer, and the Pierce trucks are also well protected. But for present army conditions even these good examples are ineffective. It has now become the practice to fit locomotive-type spring buffers front and rear on all trucks going into active service in France. Velie trucks, which are among the latest to be adopted by the French army, have a most formidable set of buffers and bars set out a couple of feet in front of the radiator. It consists of a very heavy steel gate, the full height of the radiator, with powerful coil springs back of it. In order to crank, or indeed to get near the radiator, the gate has to be opened; it is on hinges for this purpose. The officers here maintain that they need all this protection. The type of guard on the level of the frame members, as fitted to Packards and a few others, is generally useless, for the regulation army body has a rear overhang which will pass above the guard into the center of the radiator.

Some time ago White trucks were fitted with a stout steel bar carried in hangers rivetted to and projecting from the front of the frame members. The bar was ahead of everything and a few inches above the bottom of the radiator. This was not found to be sufficiently effective and now the bumper is an I-section steel member, as heavy as the frame members, placed level with the middle of the radiator. At the rear of the truck is a lighter transverse bumper, with coil springs back of it, placed at exactly the same height as the front bumper. In case of collision the two bumpers come together. It should be pointed out that these safeguards are not necessary for ordinary commercial service; they were not even found necessary in the army tests prior to the war, for then skilled drivers were always employed.

Generally solid tires on trucks working in the North of France do not average more than 5000 miles. This figure is obtained from records of trucks using tires of a size considered adequate in civilian service. The shorter life is due to the more strenuous conditions under which the trucks have to operate. No matter how good the service, there is always a certain amount of speeding; English drivers are as great sinners in this respect as the French. In the northern parts of France most of the roads are granite paved, with a macadam or dirt strip at each side. When traffic is heavy the right-hand wheels are constantly slipping from the paved portion to the dirt strip, and back again, this series of jumps causing the tires to chip away laterally. Sections of the tire also loosen from the

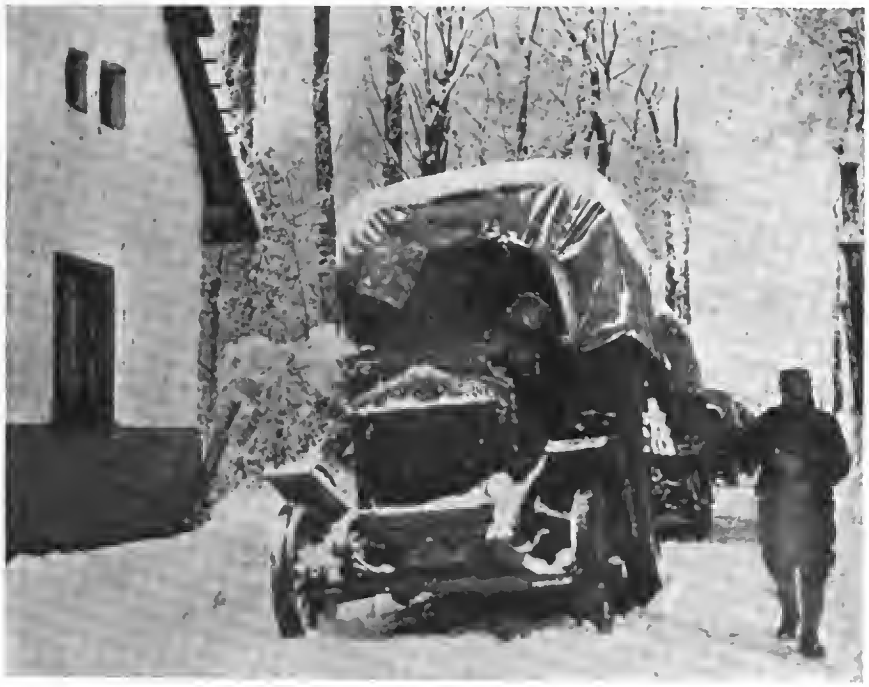

London omnibus B type chassis carrying a naval gun


Rolls-Royce armored car which hauls a naval gun on a special twin-tired chassis

rim, and when there has been a loosening up in two or three places the whole tire is liable to come away. This appears to be due to bouncing of the wheel on the road; when driving fast the wheel strikes the ground at intervals with considerable force, and these repeated blows loosen the rubber from the base. It is found that this is more common with front than with rear wheels.

Another source of tire trouble, which was known to users before the war, but has become more accentuated since, is due to arched roads. It is obvious that with a truck running on one side of a highly crowned road the full width of the tread cannot be in contact with the road surface, and the wider the tire the smaller the proportion in contact. This throws an excessive load on one portion of the tire, or on the inner tire when duals are used, and causes rapid wear. The evil is lessened on those trucks having chain drive with slightly toed-in wheels, as is common with the front wheels of automobiles.

This evil has been recognized for a long time and attempts have been made to construct a type of transmission allowing the wheels to accommodate themselves to the arch of the road. Also the latest road engineering practice is to make road surfaces as flat as possible consistent with drainage. The war has only served to emphasize the need for attention to this matter. Where worm, bevel, internal drive, and chain drive trucks are working together it has been possible to make interesting comparisons on this question of tire wear.



Pierce-Arrow trucks working under winter conditions

War's Severe Test

The war is proving more strenuous than the severe tests to which some of the manufacturers submit their trucks at home. As an instance, a high-grade American worm-drive truck is giving trouble owing to the breakage of differential housings. This is a good truck, which before being put on the market was given a very thorough try-out in the Middle West and the West, without any defects being revealed. However, the roughly paved roads of Northern France, together doubtless with some overloading and some speeding, are causing the housings to crack, and the maker is replacing them free of cost. Closely examined, this is found to be a case of faulty design, but is a fault which American dirt roads and cross-country conditions could not reveal and which required the abuse of war service to bring it out.

Many Parts Fail

There have been some other cases of axle housings failing, but these have been traced to a heavy load shifting to the right-hand side of the truck. Loads of shells are particularly liable to slip in this way, and as the right-hand side gets much more pounding than the left, it is not surprising that axles sometimes fail.

Manufacturers all over the world who had old models or units in stock have been tempted to get rid of them in the various armies. These cases are now coming to light. One high-class firm used a certain number of touring car crankcases in order to finish a series. These were too weak for truck service, with the result that all the front hangers snapped and the French repair shops have had to fit these trucks with a steel member forming a brace under the front end of the crankcase. The policy of this company cannot be considered a wise one. Had it been a French company of equal standing, there would have been plenty of people to excuse or explain away the incident, as some French firms have so many interested boosters that the knockers are never heard. But being an American firm the bare statement goes round that X— crankcase hangers break off. There is nobody to explain, and X—, who makes one of the best trucks in America, is apt to be rated with the firm making one of the worst.

All American manufacturers are at a disadvantage owing to the absence of really skilled men, or men with lengthy experience of their particular make. At home real service is given users, and every manufacturer is interested in seeing that the user of his truck is getting the best out of them. In the war zone there can be no real service, and even if the service man were on the spot he would not be allowed to follow up his own trucks. One case with which I am acquainted is interesting. Pierce-Arrow has about thirty 5-ton trucks in armored car service in Northern France. This is the most strenuous service on the front, for half the cars are overloaded all the time, and all of them have to operate very close to the German trenches. This fleet is in charge of an officer who knows all there is to be known about Pierce trucks and who gives them all the attention that could be obtained from a service man at home. The result is that at the end of six months' active service in France, preceded by several months' service in England, not a single order has been sent in to the permanent store department. The only consumable stores that have been used are brake liners, lock washers, carbureter floats and needles, rear lamps, etc. Two men, one of whom is only a driver, are sufficient to attend to all the repair work.

In the same battery ten mechanics are required to keep the officers' touring cars and the despatch riders' motorbicycles in proper order. In other sections of the army, operating in the same district, constant reports are being received of burned out bearings on Pierce trucks. Inquiry has shown that in every case this is due to the use of unsuitable, though not poor quality, lubricating oil for this type of motor.

Carbureter Adjustments Needed

Carburter settings found right in America are very rarely satisfactory here, owing to the different grade of gasoline used and changed climatic conditions. If the trucks pass

A row of White trucks with a type of radiator guard that was insufficiently strong

through the hands of a tester in Europe, this trouble is considerably diminished; yet there are hundreds of American trucks operating extravagantly in Europe owing to lack of carbureter adjustment. As a general rule American trucks have bigger motors and will do a lot more top gear work than those of European construction, but much of this advantage is lost owing to indifferent carbureter settings.

Magnetos Last Six Months

One important repair depot finds that magnetos cannot be relied on for more than six months' average under war conditions. At the end of that time they have lost much of their magnetism and various screws have begun to work loose. The repair depot in question finds it necessary to remove and carefully examine all truck magnetos every six months. The same trouble has been observed at various times on visits to touring car repair depots, but this case of the trucks is the only one on which really reliable data has been obtainable.

Carbureter Needles Wear

There is an unusual wear of carbureter needles attributed to the presence of very fine sand in the gasoline.

The complaint is heard that differential locks are not sufficiently used; under present conditions they are more than a luxury.

Self-starters are not appreciated. They are to be found on one make of truck used by the French, but they are very rarely in a condition to be used. More often than not the batteries are requisitioned to light a dug-out, or some under officer takes them to light his own quarters. Some of the mechanical transport sections use enormous quantities of dry batteries, but the current is used for lighting the men's quarters and dug outs and not for exploding charges in the motor cylinders.

Want Simpler Control

As army regulations call for two drivers on each truck, a self-starter is certainly a luxury. Controls should be simplified for military service. With two ignitions, spark and throttle levers, extra air lever, electric light, electric self-starter, and gasoline and lubricating oil gages, there is enough to keep the average green driver worried for at least twelve months. At least one truck has the whole of this equipment. The ideal is fixed ignition, with magneto only, and accelerator pedal. A lever on the dash should regulate minimum throttle opening and cut off the ignition when fully closed. The use of a motor governor is preferable; European manufacturers had little use for the governor before the war, but they have changed their views since.

Disembarking at Salonika

"The man who is driving an ammunition truck at the front has got the least satisfactory job in the whole army," declares an automobile agent who has been serving as a private in the infantry since the beginning of the war, and was present at the great Champagne battle last September.

Trucks Run to Firing Line

"There is an impression that automobile driving is the soft job of the war, but as a practical motorist I would much rather be serving in the trenches than at the wheel of a truck. The number of shells which had to be fired by each gun prior to the infantry attack in Champagne was really prodigious. Thousands of American trucks were running day and night, taking shells right up to the gun positions, for the old method of transferring to horse teams has long been abandoned. Generally the guns are in positions away from the main roads, but special tracks are made so that the automobile trucks can go right up to them. The ammunition is unloaded and placed in underground shelters within easy reach of the battery. Naturally the enemy keeps a close watch for the ammunition columns and shells them whenever possible. If an enemy's shell strikes an ammunition truck there is not much left of either truck or men. In the big attack a certain number of American trucks were blown up in this way.

Truck Drivers Hard Worked

"When a big offensive is in progress truck drivers are much harder worked than men in any other branch of the army. I met some drivers who for three weeks had not averaged more than four hours sleep out of each twenty-four. The call for ammunition was so great that they had to work prac-

Steam tractors are still used extensively

tically day and night. When off duty they slept in hammocks fitted up inside their trucks. Some of the men have displayed considerable ingenuity in making their trucks into comfortable living quarters. They strengthen the top, so as to make it absolutely waterproof and capable of supporting two hammocks, and they make the front and end panels of the body close fitting, so as to keep out all drafts. Hay in the hammocks is an additional comfort. The beds have to be arranged so that they can be put out of the way almost instantly and brought out as quickly. In rush times the men get their sleep in snatches, and it is a great convenience to be able to pull down the hammock, get into it and sleep by the roadside for an hour.

Straw Packed Radiators

"The men take the same care to keep their motors warm as to preserve themselves from the cold. Precautions have to be taken as a matter of safety as well as general convenience, for delay in getting away may be fatal. The most commonly adopted plan is to make two straw mats, such as are used by gardeners, one fitting closely round the motor hood and the other completely covering the radiator. An additional precaution is to drain the carbureter float chamber and leave a small kerosene lamp burning under the hood. In this way a truck can stay on the road all night and be easy to start in the morning. Water is not usually drained off, for there may be difficulty in getting a fresh supply, and anti-freezing solutions are not much in favor with the drivers.

The latest form of French Army Packard. Note substantial radiator guard

"Not only have truck drivers little opportunity for sleep, but they cannot count on meals with the same regularity as the infantry. During the Champagne attack drivers would often come into our quarters and beg food which they would take away with them to eat on the road. The men who are wise to the game make a point of always carrying reserve rations and a portable cooking stove. As there are two men on each truck at the front, one of them can look after the cooking arrangements while on the road or whenever a stop is made, and thus overcome the defects which are inevitable when men are moving about frequently and rapidly as required in this military work with its rapidly changing conditions.

General Gallieni, the new War Minister, is on a campaign against all favoritism and abuse of privileges. His activity has been drawn toward the automobile section of the army and very drastic measures have been taken in one particular case. An officer in the territorial army had taken as his orderly a soldier who was the private owner of an automobile, the officer and soldier making use of the car for their military duties. While there is nothing in the regulations specifically against this, the Minister of War considers it an abuse of the spirit of the law, for the fact that he owned a car gave the private soldier an advantage over his companions and the officer got the use of a non-military machine.

Punished for Using Own Car

As a punishment the officer has been condemned to sixty days imprisonment in a fortress and to the loss of his rank. If he is of military age he will still be eligible to serve as a private. The owner of the car has been ordered to take his place in the reserve depot and to be sent to the front with the first draft. This decision has been sent to all military commanders as an example.

In automobile circles there is some annoyance at the tendency of military authorities to look upon professional drivers and mechanics as shirkers. The purely military view is that any old man can be taught to handle a truck or a touring car and that the best place for young professional drivers is in the trenches. Thus men totally devoid of mechanical ability are being rough-hewn into drivers and men of twenty years road and factory experience are sitting behind a gun. One specific instance is that of Louis Wagner, twice Vanderbilt Cup winner, who until recently was serving as a private, while the truck driver attached to his regiment was a former village schoolmaster with one week's experience at the wheel. There is also a tendency for the professional military view regarding automobilists to be shared by the general public, with the result that automobile drivers are considered to be in less danger than men serving in other branches of the army. Because of this a large number of professional race drivers have asked for and obtained transfers to the flying corps. The men consider that they are in no more danger in the air than on the road, but they get credit for undertaking more difficult work.

Want Motorists to Drive

As a protest against the present system, a syndicate of automobile drivers and an association of automobile manufacturers at Lyons has written to the Minister of War and other public officials asking that all professional drivers and mechanics should be drafted at once into the army automobile service. The next set to be called up for automobile service should be those men who had once been professional drivers; following this drafts should be taken from private motorists holding the Government driving license, the men with the oldest licenses being called first.

The adoption of this plan would improve the automobile service of the French army and, besides this, would result in a marked economy in the operation of the military automobiles and motor trucks.

The Truth About Materials

All Metals Are Raised in Price, But Steel Supply Is Adequate—Rise Must Fall Partly on Consumer—Light Weight Design Encouraged—No Need for Alarm

IN a year the amount of steel that is being produced in America has doubled, and of this double output munitions of war consume but a moderate percentage. The doubled output is hardly enough to meet the demands of war and the immense demands of peaceful industry as well. Steel prices always have fluctuated with the normal alterations always taking place in demand and to-day, the demand being higher than ever before, the prices are likewise. But there is no *shortage*, there is no fear that any responsible manufacturer using steel in his business will have to curtail his output below what it was for last year, and there is little doubt that the automobile industry will be able to *increase* output to a marked degree.

In a broad and general way the attitude of the steel makers is that a regular customer can have his regular supply, the steel trade will stand back of the steel consumer whom he knows and trusts, but no consumer will be allowed to buy in excess of his real needs.

In two metals there is a real shortage, and means must be devised for doing with less of them in almost every class of service, these being aluminum and zinc, but slight changes in design render it possible to dispense with some aluminum and almost all brass, so the output of automobiles is not going to be held up on that account. Steel prices are unlikely to drop for some time to come, but the situation is easing in certain ways. For instance, there has been an immense amount of building done in 1915 and this is still in progress, but there are indications that the enlarging factories will soon have completed their growth for a time. Similarly, the railroads have needed much extra material in their attempts to combat the shortage of freight cars, and this will slack as the shipping situation eases, and it is beginning to ease perceptibly.

Cars May Cost More Temporarily

However, it is practically a certainty that all car manufacturers will have to raise the price of their machines for next year, or, if they do not do this and hold the prices where they are they will have to cut the quality. This is the unanimous opinion of men who are closest to the present condition of the materials market. In fact, there is no more important thing in the minds of automobile producers to-day than this question of price. There is no need for maintenance of present automobile prices, just as there was no need for the immense cuts made last summer. The demand for passenger cars and trucks is such that a rise in price sufficient to cover the rise in the cost of materials would hardly lose the industry a single order. To have the situation covered and more than covered it would not be necessary to raise prices of cars all the way back to what they were a year ago.

Three of the foremost companies have now raised the selling figure, Cadillac and Packard having done so some months ago, and Chalmers falling in line recently. Other concerns need have no fear in following this lead.

The general feeling is that all must meet the situation fairly and acknowledge that they cannot continue at present figures when it is costing them about one-fifth more to build the vehicles than it did a year ago, solely because they have to pay much more for the raw materials. Therefore, it can be stated positively that, unless some unforeseen and highly improbable easing-off of the demand for iron and steel, copper, zinc, aluminum, brass, bronze, tin, etc., takes place, the profit in the vehicles will not be sufficient to give a reasonable return on the money invested.

Supply and Demand

The whole situation is primarily a question of supply and demand. There is an over-demand for everything and this is immediately reflected in the price. Fortunate indeed is the far-sighted purchasing agent who looked ahead and contracted for his supplies well in advance, but there are a great number who did not anticipate the present condition and it is these that are in difficulties. Steel mills will not contract now for material for delivery before six months hence, and there are mills which are asking ten months. Heretofore it has been possible to secure contract material within thirty to sixty days at the longest. This will immediately make clear the predicament of the concern which is not well supplied with what it will need for another half year. Add this question of delivery to the problem of price, and you make a combination which is serious for the big manufacturer as well as the little fellow.

Assemblers Suffer Most

Investigation has shown that only in very few cases have the manufacturers been able to take care of their prospective needs beyond January, 1917. They cannot even make contracts at present prices to extend farther ahead than that time because the steel mills will not entertain them. This may change as the year advances, but at present no one will venture to say what conditions will be when another twelve months roll around.

Apparently the car assembler is hit the hardest—much more than the producer who makes the parts he puts into his chassis. The parts maker only gets materials as he contracts for his product, and hence he cannot buy material in large quantity very far ahead unless he is a very big parts maker and is able to figure on a general average from year to year. This condition immediately reflects on the price which the car builder has to pay, and any manufacturer to-day will say that he is paying more in proportion for everything he does not make in his own shops. This means simply that the assembler cannot make as much profit to-day on a car which he sells at the same, or even a slightly higher price, than the actual car manufacturer, even though both cars were identical in quality and design. This statement would be discounted somewhat where the assembler works on a very large scale and is in a position to contract for what he is reasonably sure he will need many months hence, but very few are in that enviable position.

Some of the strong car makers will not feel the present great increases in price before next January because their contracts were made at lower figures to run until that time, but after that date none will say what he will have to pay. Therefore, with the announcement of 1917 models, which will begin about the middle of the year if past policies are taken as a criterion, we will see increases all along the line unless some other way is found to surmount the situation.

Perhaps in some cases reduction of manufacturing cost can be made to offset the added cost of what goes into the cars, but this is very doubtful in view of the enormous increases. Then, too, the manufacturers, even though some of them are fixed until next January, will have to look ahead farther than that, because in most cases, they are simply getting nicely started on the new models by the first of the year.

Cost Up 20 Per Cent

For regular customers, the general advances in materials means at the present time an increased cost of about 20 per cent on every car turned out, all other manufacturing cost factors remaining the same. This takes into account all materials with which the automobile is concerned. It figures in the aluminum, copper tubing, wiring, etc.

To give a few specific instances of what this materials shortage—it can be called that—means, it might be said that the hot-rolled steel makers have increased prices nearly 100 per cent within a year. This takes in all sorts of bar stock which is a very important part of the car man's needs. Normally such material can be bought for $1.10 per 100 lb., but at present it is quoted at $2.00 and delivery is far in the future.

Manufactured steel is especially telling upon the automobile industry. This is the stock that is re-rolled and made into frames, and countless other parts. Small strips of this kind have advanced from $2.40 per hundred to $3.50 and $4, and frame strips have gone up almost $1 a hundred.

One prominent manufacturer with an output of some 15,000 cars yearly figures that the frame alone costs $4 more than it did last year, and this advance is proportionate throughout. Nor does the advance stop with the metals; on the contrary the leather and upholstery materials are up, too.

Effect on Parts Makers

What has been said regarding car makers applies with equal force to the manufacturers of component parts for cars. Needless to say, they cannot take contracts with a certainty of delivery at any specified time, nor will they take any new business without raising the price to meet the new conditions, and perhaps even discount further advances to a large extent.

The parts people are especially hard hit in cases where they have long time contracts to meet which were taken at prices based upon material costs far below present prices. Unless they were able to contract for what materials they needed, at prices in proportion to what they are getting for their products, they are simply taking the loss out of their expected profit. In many instances the parts concerns under contract have been to the manufacturers with the matter, but the car maker's answer is that he is in the same boat, and naturally looks to the parts man for that which he has planned.

This condition was well illustrated by a well-known carbureter maker of Detroit. He buys $12,000 worth of brass castings monthly and the cost has risen from 20 to 27 cents a pound, with an expected advance to 35 cents. He further uses $2,000 worth of brass rod each month, and on that the price has gone from 13 cents normally to 35 cents. Besides this, deliveries cannot be secured within four to five months, whereas in the past he has been accustomed to get what he wanted within two to three weeks.

Weight-Saving Design Forced on Engineers

As a result, this carbureter producer is like all others—he is trying to reduce the weight of his instrument by redesigning and shaving here and there without impairing the design. Necessity is dictating great things in the carbureter field, as in most others, for in another great carbureter plant in Detroit they are daily turning out 500 carbureters made of malleable iron instead of brass because the former is a cheaper material and seems to work equally as well. Some of the makers are even striving so to build their carbureters that some parts can be made of pressed steel, this reducing the cost.

So it goes down through the industry. You will see axle makers scratching their heads over problems of weight reduction; see them substituting certain constructions for others where they can save in material cost without hurting quality; you will see this thought uppermost in the minds of a great many engineers.

Position of the Automobile Industry

It is sometimes suggested that the industry should assert itself with the iron and steel makers, the aluminum producers and the rest. The assumption being that the industry takes such a large proportion of these products, that it should be able to *demand* deliveries when it wants them; in a word, it should by its united strength be able to bring the materials people down on their knees and bring about reasonable service.

Nothing could be more absurd. ***The combined tonnage of iron and steel used by the automobile industry is not over 5 per cent of the total production of the iron and steel industry of this country.*** Why should the iron and steel industry, then, have any particular regard for the automobile industry? The railroads, the structural steel users and the bridge builders are the big consumers, and their demands must come ahead of the automobile makers. This fact is recognized by a great many of the automobile men, but it is likewise overlooked by a great many.

The total consumption of steel last year by the automobile industry was not over 1,200,000 tons, whereas the production estimated for 1915 was about 24,000,000 tons. One has but to figure it out to see where the automobile industry must inevitably stand in the eyes of the greatest of American industries—iron and steel. By careful estimate, it was found that one car maker with an output ranking very close to the top, utilized about 10,000 tons per year. Supposing there were 150 companies producing cars who used an equal amount. The total would be 1,500,000 tons, but as there is not anything like that number, the figure will be roughly correct, nevertheless, when we equalize it by considering that Ford, Overland, Buick, Studebaker, etc. make more cars than the firm from which the estimate of 10,000 tons was obtained. Even then we are probably high in the total consumption, but if we are high, the percentage that goes to the automobile industry must be even less than 5 per cent. And 5 per cent is low enough.

To-day it is said that certain of the munitions makers are offering a premimum of 2½ cents and more, per pound, for preferred rollings, this over the present market. Think of that point along with the meager percentage of five, and you will wonder why the automobile industry is treated as well as it is at present.

Some Effects of Conditions

An important result of present material conditions and the future outlook is that designers are paying closer attention to weight reduction and better working out of the details of their cars so that every pound of useless weight can be eliminated. Each pound is important.

There is also chance for capitalization upon the situation. Supposing a maker has bought farsightedly and advantageously. He can raise prices with the present market conditions as an excuse, and thus increase revenue with no added production cost, for the length of his contracts at least. This, it would seem, he has a perfect right to do, and it is a reward for his buying shrewdness.

One thing seems certain. The makers should tell the public plainly how things stand and frankly meet the issue.

Minneapolis Center of Huge and Growing Prosperity

Twin City Show Is Annual Meeting Place for All the Great Northwest—Show Serves 4,000,000 Population

By David Beecroft

MINNEAPOLIS, Feb. 7—The Minneapolis show, drawing its thousands of dealers and tens of thousands of citizens from the great Northwest territory embracing all of the State of Minnesota, all of North Dakota, all of South Dakota and the eastern half of Montana, to which might be added the northern counties in Wisconsin, is perhaps the most potential show west of Chicago. It is a greater gathering point for dealers than Kansas City, Omaha, or Des Moines, and is a veritable magnet for the public throughout the territory, a public which does all of its buying in the Twin Cities and looks to them as New England looks to Boston, as the South looks to New Orleans and as the Rocky Mountain section looks to Denver and Salt Lake City.

Naturally, then, the week's motor car show, with its sixty-four different makes of gasoline cars, its four makes of electrics, its six different makes of motor trucks and its two makes of tractors for the farm, not to mention a small outside tractor show, gives the 4,000,000 from these States the best opportunity to view the show, to shop in the Twin Cities and to meet their friends. Show week is the great gathering together event of the year for the Northwest. Hotels are crowded by reservations booked weeks in advance, theaters play to sold-out houses, lodging houses are at a premium, and the great Northwest measures its strength, takes inventory of itself in show week as it does in no other week of the year.

It is meet that this greatest of all distributing territories for automobiles should have an annual week that measures up with any other city outside New York and Chicago, with the possible exception of Boston, which has more cars on exhibition at its annual show.

These are the greatest years that the Northwest has ever known, and the more conservative bankers of the Twin Cities show you figures which go a long way to establish the fact that it is questionable if there is any other territory on the earth's surface, in this or any other country, where prosperity of all classes has reached so high a mark as in our own Northwest during the past eighteen months.

Prosperity Is Prodigious

The prosperity of the farming communities is staggering. Crops in 1914 were record breakers and sold at high-mark war prices, but 1915 crops were often 50 per cent higher and, while prices have been a little lower, the sum total of crop value for 1915 is vastly in excess of 1914. These two have been years without precedent. The agricultural sections of Minnesota, the Dakotas and Montana have fallen into unexpected wealth, just like the Eastern stock speculator who got in on General Motors or Bethlehem Steel when they sold under a dollar and watched them steadily climb to 500 or higher.

Some farmers who bought "quarter sections," or 160-acre farms five years ago and who for two or three seasons were not able to pay interest or even taxes have within the last two months not only paid off all taxes and interest charges, but entirely paid for the land. This means that all other bills have been paid, and that the proud possessor has a snug bank account.

The condition of a great territory is always reflected in the financial reports of the territory, and the Twin City banks are always a sure criterion of the financial condition of the Northwest. E. W. Decker, president of the Minneapolis Loan & Trust Co., whose estimate of money conditions in the territory stands highest, says there never was a period when the Northwest was in such good financial condition. Scores of the small country banks are carrying deposits of $500,000 with the large Twin City banks, an undreamed of condition. In the four States money is more plentiful than ever before. The interest rate on mortgages in parts of Minnesota has dropped from 6 to 5.5 per cent, and to as low as 5 per cent in a few sections. There has been a more general paying up of old debts of four or five years' standing than ever before; in fact back debts are no more.

When in Rome do as the Romans do, and when in Minneapolis you must think as the Twin City people. Here you think crops, the production of the soil. Money and crops are synonymous. If you sell automobiles, you must think crops, because farmers own over one-half of the 95,000 automobiles in the State of Minnesota. Statistics do not give the farmer percentage in the Dakotas and Montana, but it is equally high if not higher.

Registration 35 Per Cent Up

Perhaps before analyzing what crops were last year, and what they are expected to be this year, we can get a better realization of their value by glimpsing what crops have already done in increasing the number of automobiles in the State of Minnesota. To-day Secretary of State Julius A. Schmall states there are 95,000 cars in the State, while a year ago there were but 68,500 machines. The increase in the past year has been 24,500, an increase of 35 per cent during the year. The secretary estimates that 35,000 cars will be sold in 1916, and he is a good estimator. A year ago he predicted 100,000 cars in the State by Jan. 1, 1916. Unquestionably this total would have been reached had the dealers been able to get all the cars they could have sold. Hence the large Buick distributor claims he could have sold 2000 more cars if he could have obtained them.

Overland, which stands next to Ford in the territory, could have disposed of several thousands more. The same is true in proportion to output with many other concerns of smaller output. There is nobody familiar with the facts who does not believe Secretary Schmall's estimate of 100,000 would have been exceeded could the vehicles have been obtained.

Glance over the growth of motor car, automobile, registrations in Minnesota since 1909, when registration began.

These figures of growth tell best their own story. To them you can add 2000 registered chauffeurs and 474 registered automobile dealers.

1909	7,000	1913	45,800
1910	12,500	1914	68,500
1911	19,000	1915	95,000
1912	28,400	1916 (Estimate)	130,000

Farming Community in 2.25 to 1 Proportion

Looking into the present 95,000 cars owned in the State a further analysis shows that the farming community is a very great buyer. The *Farmer*, in an analysis, shows that 36,000 cars are registered in towns of 1000 population or less. The majority, in fact, nearly all of these cars, go direct to farmers. The relative number of cars owned in small towns and the number in the three large cities of Minneapolis, St. Paul and Duluth, proves the farmer's case still further. These three cities have a combined population of 700,000. The total farm population of the State is 750,000. The total number of cars owned by the farmers is 46,000, whereas these three cities have but 20,000. The farmers are two and one-quarter times as strong in car ownership. In the towns of 1000 population or under the people are buying cars to-day at the rate of one car to every thirty-five people; it is estimated that by 1926 there will be one car for every ten people in the State of Minnesota.

But Minnesota farmers are not anywhere near the saturation point, so far as car buying is concerned. There are 156,000 farmers in the State. The average farm contains 177 acres. The average value of a farm in 1910 was $9,500. Of these 156,000 farmers it is conservative to estimate that 100,000 can afford to buy cars within the next five years. To-day 46,000 of these farmers have cars and 54,000 are waiting to buy.

Perhaps a brief analysis of how certain makes of automobiles have increased in the State during the past year will serve as a better indication of what may be expected this year and next. Ford registrations have increased by 12,000 cars, 2500 of these going to the large cities and 5500 to towns of less than 1000. Overland has increased 2545, 311 going to the large cities, 1522 to the towns of less than 1000. Dodge has registered 948 during the first year of its sales; Maxwell has made an increase of 1291 in the year. Studebaker has increased 2636, Reo 518 and others in like proportions. Here are some of the makes that lead in registrations in the State:

Ford	30,708	Chalmers	826
Overland	7,518	Regal	787
Buick	6,686	Kissel	718
Studebaker	5,637	Packard	653
Maxwell	3,551	Saxon	664
Reo	2,380	Velie	637
Cadillac	1,597	Paige	613
Chevrolet	1,284	Krit	563
Oakland	1,075	Imperial	542
Mitchell	983	Metz	516
Dodge	948	Oldsmobile	505
Hudson	917	Jackson	505
Hupmobile	893	Jeffery	440

These figures show that farmers must be buying cars selling over $1,000, and a straw vote of the Minneapolis distributors exhibiting at the show was conclusive to demonstrate that farmers are gradually mounting in the price scale, and that many farmers own cars listing at more than $1,000.

Minnesota License Lasts Three Years

Minnesota is typical of Middle Western States that do not pay too much for automobile registration. She has a tri-annual system, a registration fee of $3 having been sufficient for three years, or a dollar-a-year rate. The present tri-annual registration dates from Jan. 1, 1915. Beginning with the next tri-annual period, Jan. 1, 1918, the registration fee has already been fixed at $5 for the three years. Registration for the last two of the three years will be $3.50. In Minnesota the license tags belong to the person registering and do not go with the car in case of sale.

During the past year the Twin Cities territory has advanced into a new position in the automobile field by becoming the biggest distributing territory in the country for several makers. Manufacturers are beginning to appreciate the importance of the territory. It is several years since Ford established its large assembly plant here, and preparations are being made practically to double its size.

A step which well indicates the importance of the Twin Cities and the buying capacity of the Northwest is the erection of the mammoth storage building put up last fall by the Willys-Overland Co. and only recently occupied. Here is a huge brick structure four stories high and capable of storing 7500 cars to be held for quick shipment to the hundreds of sub-distributors and dealers in the four or five States served. The new building is a model of its kind, and the only one of its particular type in the country. It is an impressive structure 462 ft. long and 280 ft. wide, occupying one of the most commanding positions on University Avenue, the connecting thoroughfare between Minneapolis and St. Paul. The building is just over the dividing line and stands on St. Paul territory. Although a four-story building, it is much higher from a car-storage viewpoint, as its storage floors are double-decked, the second deck on each floor being a suspended steel frame-work with the long lines of cars carried on two 4 by 6-in. angle pieces. The entire scheme is such that one man can easily push any car off the railroad car from the switch lying along one whole side of the plant to the elevator, and thence to any part of the storage space.

Across the front, on the ground floor, is a mammoth show room, and over it on the second floor are the offices. The basement has a large battery room, and is also used for tuning motors, while half is given over to car storage. On the main floor is a stock room 140 by 60 ft. for spare parts for the territory. Cars are at present being received at the rate of fifty per day, and there is a force of twenty-two men looking after the plant. The salesroom and offices have not yet been opened. The territory served includes Wisconsin, Minnesota, Iowa, Montana and the two Dakotas.

But there have been other automobile activities during the past year. Chevrolet is at present negotiating for a site on which to erect one of its assembly plants; and real estate people are arranging with the Maxwell company for larger arrangements for representation in the Northwest.

Tractor Business Growing Fast

Another motor aspect that has developed in Minneapolis and St. Paul during the past year is the agricultural tractor business. The Twin Cities are to-day the acknowledged home of the agricultural tractor industry, just as Detroit claims similar distinction in the motor car trade, Pittsburgh in the steel industry, Chicago in live stock and New York as the financial center. To-day there are over twenty-five concerns building agricultural tractors, and every week brings a new one to the surface. Nearly every back-yard machine shop has a tractor in development, in fact tractor development is as rampant here to-day as automobile promotions were in Detroit four years ago.

The amazing crops of the last two years have largely been responsible for this development, although the tractor industry in the Twin Cities is over five years old, many having been built eight and nine years ago. The largest producer markets the Bull tractor and will build approximately 5000 next year, while the output of others will range from this figure down to ten machines. There were several makers that put out twenty last year, others that built forty, and others that went over the 1000-mark.

A rapid development of the tractor industry is looked for. The farmer is a heavy car buyer. He has learned the utilitarian value of the gasoline engine. It is not necessary to sell him the engine. It only requires time until he has enough ready cash to replace his horses with the gasoline engine.

The trend of agricultural tractor development will unquestionably follow closely the trend exhibited in passenger cars and also in motor trucks. Already the low-priced machine has arrived in volume. The old price of $3,500 has been cut until you can now buy machines for less than $600. The bottom limit has not yet been reached, but it is certain that the $500 tractor will be the big-column type. This fact is already realized by the tractor makers, and there is more activity in this field than in the low-priced automobile field.

Automobile Dealers Handle Tractors

A point of particular interest to automobile dealers is that tractor makers are turning more than ever before to the automobile dealer as the person to market the tractor. In the past the implement dealer has sold them, but the automobile dealer is accepted as having a better knowledge of the gasoline engine, as having better service facilities and being generally in a better condition to market the low-priced tractor than is the implement man. The automobile dealer sells more than one-half his cars to the farmer, and taking on the tractor line will be quite in harmony with the present movement in the development of his business.

Having noted the very general development of the automobile business in the Northwest during the past year, we must next look to the all-convincing question of crops to get a correct estimate on the buying capacity of Minnesota, the Dakotas and the eastern half of Montana, as well as the northern counties in Wisconsin, the territory served by the Minneapolis distributors.

Minneapolis and Duluth are the two great primary grain markets for this territory. The products of the farm reach these two cities and it is in them that Chicago, Liverpool and the other great grain-buying cities secure their supplies.

Some conception of what grain has been grown in this territory in 1915 can be had from the fact that between Sept. 1 and Jan. 1 there were 264,000,000 bushels of grain shipped from the farms and delivered in Minneapolis and Duluth. In Minneapolis alone, 160,000,000 arrived in these four months. That meant 40,000,000 bushels a month. It meant that every day during those four months a million and one-third bushels of grain were arriving in Minneapolis. It is a staggering total even to blasé grain merchants in this city. But this total does not in any way represent the total volume of grain, because the farmers are holding wheat and oats for higher prices.

Here are a few examples of how the 1915 crop has quite outdone the bumper crop of 1914. The Dec. 30 federal government report gives the value of wheat to the farmer for Minnesota alone at $66,078,000 as compared with $43,834,000 for 1914. Here is an increase in dollars of over $22,000,000, this representing more than a 50-per cent increase in value over 1914.

Now turn to North Dakota: For 1915 the wheat value at the farm was $132,214,000. In 1914 it was $82,408,000. Here is an actual dollar gain of $50,000,000; it is a gain of over 60 per cent in one year.

Turn now to South Dakota: The figures for wheat are $54,835,000 for 1915 as compared with $29,672,000 for 1914. Here the output was nearly doubled in a year.

Lastly, look at Montana and her wheat gain: The figures are $26,384,000 for 1915 as compared with $16,704,000 for 1914. Here is another gain of over 60 per cent in the year.

Wheat Gains $107,000,000

Now recapitulate: Here is $107,000,000 more for wheat alone in these four States than a year ago. These figures are not speculations, they are established facts. But this $107,000,000 means more to-day to the automobile dealer than it would have meant a year ago. To-day the farmer's financial decks are cleared. Last year from his bumper crop he paid his back payments on land, paid back taxes, redeemed his old notes, paid his old implement bills and feathered his bank account. This year he starts without these handicaps of former years. Of this volume of wheat money, which represents but a small percentage of crop value that the farmer has, a good percentage is going toward buying automobiles. No longer is the banker talking against the automobile. To-day he is the greatest booster for it. He now sees it as a utility, an investment. These same bankers today see the time when the agricultural tractor will be considered a sound financial investment to these same farmers. The tractor will enable them to work night and day with relays of men and thus get their crops in in good season. The same program can be followed in harvest time. The tractor will permit of deeper plowing and better cultivation of the soil; in fact, in divers ways the tractor will prove a great improvement over the present horse regime. At present the farmer's horses work 100 days in the year. They are idle 265 days. They must be fed these 265 days. Feeding them costs nearly as much when idle as when working. Herein is one of the great assets to the tractor argument. It is not piling up maintenance costs while idle.

But other crops are well in advance of the 1914 mark. The oat crop value on the farm is $17,000,000 more for 1915 than 1914. The Northwest is the great center of the flaxseed industry of the country. Its value last year was $24,000,000 as compared with $19,000,000 for 1914. Over 99 per cent of this industry is in the Northwest, served by the Twin Cities and Duluth.

Summarizing a few of the crop figures, we discover that for 1915 the total of eight crops aggregates $589,428,000, well over half a billion of dollars. The crops included in this total are wheat, oats, corn, barley, flax, hay, rye and potatoes.

The ratio that the Northwest bears to the entire country is obtained from the figures for the country on these same crops for 1915, where the grand total is $4,662,926,000, as compared with $3,235,319,000 for 1914. This represents a net gain of over $425,000,000.

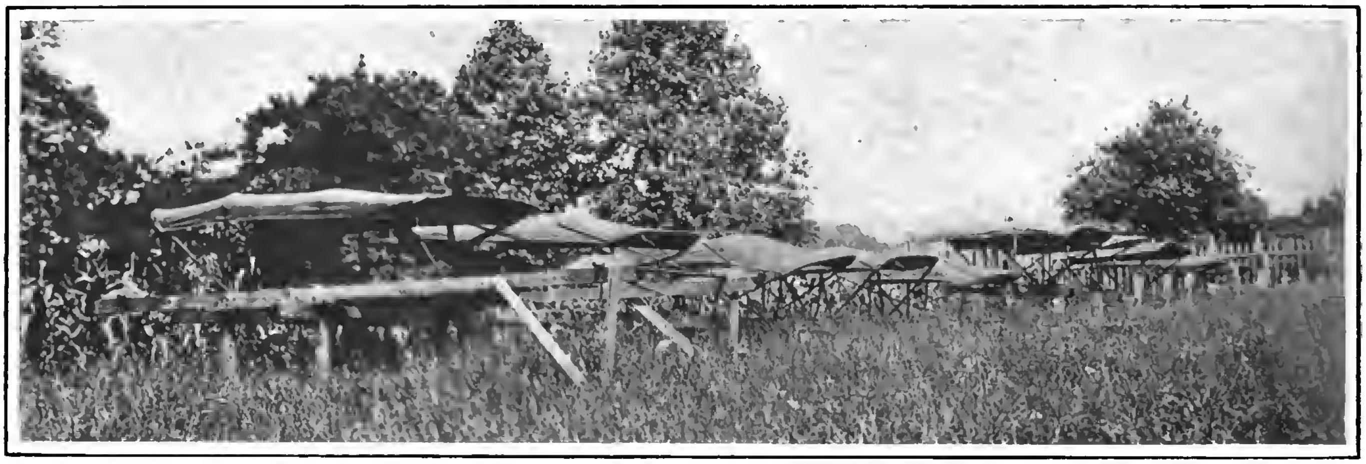
Physically the Northwest territory is as stupendous as the value of its products. It is a giant in dimensions. From Minneapolis to the limit of the territory in Montana is a 20 to 24-hr. ride on the limited trains. In area the States of Minnesota, North Dakota, South Dakota and one-half of Montana, to which is added a fringe along northern Wisconsin, exceeds the area of France or Germany. You could set six New England States in this area.

So great is this area—to be exact, 306,134 square miles—that you could put the whole 100,000,000 population of the country in it and there would only be 329 persons to each square mile. The population would not be nearly so dense as the present population of the State of Massachusetts, which has 418 persons to the square mile. It would scarcely equal New Jersey with 337 persons to the square mile. It would fall far short of Rhode Island with its 508 persons to the square mile.

Thus do we get some slight conception of this enormous Northwest with its empire dimensions and its city population of but 4,000,000. Its fertile fields can accommodate twenty-five times this number and then not suffer from congestion. Why should not our automobile makers with an eye looking to the future seize upon this great logical center for distribution and perhaps assembly? Are our tractor manufacturers to be criticized for selecting such a center for their industry which by 1955 will be a giant?

Use of Magnetic Materials

Circular No. 17 of the United States Bureau of Standards, on "Magnetic Testing," is published for the benefit of engineers and others who are interested in the testing and use of magnetic materials. It gives definitions of the fundamental magnetic quantities ordinarily employed in technical work, outlines the scope, and describes the methods of magnetic measurements employed at the Bureau of Standards, and discusses the type of data required in engineering work.



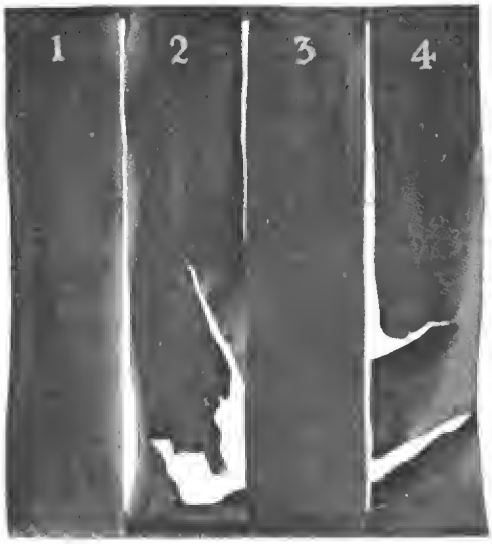
Tops of various manufacture tested by the Du Pont company for a year in an open field. They were opened and closed more frequently than if they had been mounted on cars in active service. Water was allowed to collect and stand on the tops for weeks and months at a time, as illustrated at the bottom of page 271

Solving the Upholstery Problem

Fabrikoid, a Du Pont Product, Developed To Supplant Split Leather on Popular-Priced Cars—Durability Demonstrated by Tests—Rayntite Is a Similar Material for Tops

IT has often been remarked that whenever the natural supply of an indispensable commodity decreases, or the demand for it increases, to a degree which threatens to embarrass the industries affected, the ingenuity of man rises to meet the emergency.

The uses to which leather is customarily put have increased enormously in recent years, and no more striking illustration of the multiplication of demand is being presented than the rapid growth of the quantities required for upholstering automobiles. Added to this and the widening of the other fields in which leather is largely used comes the great demand from abroad due to the European war. Then, too, the supply is not increasing in proportion to the heightened demand, while prices resultant upon these conditions make it very difficult, if not impossible, for the manufacturer of the popular-priced cars to use the best quality leather, usually referred to as No. 1 machine-buffed leather, which is conceded to be the best possible material for this purpose.



Results of an eight-hour test of the relative surface durability of Fabrikoid and split leather made on the machine illustrated at the top of page 271. No. 1 is black Fabrikoid and No. 4 is black split leather. No. 2 is Spanish-finish split leather and No. 3 is Fabrikoid in the same finish

To meet the demand thus created the Du Pont Fabrikoid Co., Wilmington, Del., after two years' work, developed, about 1912, a grade of its product, Fabrikoid, suitable for upholstering automobiles. This material, the company claims, is superior in finish and durability to the so-called "splits," or sublayers of leather usually employed for automobile upholstery in default of the No. 1 machine-buffed grade, while it compares favorably in price with any of them. Moreover, the Du Pont company regards its type of upholstery material as the logical solution of the upholstery problem, the difficulty of which is enhanced by the low car prices due to keen competition. Another feature of the situation is the great increase in the demand for leather in manufacturing articles for which the Fabrikoid type of material is unsuitable.

Minimum Waste in Cutting

The Du Pont company estimates that 75 per cent of the cars on the American market for 1916 use upholstery of this type, of which 60 per cent will be Fabrikoid, stating that this is one of the improvements in efficiency and economy which made possible the low prices characterizing the majority, as compared with previous years. Over 70 per cent of the 1915 cars were fitted with this type of upholstery, of which 40 per cent was Fabrikoid, according to the same authority. A prominent factor in the economy attending its use is said to be the small percentage of waste in cutting, as compared with leather. Since Fabrikoid of the grade used for automobile upholstery is shipped from the factory on rollers carrying rolls of material 60 yd. long and 50 in. wide, the waste is minimized in handling, whereas the irregular shape of a hide renders it practically impossible to avoid a waste in cutting of 25 to 33 1/3 per cent.

Grain Is Embossed

Fabrikoid is made of moleskin, a very fine, closely-woven grade of cotton cloth, over which is spread under pressure, a coating of soluble cotton mixed with mineral coloring pigment and other ingredients imparting the qualities of pliability, toughness and elasticity. The first coats are very thin to insure anchoring the jelly to the cloth filaments. The resulting product goes to the embossing machine where it is given the desired grain by electroplates of real grain leather. The more popular grains are embossed by the use of rollers, this method facilitating quantity production, while the other varieties, which are made in smaller lots, are taken from plates being easily changed and less expensive than the rollers. Castor oil is one of the ingredients used in the jelly coating, the latter being practically the same as that used for coating the split leather used for upholstery work. The quality of the goods is determined by the number of ounces of coating solution applied per square inch, while the grade of cloth used depends on the tensile strength required. Prior to the development of the wide demand for materials of the Fabrikoid type, it was impossible to obtain the cloth used in their manufacture from American weavers, but more recently looms of the type required for its making have been constructed so that there is now no difficulty in securing it.

Strength and Thickness Uniform

Besides the qualities of pliability, toughness and elasticity mentioned, Fabrikoid is waterproof, easily washed with soap and water, not affected by extremes of temperature and oil or gasoline cannot stain it. Another advantage, as compared with split leather, is pointed out by its manufacturers to be its uniform strength and thickness throughout.

Tensile Strength 350 Lb. per Square Inch

Motor Quality Fabrikoid, as the grade for automobile upholstery is called, is made in plain black grain, the Du Pont company stating that its tensile strength is indicated by the fact that it has withstood a tensile strength test of 350 to 400 lb. per square inch, whereas a piece of split leather broke at 157 lb. The method of making this test and its results are shown in the accompanying illustrations. A folded strip of Fabrikoid and a similar strip of split leather were secured to the two scale beams illustrated, and to the lower end of each was attached a pail of sand. The Fabrikoid remained intact at 350 lb. pull, while the split leather broke at 157 lb.

An Abrasion Test

Another test made on the same machine to determine the relative strength and durability of Fabrikoid and split leather consisted in a continuous whipping of parallel strips of these materials held by the horizontal frame as illustrated, the whipping means being beaters like sewing machine belting attached to the revolving rack driven by belt from the electric motor. The ability of Fabrikoid to withstand severe surface abrasion was clearly demonstrated, the only effect after eight hours' whipping being a slight stretch, whereas the similar strip of split leather stretched badly and broke after three and a half hours.

During the year that the top materials were under test at the Du Pont plant the frames were frequently loosened and water allowed to collect and stand for weeks and months at a time to test their waterproof qualities

Machine for testing tensile strength and surface durability of leather, etc. A strip of Fabrikoid suspends the pail at the left, which contains 350 lbs. of sand. The strip of split leather suspending the pail at the right broke at 157 lb. pull. The beaters, attached to the rack revolved by belt from the electric motor, play on parallel horizontal strips of Fabrikoid and split leather. The results of this test are illustrated on page 270

The manufacturers state that Motor Quality Fabrikoid has been used for two years by several of the largest producers of automobiles in the country on several hundred thousand cars. During that period, they say, there has been only one complaint, a defective piece of goods being found on the driver's seat of a single car.

Rayntite—a Top Material

Closely associated with Fabrikoid is the material made by the Du Pont company for automobile tops. This is called Rayntite and it is manufactured in both single and double textures. Single-texture Rayntite is a Fabrikoid, and is waterproof, sharing the other properties of that material as well. The double-texture material is Fabrikoid combined with a cloth backing. Before Rayntite was put on the market it was tested for a year in competition with top materials of other manufacture, the tops being mounted side by side in an open field, as shown in the accompanying illustration, where they were exposed to all sorts of weather. They were also opened and shut frequently, in fact more than would be the case if they had been mounted on cars during the year of the test. The other illustration shows how the tops were left loose on the frames so that water might accumulate on them and test their waterproof qualities when subjected to this condition for weeks and months at a time.

The Du Pont company's business for 1915 was almost double that of 1914, due chiefly to the increase in sales of Fabrikoid and Rayntite materials to automobile manufacturers. A corresponding increase is expected for 1916, owing to the quality of the results shown on cars equipped with these materials and the increased output of popular-priced cars.

Winton Sixes on Standardized Chassis

Motors of Similar Design for Large and Small Chassis of 138 and 128-In. Wheelbase—Unit Power Plant Construction

WINTON policy for 1916 is summed up in two chassis with two six-cylinder motors and two lengths of wheelbase, as announced early in December, 1915. With the option of motor and wheelbase as the primary matter of choice, there are a number of secondary options such as the color scheme, wood or wire wheels and body design. Another interesting feature is that the chassis can be secured with two different types of bodies for winter and summer use and no mechanical changes are required in mounting the different bodies. All the wiring is brought to a single connection on the dash so that no electrical complications are met with in making the change.

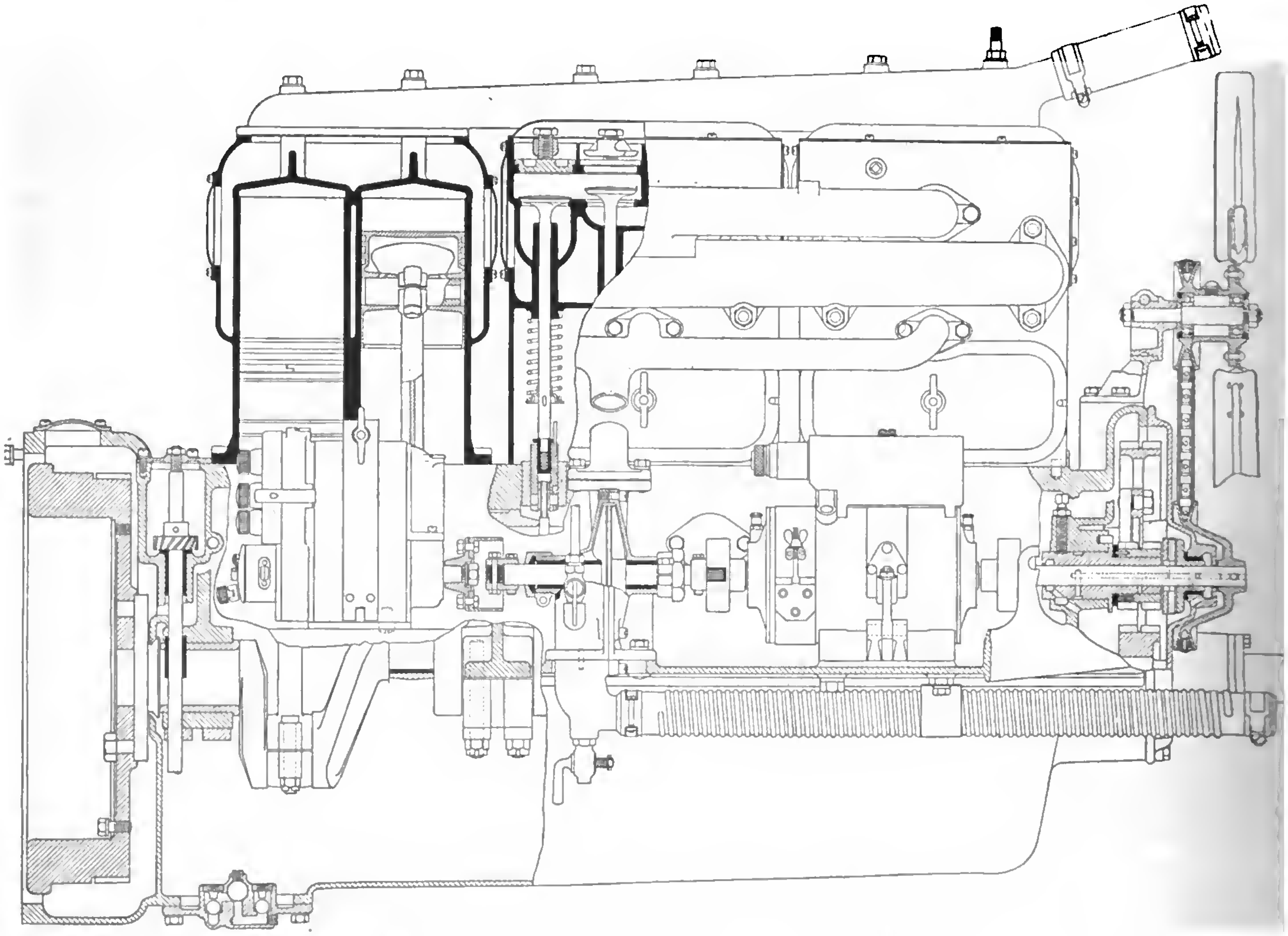
The Winton models for 1916 are known as the 33 and 48, the prices for the stock cars being respectively $2,285 and $3,500. Both cars are built to give the highest degree of comfort and luxury combined with low upkeep cost. Mounted on wheelbases of 138 and 128 in. the cars are fitted with roomy seats, deep upholstery and the latest features of mechanical equipment. The design follows up-to-date practice with left drive, center control, unit power plant, underslung rear springs, vacuum feed, magneto ignition and a motor-driven tire pump is incorporated within the stock jobs.

Both motors are similar in design, the 48 has its six cylinders cast in pairs and with dimensions of 4½ by 5½ in., has an S. A. E. rating of 48.6 hp. Following the tendency of the times all the moving parts of this motor are fully inclosed and all possible parts operate directly in an oil bath. The cylinders are cast of close-grain iron ground to a mirror finish and submitted before assembly to a hydraulic test of 300-lb. per square inch, the waterjacket space surrounding each individual cylinder.

The piston rings are concentric and in carrying out the balance scheme all the pistons, rings, connecting rods and wristpins must be of the same weight per set. Hardened tool steel is used in the piston pin, and as will be noted in the accompanying sections the connecting rods are long to reduce angularity of operation.

Chain Camshaft Drive

Following through the valve action it will be noted that the camshaft drive is by silent chain from the crankshaft. The camshaft and cams are a one-piece integral forging

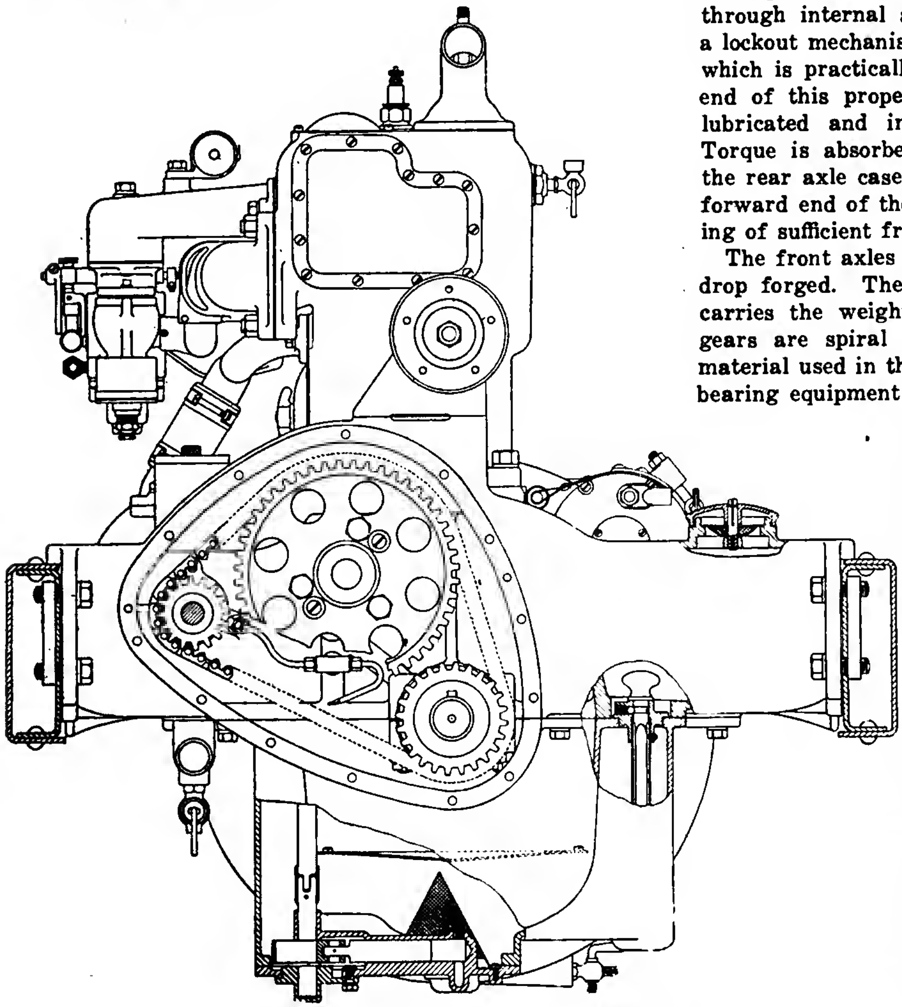


Partial section through Winton six-cylinder motor showing details of cylinders, pistons and valve acti with the profile of the cams such as to provide a gas flow proportional to the piston speed, and the entire shaft can be removed through the front of the timing case without removing the valves, valve springs, pushrods or rollers. To increase the durability of the chain the latter is equipped with a Moore eccentric takeup attachment. All the valves are the same size and the exhaust valves are of tungsten steel with nickel steel valve heads for the intake side. Covering the valve springs, plungers and adjustment points are steel plates.

Materials Chosen Carefully

Throughout the entire car the materials have been made the subject of a careful study. The crankshaft is chrome nickel steel having a tensile strength of 130,000 lb. per sq. in. and runs on four bearings bushed with Parsons' white brass, the crankshaft bearing surfaces being ground to a finish fit. For the crankcase, aluminum is used and the casting is provided with integral arms resting on the main frame. Also integral with the crankcase is the base pan extending from arm to arm, and the case itself is divided into two halves with the bearings all supported in bridges in the upper half. Fitted to the crankcase are a drain at the bottom for flushing and a breather pipe.

Electrically the car is equipped with the Bijur two-unit starting and lighting system and Bosch ignition system with storage battery to supply auxiliary current for starting. The magneto is strapped to the motor base and is connected to the water pump shaft by an adjustable metal coupling. A feature of the layout of the motor is the neatness of the wiring. It is all inclosed in insulating tubes and removable at the spark plugs without tools by means of quick-detachable clips.



Front view of motor with timing cover plate removed

Carburetion is by a Rayfield, which is of a special design to meet the needs of the Winton motor. In order to facilitate gasification of the fuel it is both hot waterjacketed and equipped for hot-air supply. To take care of the changes in adjustment of mixture due to different temperature conditions there is a gasoline primer operated from the cowl board and also a dash air control.

Lubrication is by pressure feed, the oil being circulated by a plunger pump located in the lower half of the crankcase. This pump is driven by spiral gears from the camshaft and takes the oil through a screen from the reservoir and delivers it through a tube cast in the crankcase to the main bearing. From these points the oil enters conduits drilled in the crankshaft through which it passes to the lower connecting rod bearings and also by means of a tube to the front chain and sprockets. The cylinders, camshaft bearings and cams are fed by the oil which is thrown from the connecting rods, and in order to distribute the oil completely around the periphery of the cylinders oil grooves are cut around the pistons. Other parts of the car such as the steering connections and spring bolts are provided with grease cups while the springs are taken care of by Dann lubrication cushion inserts.

Smaller Motor Almost Identical

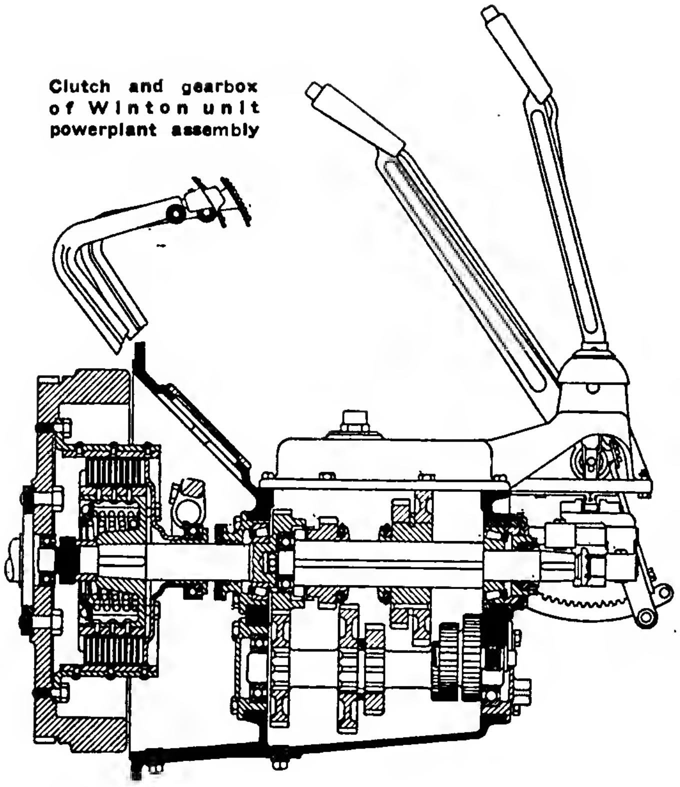
The description of the 48 motor fits the 33 except that the dimensions of the latter are 3¾ by 5¼ and the S. A. E. rating is 33.75 hp. The equipment and general detail of design is the same in both instances. Throughout the remaining chassis specifications a marked similarity also exists. Both cars have dry plate clutches with seventeen disks in the 48 and eleven disks in the 33. Both cars have four-speed gear boxes with direct drive on third speed through internal and external gear combination. There is a lockout mechanism on reverse and final drive is by a shaft which is practically horizontal under normal load. At each end of this propeller shaft is a universal joint internally lubricated and inclosed in a grease-proof metallic case. Torque is absorbed through a torsion rod extending from the rear axle case to a cross member of the frame. At the forward end of the rod there is a link with ball joint allowing of sufficient freedom of motion to give a flexible drive.

The front axles are Elliott type, I-beam section, integrally drop forged. The rear axle is floating, the housing which carries the weight being of pressed steel. The rear axle gears are spiral bevel with bevel gear differential. The material used in the gears and pinions is nickel steel and the bearing equipment is Timken roller throughout.

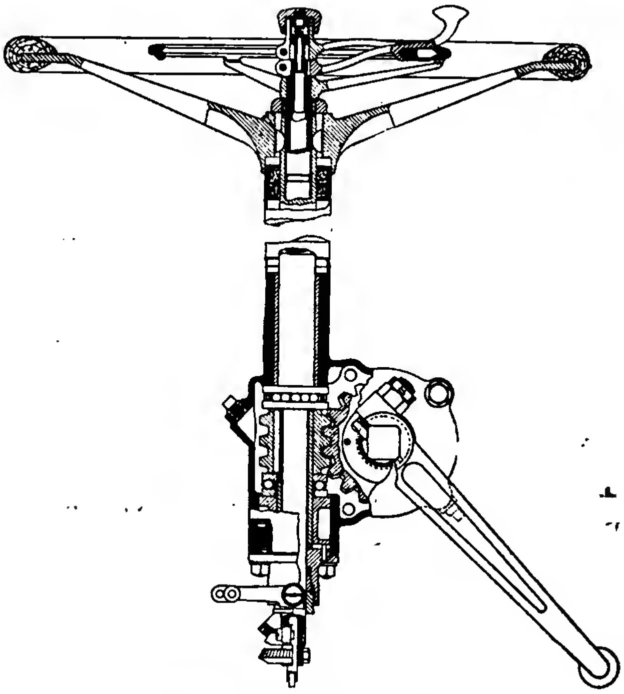
Some of the other important chassis specifications include 37 by 5 tires on the 48 and 36 by 4½ on the 33. Non-skid rears are furnished and the standard equipment is Firestone demountable rims. On the cowl board the equipment includes a combined lighting and ignition switch with Yale lock, ammeter, carbureter control, speedometer clock and gas primer. The instrument board is lighted by electric lamp. The windshield is a ventilating rain-vision design carried over the cowl board, and the cowl itself is of cast aluminum. Floor mat, foot rest and collapsible robe rail are included in the tonneau, and divided front seats are optional.

The Winton company pay particular attention to the finish of their cars and will supply bodies furnished in any color, and will also make special prices for sets of one chassis with two interchangeable bodies.

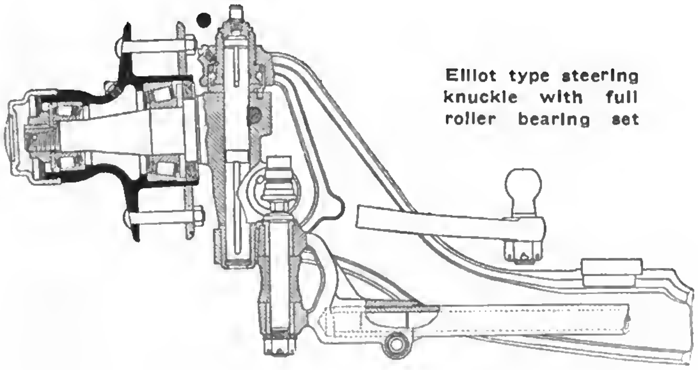
Details of Winton Sixes



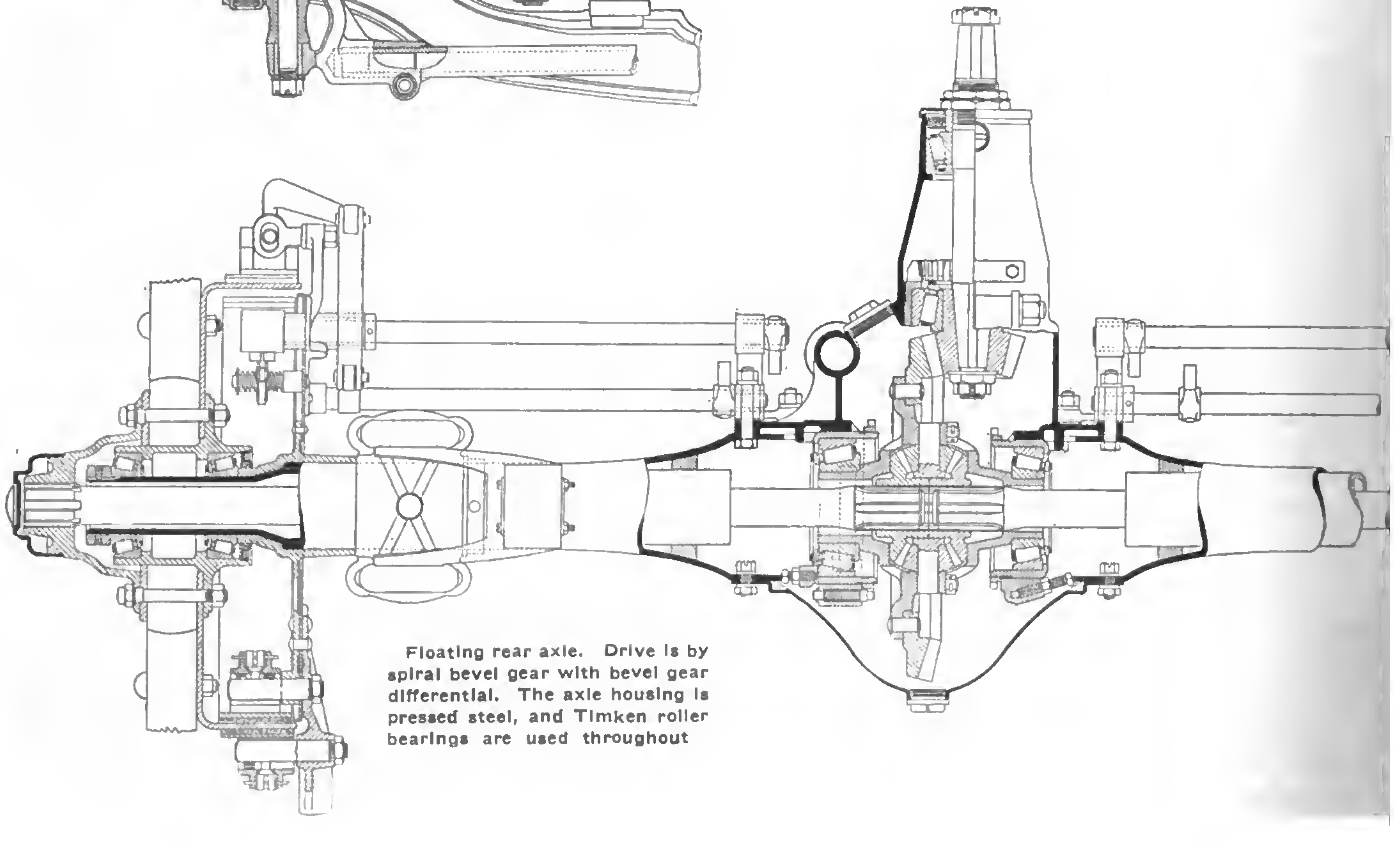
Clutch and gearbox of Winton unit powerplant assembly



Steering column and control—Column held rigid by support attached to cowl board with worm and gear steering mechanism supported by long bearing surfaces. The steering mechanism is equipped with ball thrust bearings and the steering side rod has a ball joint at each end provided with springs to give flexibility and take road shock. Steering links adjustable



Elliot type steering knuckle with full roller bearing set



Floating rear axle. Drive is by spiral bevel gear with bevel gear differential. The axle housing is pressed steel, and Timken roller bearings are used throughout

The History of the American Automobile Industry—16

Hot Air Engine Subject of Many Experiments—Hydrogen and Other Gas Engines Before 1800—Electric Ignition Used in 1807—Regenerative Air Engine

By David Beecroft

IN 1796 Lebon d'Humbersin of Paris received French patent No. 37 for a method of distilling gas from wood, closely following experiments in England by Murdock and others who distilled gas from coal. In 1801 he patented an air engine having three double-acting cylinders. Two of these were used respectively for air and gas which passed through a mixing chamber into a combustion chamber, where they burned and expanded and were then carried to the working cylinder. This device is therefore a very close anticipation of the Brayton engine of seventy-five years later, and, while right in general theory, undoubtedly gave much trouble because of the difficulty of handling and the losses involved in attempting to carry the red-hot gases from the combustion chamber through valves and pipes to the working cylinder. Lebon was assassinated soon after devising this motor and the work ceased.

Cayley's Engine on Practical Lines

He was closely followed, however, by Sir George Cayley, who, in 1807, brought out his hot-air engine and presented it to the public instead of patenting it. His device is particularly worthy of attention because it has finally led through many steps of improvement to the modern internal combustion engine that is driving the great majority of modern automobiles. He patented in 1837 the application of this engine to an automobile, which shows a well worked out device having two or more cylinders, water cooling and self starting so long as the fire was burning. The Cayley device is simplicity itself in conception, but offered a goodly number of difficulties in the attempt to carry it out, particularly in attempting to secure high economy, low first cost, long life and similar important features.

This engine pumped atmospheric air into the ash box of a tight furnace, which air passing through the flame or burning fuel was intensely heated, mingled with the combustion gases and, greatly expanded, was then sent to the working cylinder which it operated, just as steam operated the steam engine, after which it was exhausted. The pressure was, of course, limited to that which might be readily secured by the compression pump. The amount of heating could be much or little, as desired, by passing part of the air around the fire, but whether much or little it was still very high for the inferior lubrication, poor workmanship and inferior materials of those days. Speeds were low and the grit from the fuel undoubtedly quickly destroyed the valves and piston rings. That very little came of this device at this time is not surprising under these circumstances. It would show really practical results to-day.

Use of Electric Ignition

Some modification of it would seem to be particularly advantageous for converting the heat energy of peat into mechanical power, because a wet fuel would tend to develop much steam with consequent high internal pressure and low internal heat, and thus avoid the destruction of the metallic parts and the necessity for great exterior cooling found in most of the hot air engines.

So far the electric spark, although known, seems not to have been used for gas engine ignition, although suggested for firing guns by Benjamin Franklin in 1751 and by Joseph Priestley in 1761, and for air engines by Lebon in 1801. It is claimed that in 1807 de Rivaz actually constructed an engine employing hydrogen and air fired by an electric spark. He is said to have used a cylinder of about 4¾ in. diameter and to have applied his engine to a small locomotive. It is quite probable that this was also of the open-cylinder, free-piston type. The hot-air engines having continuous fires did not need electric ignition, and liquid or gas fuels were not common.

The Stirling Engine

In 1816 Rev. W. Stirling, Scotland, invented a hot-air engine, afterward patented in 1827 and 1840, which used the same air over and over and employed a displacer piston instead of a pump piston, in addition to the working piston. The displacer cylinder was cooled and the working cylinder kept hot by a fire, and the total volume of contained air would be expanded or contracted according to whether it was thrown by the pistons into the hot cylinder or into the cool one. The working piston would be pushed outward by the expanded air and sucked inward by the contracting air. No valves were necessary and the displacer piston was very light, being hollow, and was usually carried by its piston rod so that it required no oil and caused little or no friction. This form of engine found considerable favor and grew in popularity until the end of the century, when it began to be displaced by the smaller, lighter and cheaper now common gas engine.

Even more important than the engine was the "regenerator" or "economizer," which he employed between the hot and cool cylinders to absorb the heat of the air as it passed toward the cool one and to again give it out as the air passed toward the hot cylinder, which arrangement added much to the economy of the device. This regenerator has found extensive use in many industries where high heat is needed and many metallurgical processes would not be profitable and often not possible without it.

Some Leakage of Air

While the above description applies to the Stirling engine as usually made, it was found that there were some losses of air by leakage, and that unless this leakage was made up in some manner the air became so rarified that it had little heat-absorbing capacity, and the engine lost power. On this account it was common not to attempt to get power from the vacuum, but to provide a check valve opening inward which would admit atmospheric air and so maintain the working medium.

A 50-hp. Stirling was used for some years at a Dundee foundry in which the air was maintained under about 200 lbs. compression by a pump, showing even at that date recognition of the fact that this compression permitted more power from a given size engine. Its bore was 16 in. and stroke 48 in. Several reports are extant of the efficiency of this device, the lowest one being 8.5 per cent, which is probably closely correct. It was abandoned after a few years because of failure of the heating surfaces. Modern materials and methods of treating them would have prolonged its life many times.

In 1820, before the Cambridge, England, Philosophical Society, Rev. W. Cecil described an engine using hydrogen gas and air to produce an explosion followed by a vacuum. His engine ran with perfect regularity 60 r.p.m., using 17.6 cu. ft. of hydrogen per hour. He explained that his engine could be used either direct acting or on the gravity system. By the former we understand the now common practice of using the pressure of the expanded charge, and by the gravity system we understand that which was common in those early days and after adopted by Otto & Langen in their free-piston engine, which is well known to most present-day gas engineers. In those days of low pressures there was considerable question as to which method was the better. Although it was not until about 1862 that Alph. Beau de Rochas explained to the world with perfect clearness the cycle of operations now widely used, Sadi Carnot had correctly stated the important heat laws about 1826 and it seems to have been fully understood even in those days that a rapid expansion of the gases was necessary in order to get good power and high economy. In fact, any observer could hardly avoid noticing the cooling effect and loss of power so plainly evident in the first explosions of a cold, slow-moving engine. Rochas' requirements were stated as (1) the greatest possible cylinder volume with the least cooling surface; (2) the greatest possible rapidity of explosion; (3) the greatest possible pressure at the beginning of expansion; and (4) the greatest possible expansion. It is not likely that these earlier experimenters grasped the problem so fully as did Rochas, but it seems certain that they were hindered more by the mechanical difficulties than by a lack of knowledge just as Rochas himself did not carry out his own theories, but left them to be embodied by Otto 14 years later.

Rev. Cecil also describes some earlier experiments by Professor Farish, who exhibited in his lectures an engine working by the explosion of air and gas. It is also said that Farish had operated an engine by gunpowder. These engines of Cecil and Farish seemed to be the first well-authenticated, actually working devices of the internal combustion kind. Their exact construction is not clear, but Cecil seems to have used two pistons in connection with a single combustion chamber.

Great Activity After 1820

With the rapidly improving roads, a rapidly extending commerce, and a greatly increased use of the steam engine as a source of power, it was but natural that the period beginning about 1820 should be marked by great activity in the motor vehicle line in England. Naturally this activity was known in other lands and partly responsible for some of the efforts put forth both in France and America. Undoubtedly the growing use of the steam engine even with its many imperfections stimulated at first, at least, attempts to propel vehicles with other sources of power, among which were hot air, already mentioned, rarified air and compressed air. While the advantage of compressed air for doing work at a distance was not unknown, it seems that very little use thereof had been made in these earlier experiments. British patents issued to George Medhurst in 1799 and 1800 describe "A condensing wind engine for all of the purposes in which steam, water, wind or horses are employed." Also "A new improved method of driving carriages of all kinds without the use of horses by an improved Eolian engine, which may be applied to various other useful purposes." Medhurst further describes that this air may be stored by manual power, by water power, by wind power or by explosive or effervescent substances. He also describes various work that may be performed by his devices and mentions charging stations as well as portable reservoirs or magazines.

Small carriages were to be driven by rotary engines, the larger to have reciprocating engines with speed changing gear. He also describes a gunpowder engine in connection with an artillery wagon. Medhurst designed a pneumatic tube system and published several pamphlets that the knowledge of his inventions might be disseminated.

The FORVM

OLD DURYEA CAR STEERED EASILY—OBJECT OF HEAVY CONSTRUCTION FOR TRACTORS—THICK BRAKE DRUM REDUCES HEATING

Improving the Steering

By A. Ludlow Clayden

IN reply to Mr. Duryea, I must confess that his method of describing the action of bicycle steering is better than mine was. We both meant precisely the same thing, but Mr. Duryea has chosen a better method of expression. However, as to the tilted pivot being the same thing as a pivot placed centrally in the wheel, I must retain my former opinion that it is not and never can be the same. Of course the turning moment of a blow struck on the wheel by an obstacle in the road is lessened by tilting the pivot, and if the pivot angularity is increased, so will the turning moment be reduced, but it cannot be brought down to nothing.

Certainly the old Duryea cars which I enjoyed driving ten years ago or more, did steer well, but the details of their steering were good and the pressures on the various parts were light. Also, and this I think is important, the long tiller for steering, without reduction gearing, gave one the ability to "feel" the steering. Driving a Duryea on a good road was more like steering a boat in smooth water than controlling an ordinary automobile. On rough roads it was always my experience that one was wise to keep a good grip of the tiller, but that may have been because road shocks are so often of a slightly glancing nature with a distinct horizontal component.

Future for Light-Weight Tractor

By Marius C. Krarup

In reading the extracts from Mr. Eason's paper on the development of tractors and their manufacture, I notice a number of reasons for the inclination of manufacturers to stick to the traditional heavy and crude construction with cheap materials, but I find no mention of the most importan factor which makes them so conservative. This is the need of great weight over the tractor wheels to make them pull and overcome great resistance.

Cleats, or adjustable traction blades projecting more or less from the wheel rims are indispensable on soft ground even when the tractor is heavy and can only to a very limited extent take the part of weight for securing the necessary tractive effort. They are troublesome on the road and on hard fallow ground; they cause vibration which is injurious to a light-weight power plant and mechanism designed on the automobile plan, and they militate against the speed which should contibute to making the motor tractor pay for itself. In other words, the tractor system dispensing with heavy-weight construction has not yet been satisfactorily developed. The best that can be done with a light-weight tractor at present is to load it down when it is to do heavy work—likewise as a man jumps upon the back of a light mule to make it pull as much as a horse—or else to use the caterpillar tractor system, which, however, is not adapted for small and inexpensive farm machines.

Rational efforts for introducing light-weight automobile construction for farm work must therefore be aimed first of all at revolutionizing the propulsive system. To make the work done in the soil push or pull the power plant ahead, or to make it help in doing so, is the most radical thought in this connection. The Lanz machines and the von Meyenburg machines are the best examples of this principle. The soil is milled by tools rotating in the same sense as tractor wheels, and the resistance of the soil against the movement of the tools therefore assists in propulsion. But the work done is not plowing or harrowing. (The rotary disk harrow operates the other way, and does only light work, comparatively.) It is soil-tilling on a new plan, to which farmers must first become reconciled. The work done per acre consumes, so far, from 1.7 to 2 times as much motor fuel as plain plowing, but separate harrowing can in many cases be spared, as the new tools divide the soil much more finely than the plough does. The returns in the form of increased crops or final economy in cultivation are not yet proved.

One of the strongest mechanical objections to soil-milling, with the methods and soil tools which have so far been tried in public, is the necessity for rotating the tools very rapidly—approximately four times as fast at the prongs of the tools as the linear forward speed of the machine as a whole—the result of which is that these tools are easily broken or injured when striking stones in the soil. Another objection is that when the soil resistance is great the milling is slighted and the propulsion is favored.

Brake Drum Thickness Affects Heating

By E. H. Delling

Chief Engineer Mercer Automobile Co.

I have read Mr. Booth's article, "Working Out of the Rolls-Royce Brake," with interest, and find that our experience in the designing of a brake has been very similar to his.

We have had trouble with accumulating a great deal of heat in the brake drum of the propellor shaft brake, due to the fact that the shoes with asbestos lining are insulated and cannot therefore conduct the heat away. We are using a high carbon steel casting for our brake drum at present, incorporating cooling ribs on the outside.

We found we still could bring the brake drum to a black heat when abusing the brake violently in succession. We increased the thickness of the wall of the brake drum only 1/32-in., and this slight change made a wonderful difference. We can only bring these brakes to a dark yellow at present, which we think is not a dangerous heat in a brake of this type. We might add that our brake shoes are made of aluminum.

Tipton Uses Balanced Rotating Sleeve

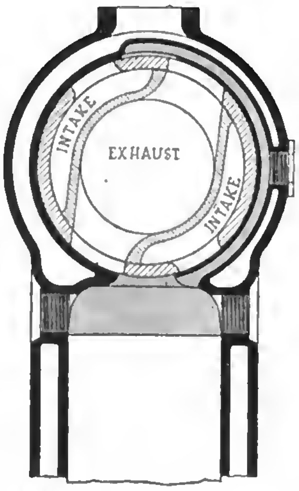
Cored Passage for Inlet and Central Bore for Exhaust in Overhead Construction—Unique Connecting Rod, Flywheel and Crankshaft Assemblies

A UNIQUE form of sleeve valve motor has recently been designed by W. P. Tipton. It is intended to overcome inertia in the valve gear in high-speed motors by employing a rotary action.

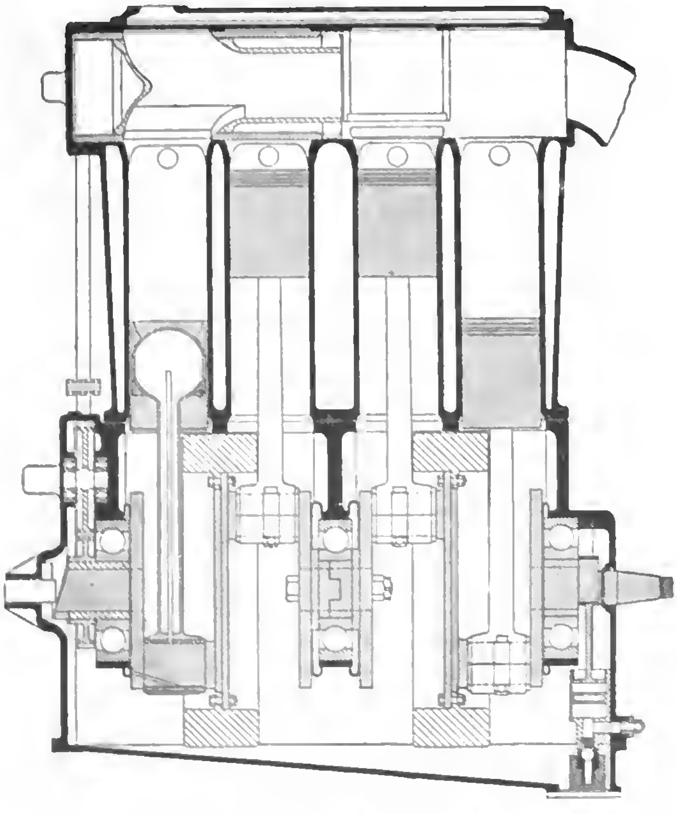
The valve design is distinctive in that it has two concentric chambers, the inner for exhaust and the outer for inlet gases. On a 3½ by 6¾-in. motor the valve diameter will be 5 in. and the area of the valve ports will be 4.844 sq. in. or 50 per cent of the piston area, a ratio which is suggestive of good action at high speeds where the greatest possible volumetric efficiency and the most reasonable gas speeds are desired.

The inlet gases are led to the combustion chamber by way of the annular bridged slot shown in the middle of the valve, which slot is connected to the carbureter through the inlet manifold. This construction is clearly shown in the longitudinal and transverse valve sections in the accompanying illustrations.

Accurate balance of the valve is secured by a second, diametrically disposed port of equal area, which distributes the gaseous pressure on either side of the valve. The passage for the gases to this balancing port is through a duct cored around the valve in the cylinder casting.



Section of Tipton Valve



Tipton motor, showing spherical connecting rod end

The area of the valve surface passing the ports during the compression and expansion strokes is inclosed by four interlocking bars of cost iron lying in grooves in the valve shell and held against the valve walls by a flat steel spring in back of the bars. With a reasonable amount of lubrication it is intended that this design should assure a gas-tight fit, without reducing the clearance between the valve and the wall.

Provision is made against warping by using an outer shell of 5/16-in. steel tubing into which grooves for compession rings are cut, also the teeth at the forward end of the valve for guiding purposes. The exhaust passage is of cast iron and is lightly welded at all contact points to the outer shell. As the outer shell is partially cooled by inlet gases as well as by the water-jacketed walls, and as it is heated and cooled uniformly throughout its entire area and not locally, the designer states that uniform expansion should occur and the vastly greater strength of the outer shell will overcome the warping stresses set up in the cast-iron exhaust passages.

The bearing speed of the valve is low in comparison to that of the piston, the ratio being 428 to 1000; and, as its load is small lubrication should be simple. The designer takes care of this by a small force feed introduced at five points, one between each pair of cylinders.

Another interesting part of the design is the ball-end connecting rod. This rod is tubular, having a flare at the upper end and a hemispherical pressed steel shell welded on. The entire end is ground spherical and an adjustable aluminum alloy guide is made with compression rings. With this construction the greater part of the explosive force is accepted directly by the connecting rod and the entire construction is intended to give light weight with good thermal conditions.

Referring to the crankshaft construction, it will be noted that two flywheels are used flanged to the counterbalanced crankshaft. The idea is to eliminate whipping of the shaft as the energy is stored up directly in the flywheel, without the necessity of the impulse passing through the entire shaft, thus causing a whipping action.

Lubrication is by force feed to the ball bearings, the overflow being caught by the four gutter rings and led through the drilled crank web to the connecting rod bearing, thence to the upper end of the piston through the copper tube within the rod.

A positively driven plunger pump keeps the engine base dry, forcing oil to a five-gallon tank. When the pump has cleaned out the base it draws in pure air and automatically maintains a pressure on the supply tank by means of a blow-off valve. The oil feed is connected with the throttle, thus adjusting oil supply to motor speed.

The entire design aims by means of large ports, positive timing, light-weight reciprocating parts and accurate balancing to avoid the difficulties of the higher rotative speeds and to show good performance in the upper ranges.

The Rostrum

Offset Cam Distributes Follower Wear

EDITOR THE AUTOMOBILE:—Some gasoline motor manufacturer has designed an engine with an offset between the center lines of the camshaft and pushrod, as shown on my sketch. This motor is L-head type, 3¼ by 5, and valve opening is about ¼ in., and motor speed from minimum to high is approximately 800 to 1800 r.p.m. If there is any advantage in the above mentioned valve mechanism, kindly fully explain it.

Flint, Mich. W. N. N.

—The advantage of the offset cam is that the cam tends to rotate the pushrod. The result is that the wear due to cam contact is distributed around the entire circumference of the circle of travel.

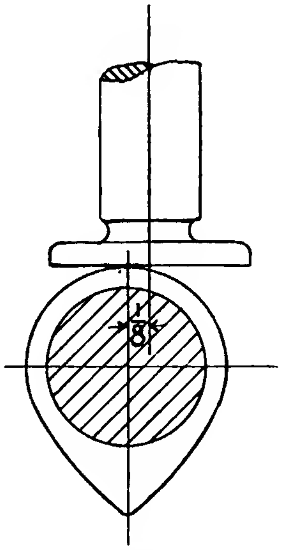


Fig. 1—Offset cam and follower

Field of Self-Lubricated Bearings

Editor THE AUTOMOBILE:—What are self-lubricating bearings?

2—Does this self-lubricating quality last as long as the life of the bearing?

3—For what special work are they used?

4—Are they fit for severe service, such as the crankshaft and camshaft bearings of a motor?

Washington, D. C. R. A. E.

—Self-lubricating bearings are those in which the frictional qualities of the bearing liners are such that they do not require the use of an additional lubricant.

2—Not always. For instance, in the case of wooden bearings where a treatment is given the wood by impregnation with a certain substance it is often necessary to renew the treatment. Bearings of phosphor bronze and compressed graphite such as are used on brake shafts are claimed to last the life of the car.

3—They have a wide variety of uses, for example: in friction shock absorbers of certain types, wood friction disks are employed which are self lubricating and in marine work the last bearing of the propeller shaft is lined with lignum vitæ. This is a wood with lubricating qualities. As stated, the phosphor bronze and graphite are used in brake work and often for spring eye bushings.

Blitzen Benz Not a Stock Car

Editor THE AUTOMOBILE:—Is the Blitzen Benz car a stock made car in more than one model or just a racer?

2—I have a 1914 model H Hupmobile in which the water boils. It does this after running only two miles. Would you advise installing a pump, and if so how can this be done? Also, what make would you advise for this?

The radiator holds about 20 qt. of water and am using Panhard medium oil in this car. Is this all right? If not, what would you advise?

Chester, N. Y. C. F. J.

—The Blitzen Benz is a racing car and not a stock design.

2—In checking up the motor to remedy the situation due to the boiling of the water the following steps should be taken:

1—See that timing is proper.

2—See that the valves are not riding. The proper adjustment is between 0.004 and 0.006 in.

3—See that spark is advanced as far as possible without causing a knock.

4—Make sure that there are no constrictions in the water passages and that the radiator is clean. The radiator can be flushed out with a solution of soda and then thoroughly irrigated by connecting a hose to the bottom and allowing it to run under city pressure. The same method should be used in cleaning the water-jackets.

5—Be sure that the carbon deposits are removed and that you are using a good grade of cylinder oil.

6—Be sure that the muffler is not clogged, giving excess back pressure.

7—Do not allow the clutch to slip nor the brakes to drag.

8—See that the gasoline mixture is not too rich and make sure that the carbureter is not flooding.

9—The fan belt must be tight so as not to allow the fan to slip while the motor is running.

10—Clean the oil screen so that the circulating system will be sure to operate properly.

Calculated Horsepower by Formula

Editor THE AUTOMOBILE:—Please tell me how to find the horsepower of automobiles?

2—What is the horsepower of a car that is 3¼ by 5 in.?

Jamestown, N. Y. K. B.

—The horsepower of a motor is calculated by squaring the bore, multiplying by the number of cylinders and dividing by 2.5.

2—The formula horsepower for a car having a bore and stroke of 3¼ by 5 in. is 16.90 for a four; 25.35 for a six; 33.80 for an eight and 50.70 for a twelve.

Kerosene Not Good for Radiator Use

Editor THE AUTOMOBILE:—Could coal oil be used in the radiator of Maxwell model 25 this winter instead of water?

Laurelville, Ohio. W. P. DeH.

—It is inadvisable to use coal oil in the radiator of a car. The first warm day will cause such rapid evaporation that serious harm is apt to be done the motor by overheating.

Carburetion Not More Complicated on the Six

Editor THE AUTOMOBILE:—I would like you to explain to me in what way six-cylinder carburetion is more complicated than on a four. In other words, why is carburetion more complicated on a six than a four? What is the reason for this? High authority claims that a six is not as efficient as a four for the same piston displacement. Why is this? What is it about a six that accounts for this lack of efficiency?

2—Is a six of standard make subject to vibration up to 1500 r.p.m.?

3—Is not a four-cylinder motor as satisfactory up to 300 cu. in. and 3000 lb. weight as any six?

Beemer, Neb. GROVER SHARP.

—Carburetion difficulties are hardly more complicated on the six than they are on the four. One of the reasons advanced for less thermal efficiency in the six than in the four is the fact that there is more cooling wall area per unit of displacement in the six than in the four. However, it is generally maintained by six-cylinder manufacturers that the gains in balance, etc., more than make up for the possible losses in thermal efficiency.

2—This you can readily determine by actual experiment. It all depends on how well the motor is balanced.

3—This is another matter of personal opinion. If one were better than the other to such a degree that the opinion was unanimous the other type would surely be abandoned.

Cutout of No Benefit to Motor

Editor THE AUTOMOBILE:—Kindly let me know through THE AUTOMOBILE of what benefit a muffler cutout is to a motor.

Hazleton, Pa. H. M. S.

—No direct benefit or harm results to the motor from the installation of a muffler cutout. Many motorists like to listen to the sound of the exhaust but it is unfortunately true that the use of the cutout is often abused.

Auxiliary Exhaust's Added Complications

Editor THE AUTOMOBILE:—Does any automobile manufacturer employ an auxiliary exhaust in the construction of their motor? If not why? It is used on some makes of stationary engines to advantage and would seem to be practical for use in automobile motors and particularly in those of the valve-in-head type. It would certainly relieve the valves of a considerable amount of heat due to the sweeping of the hot exhaust gases directly against them. I have reference to the vertical type of valve and would make for more complete scavenging of the cylinders of the burned gases and result in greater power and efficiency.

Webster, N. Y. G. J. A.

—No auxiliary exhaust valves are used at the present time. The reason for this is that it has been possible to design the exhaust valves to take care of all the gas flow. Besides, with one set of valves the manifolding arrangements are much simplified.

Balancing Single-Cylinder Vertical Motor

Editor THE AUTOMOBILE:—Kindly explain by sketch and description how to balance a vertical 4 by 5 high speed single cylinder four-cycle air-cooled motor. The flywheel is inclosed in the crankcase having a 9-in. diameter and weighs 30 lb.

2—What clearance would you allow for expansion in this motor using light alloy pistons?

Portland, Ore. A. W.

—Balance of a single-cylinder motor is effected by crankshaft counterweights and heavy flywheel to maintain the minimum variation in angular velocity of the crankshaft.

2—The clearances used with the light alloy pistons are about double those of the cast-iron type.

Compares L-Head and I-Head Motors

Editor THE AUTOMOBILE:—Will a 4 by 4½ valve-in-head motor develop more power than the same size poppet valve motor?

2—Will the above size engine consume more or less gasoline than the poppet valve motor?

3—How will a Knight motor, say 4 by 4½, compare with a poppet valve and valve-in-head motor as to gasoline consumption and power?

4—Will a poppet valve motor have the same compression as a valve-in-head motor?

5—Does it take more or less power to open the valve of a valve-in-head motor than the valve of a poppet valve motor?

6—If you had a poppet valve motor having the same size valves as a valve-in-head motor, which type of motor would develop more power and which would consume more gasoline?

Manitowoc, Wis. J. A. R.

—The probabilities are that the maximum power will be higher due to the more advantageous shape of combustion chamber.

2—There will be no material difference.

3—This depends on individual design.

4—This also depends on individual design.

5—About the same.

6—The efficiency would probably be a little in favor of the valve-in-head type due to the advantageous combustion chamber form. The whole question, however, is one of individual design, as a poor valve-in-the-head motor would not perform as well as a good L-head and vice versa.

Current Regulation of Delco Buick 25

Editor THE AUTOMOBILE:—How is the regulation of current taken care of in Delco system used on a model 25 Buick?

2—In assembling a Ford motor does it make any difference which side of the motor you place the connecting-rod which has the bolt through it at the top making one side heavier than the other?

Blanchard, Iowa. R. H.

—Regulation is taken care of by the inherent qualities of the field winding of the motor generator. This is a reverse series winding.

2—It makes no difference.

Timing of Rotary Valve in Elmore Motor

Editor THE AUTOMOBILE:—Please give timing of rotary gas valve in relation to the piston position on a 1912 model large four-cylinder Elmore.

2—What motor, if any, is interchangeable with the above, meaning four cycle motor? C. BROS.

Clarksburg, W. Va.

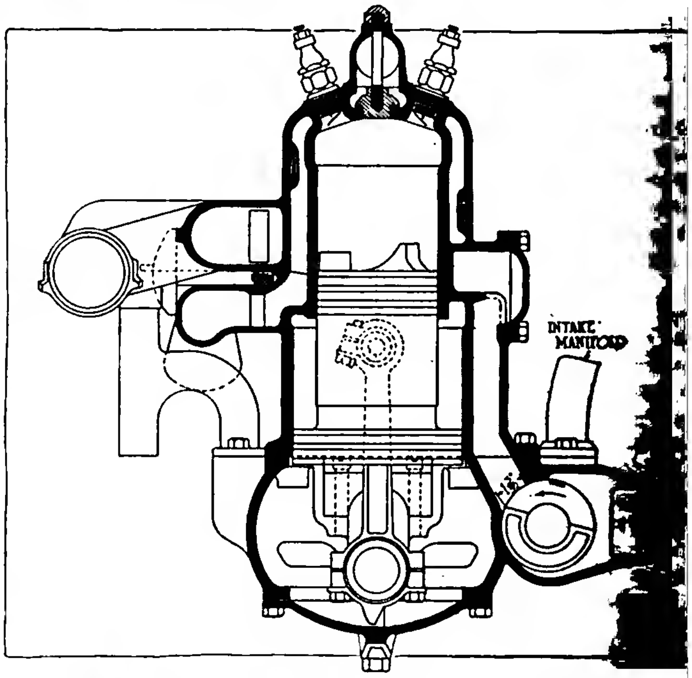


Fig. 2—Section through Elmore showing valve at lower center

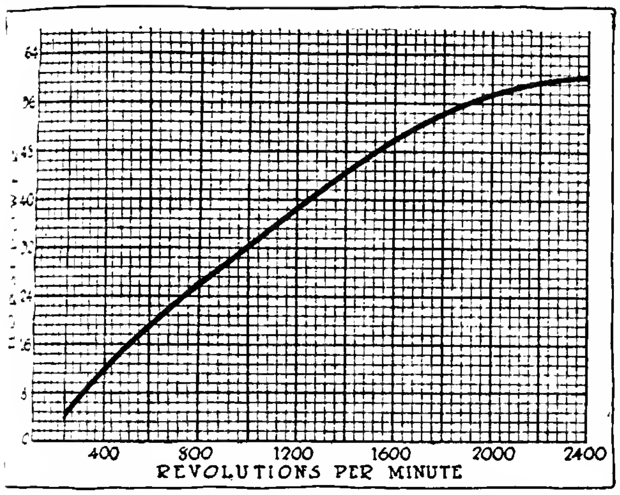


Fig. 3—Horsepower curve of Cadillac Eight for 1916

—The accompanying section of the Elmore motor in Fig. will give an idea of the timing.

—No motor of which THE AUTOMOBILE has any record is interchangeable with the Elmore. It is not difficult, however, to bolt or rivet a sub frame for installing another motor.

Can't Charge from Alternating Current

Editor THE AUTOMOBILE:—A man owning a Ford states that he is going to buy a storage battery and a regulator. He claims he can keep his storage battery charged from the magneto with which the car was equipped. Can that be done? What would it cost?

The battery is to be used for lighting only.

Adams, Minn. J. A.

—It is impossible to use any form of storage battery with a Ford magneto because the current produced by this magneto is alternating.

Wants Parts for Old Dragon Car

Editor THE AUTOMOBILE:—I have a Dragon car with a Buick M-17 rear end, 32 by 3½ wheels. Can I use to advantage 34 by 4 wheels?

2—If I have a plate ⅛ in. thick placed on the end of each valve plug, will I get any advantage from the higher compression?

3—What is best carbureter to use on this type of motor, the intake manifold has been shortened 3 in. to bring the carbureter higher and nearer the cylinders. Is that an advantage?

4—Did the Dragon firm make the motor? If not, whose make was it?

Trenton, N. J. W. R. D.

—The oversize tires for the 32 by 3½ are 33 by 4 and possibly you would save money and secure all the advantages by employing these tires instead of fitting entire new wheels.

2—No.

3—Any standard design of carbureter will be satisfactory. Shortening the intake is an advantage with the present heavy fuel.

4—Yes. You can secure parts for this car from the Philadelphia Machine Works, Philadelphia, Pa., or the Gerson Automobile Exchange, Philadelphia, Pa.

Grabbing Clutch Is Hard on Gears

Editor THE AUTOMOBILE:—We have a car which is continually stripping differential drive gears. The clutch is so savage that it is nearly impossible to start the car without jumping. We have used Neatsfoot oil and adjusted the tension on the springs under the leather and when you get it so that the clutch will take hold easy it spins so that you cannot get into the gears when the car is standing.

Have you any suggestions to offer that might be of benefit to us?

Portales, N. M. E. L. K.

—The clutch and universal assembly used on this model has to be treated very carefully in order to secure satisfactory operation. The best thing to do is to adjust the insert springs so the clutch will engage smoothly and then put on a clutch brake which will slow it up when fully disengaged. This clutch brake must be so located as to have no effect on the clutch until it is thrown out to the limit. If the clutch brake is located so close that it serves as a resistance when it is not fully disengaged it will make shifting from first to second and from second to third very unsatisfactory. Even with this adjustment it will be necessary for the operator to be very careful in the action of his feet when shifting gears. Another suggestion is that the spline shaft between the universal be kept well lubricated.

Valve Timing for Model E Maxwell

Editor THE AUTOMOBILE:—Please give the valve timing which will give maximum power for model E Maxwell.

Hickory, N. C. G. G. W.

—Inlet valve opens 15 deg. late and closes 40 deg. late, these dimensions being 2.387 and 6.633 in. respectively on the flywheel. The exhaust opens 40 deg. early and closes 10 deg. late or 6.633 and 1.691 in. respectively on the flywheel.

Charging Battery from 550-Volt D. C.

Editor THE AUTOMOBILE:—Would it be possible to reduce a 550-volt D. C. current to a voltage suitable for recharging storage batteries such as are used on automobiles for starting and lighting purposes?

2—Could you furnish me a sketch or drawing showing how this could be done with the least expense? Would like to have the most simple method possible as I wish to do the installation myself.

Windber, Pa. R. M. S.

—In charging a starting and lighting battery from a 550-volt D. C. circuit it would be necessary to install sufficient resistance so that the drop across it would be 542½ volts for a 6-volt battery, 535 volts for a 12-volt battery, etc. In the first instance you are utilizing only 7½ ÷ 550 of the energy and in the second case 15 ÷ 550, or 1.36 and 2.72 per cents respectively. It is seen from this that this would be an extremely wasteful method of charging batteries. It can, however, be done, and about the simplest method is to use six strings of 32 c. p. carbon lamps. Strung in groups of five across the positive battery and positive 550-volt D. C. current line. One string of five lamps is lighted for every ampere of charging current desired. The lamps used are the regulation 110-volt 32 c. p. carbon lamps screwed in porcelain sockets, mounted on a board, covered with transite or asbestos board. A wiring diagram of this is given in Fig. 4.

Details of the Cutting Model T

Editor THE AUTOMOBILE:—I have a 1913 model T 35 Cutting car geared 3½ to 1 of which you will kindly answer the following questions:

1—The S. A. E. rating?

2—Probable cause of the car not being able to make more than 35 m.p.h. seemingly at best?

3—The cause of the clutch rattling when disengaged and car is running idle?

4—Where parts can be obtained at lowest prices for said car?

5—Whether car is equipped with Wisconsin engine and whether parts for same can be obtained from Wisconsin Motor Co.?

Danielsville, Pa. W. L. P.

—The S. A. E. rating of this car is 25.60. It had a bore of 4 and a stroke of 5 in.

2—Probably leaky pistons, worn cams, worn timing gears, worn cylinders and loss of compression due to the above and possibly to improper valve seating.

3—Clutch disks worn and also worn keys on clutch drum.

4—Puritan Machine Co., Detroit, Mich.

5—Answered under question 4. THE AUTOMOBILE has no record as to the manufacturer of the motor.

Cadillac Horsepower Curves Are Similar

Editor THE AUTOMOBILE:—Kindly give me the power curves of the 1915 and 1916 Cadillac eights?

Burlington, Vt. H. W. F.

—The horsepower curves for the 1915 and 1916 Cadillac eights are similar. The curve is shown in Fig. 3.

Lamps Use About One Watt per C.P.

Editor THE AUTOMOBILE:—Which consumes more current, a 32 c.p. nitrogen tungsten lamp, 7-volt, or a 15 c.p. mazda tungsten, 7-volt?

Montclair, N. J. S. L. G.

—The 32 c.p. lamp will consume about double the current of the 15 c.p. On the tungsten lamps the current consumption is just about 1 watt per c.p. but on the nitrogen lamp it is slightly less than 1 watt.

Oxygen-Carbon Burning Will Not Harm Piston

Editor THE AUTOMOBILE:—Is the oxygen decarbonizing system successful and will it affect aluminum pistons or piston rings?

St. Louis, Mo. A. R. C.

—The oxygen method of removing carbon is successful. It will not harm aluminum pistons since the action, after the burning has once started, is catalytic and local. The instant the carbon is burned off in a certain locality the combustion in that area ceases.

Sand Hole in Piston Causes Misfiring

Editor THE AUTOMOBILE:—I have a Premier 6-60 1912. When running idle number six cylinder will not fire, but when given more throttle, it will and runs smoothly when speeded up. There is the same compression in this cylinder as in the others.

I have put more tension on exhaust spring so there is not any chance of lifting it on suction stroke. I have put felt washer on intake valve stem in case there was false air getting in around the stem, also put felt washer on number five valve stem. The spark plug is firing all right, at least it does not become dirty. I have changed the plugs from another cylinder, without results. I have also decarbonized and ground the valves.

2—My Remy generator has stopped charging. I have tested the fuse and found it all right. I took the relay off, cleaned the brushes and commutator then when it was started it charged, but the engine sat idle for a day and when started again it failed to charge. On pressing the platinum points together on the automatic relay, it did not show any discharge on the ammeter, but when lights are on the ammeter shows discharge. Will be heartily grateful for anything you may be able to offer on this subject.

Bangor, Me. P. R. W.

—This probably is due to manifold trouble, if the motor is in sound condition throughout. The manifold on the 1912 car may have acted satisfactorily with the gasoline secured at that time, but with the present heavy grade the probabilities are that a good firing mixture is not obtained at idling speeds in the No. 6 cylinder. It is suggested, however, that before giving up the idea of remedying the trouble you remove the piston from No. 6 cylinder and examine it for sand holes, especially under the rings, and also examine the rings for bearing surface around their entire circumference.

2—Although you do not give sufficient data to diagnose accurately the trouble the majority of similar complaints are due to loose connections. Therefore, it is suggested that the first possible cause of the trouble is a break in the generator charging line. A loose connection at the relay or a loose or broken connection or broken wire in the generator charging line will, of course, prevent the generator from charging the battery and would prevent a discharge reading on the ammeter when the relay contact points are placed in contact.

You state that you have examined the relay fuse and found it all right. However, it is suggested that you pinch the fuse clips a little closer together to be sure that these clips are making good contact with the ends of the fuse.

As a third possible cause of this trouble, there may be a small quantity of dust or dirt between the relay points. A very fine piece of sandpaper should be drawn lightly between these points and all dust carefully removed. A very small quantity of dust or dirt lodged between the points might prevent them from making good contact and would therefore prevent the generator from charging.

Kerosene Carbureter Details Not Available

Editor THE AUTOMOBILE:—Kindly give me a description and cut of the Holley kerosene carbureter as stated in THE AUTOMOBILE of Sept. 20, page 584, which is used on the Ford tractor.

2—Kindly give cut of the Ellmore two-cycle engine.

Barberton, Ohio. F. S.

—Details of the Holley kerosene carbureter will not be available until the device is put on the market. This will probably be coincident with the appearance of the Ford tractor.

2—The Ellmore two-cycle motor is shown in section in Fig. 2. Its operation is readily understood from the drawing, as it is a two-cycle motor with a simple rotary valve gas distributer.

Heavy Gasoline Makes Starting Difficult

Editor THE AUTOMOBILE:—I have been unable to start my Buick model 16 on a quarter turn, even when my valves are ground in good and tight, unless it is warm. What is the cause of this?

Lawrence, Mass. C. E. C.

—This is probably a matter of low-grade fuel. As the quality of the fuel becomes poorer the motor will become naturally harder to start.

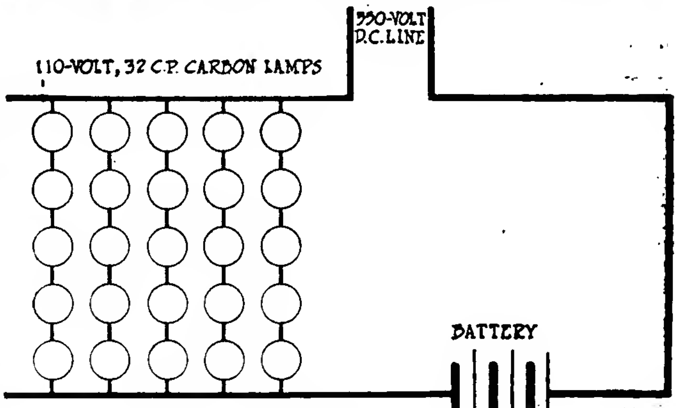


Fig. 4—Charging 3-cell battery from 550-volt D. C. line

British Trade in Strong Condition

War Orders Maintain Profits and Often Increase Them—Sunbeam Co. Earns 89 Per Cent

LONDON, Jan. 15—After one year's operation under war conditions, the British motor industry finds itself in a remarkably strong financial condition. It is only possible to judge with any degree of certainty the strength of those companies registered under the limited liability law and, in consequence, having a published balance sheet. In practically every case the net profit earned during the financial year ending on or about December, 1915, is greater than the earnings for the year 1914. In other words, the war has not had an adverse influence on the British automobile industry.

Sunbeam Profits Huge

The most notable balance sheet is that of the Sunbeam company, which shows a profit of more than $1,200,000, and has paid a dividend of 25 per cent free of income tax. At the same time the company has placed $600,000 to reserve, bringing this account up to $1,100,000, and has carried forward a sum of $378,335. The paid-up capital of the company is $1,350,000, so that the profits of the year bear a very important relation to the capital employed. Further, the amount placed to reserve fund is larger than the net profit in any year in the history of the company, while the amount carried forward exceeds by $25,000 the profits for the year immediately preceding the war.

Firm	Last Div. Per Cent	Net Profit	General Reserve	Special Reserve	Carried Forw'd	Prev. Div. Per Cent
Belsize Motors	10	$235,100	$125,000	....	$51,560	7
B. S. A. and Daimler	20	2,042,275	567,455	....	823,125	15
Brett's Stamping	20	48,000	....	....	....	..
Coventry Chain	10	109,865	....	....	....	..
Calthorpe	30	104,500	....	....	....	15
Briton Motors	10	22,550	5,000	....	....	15
Darracq	7½	695,595	250,000	269,840	85,720	..
Dunlop	20	2,058,195	875,000	....	377,640	15
Dennis Bros.	15	586,100	200,000	125,000	56,745	10
Halley	15	110,195	....	....	....	20
Humber	..	320,730	....	50,000	243,295	..
Lncas Components	20	195,375	....	....	118,770	..
Napier & Son	5	350,865	100,000	....	49,195	3
Palmer Tires	12½	54,835	15,000	....	6,565	12½
Rolls-Royce	10	384,250	100,000	92,500	147,515	10
Rover	10	327,505	150,000	87,500	201,800	40
Rudge Whitworth	10	165,500	....	....	....	10
Singer	15	184,000	....	....	....	10
Star Engineering	10	664,000	....	....	....	10
Swift	7	91,000	....	....	....	7
Sunbeam	*25	1,206,780	600,000	20,000	378,335	15
Stepney Spare Wheel	5	44,810	20,000	77,420	66,630	10
Vanxhall	10	51,740	....	50,000	28,825	..

*Free of income tax.

	Stock Quotations		Last Dividend Before War Per Cent	Last Dividend Since War Per Cent
	July 27, 1914	Jan. 12, 1916		
Anstin	$3.90	$3.95	7	..
Belsize	5.34	5.04	10	10
B. S. A. and Daimler	10.14	9.68	10	20
Calcott	11.52	9.72	5	..
Calthorpe	.....	12.60	..	30
Charron	2.46	1.68	15	..
Darracq	6.42	5.40	..	7½
DeDion Bouton	1.50	1.74	..	..
Dennis Bros.	4.92	6.36	10	15
Dunlop Rubber	10.56	10.38	15	20
Humber	2.78	2.36	..	..
Napier	3.78	.....	7½	5
Riley	1.56	1.92	..	..
Rolls-Royee	12.84	9.42	20	10
Rover	21.12	8.94	40	10
Rudge Whitworth	3.96	4.62	..	10
Singer	10.56	10.92	..	15
Star	2.34	4.80	..	10
Sunbeam	8.94	11.58	33⅓	25
Swift	8.10	4.38	10	7

Tables showing stock quotations of leading British automobile companies on July 27, 1914, and on Jan. 12, 1916. In each case the nominal value of the stock is $4.80. The tables also show the last dividend paid before the war, the last paid since the war, net profits, general reserve funds, etc.

The B. S. A. balance sheet, which also includes the Daimler company, is another conspicuous example of the prosperity of the British automobile industry. The company shows a profit of more than two million dollars and pays 20 per cent, compared with 15 for the previous year. The increased strength of the company is not revealed, however, by the dividend paid to stockholders, for the earnings have increased from $950,000 in the 1914 financial year to more than $2,040,000 during the last year. In addition to this, the company has put nearly two and a half million dollars to the general reserve fund.

Another case which calls for attention is that of the Darracq company, which is registered under English laws but has its factory in France. It is the only one on the adjoined list having a factory abroad. After paying no dividend for four years, the Darracq stock has yielded 7½ per cent, which is very much less than the directors might have paid out had it not been for the uncertainty regarding the future and the desire to strengthen the financial position. Thus the company has placed $250,000 to general reserve, bringing this account up to its original figure of $750,000; it has placed $269,840 to special reserve and has carried forward $85,720.

Dunlop Co. Does Well

The Dunlop Rubber Co. heads the entire list of automobile and kindred firms with a net profit of $2,058,195, being a net increase on the previous year's trading of $185,000. Here again the dividend is not by any means as high as would have been in ordinary times, the directors seeing the necessity of making substantial provision against possible lean years which may follow the war.

In the few cases where the dividend this year is less than for the previous twelve months, it can in nearly every instance be attributed to special circumstances, as, for instance, foreign investments, for which huge depreciations have to be allowed, or losses through branch houses or goods being held by the enemy. These, however, bear a very small proportion to the whole. It should be noted, too, that many of these balance sheets include the first two months of the war, when owing to failure to realize the extent and possible duration of the conflict some of the factories were standing idle or running below their full capacity.

Financially the position of the English and the French automobile manufacturing concerns is unusually strong, but this does not imply complete satisfaction on the part of those holding interests in them. The government scheme to tax a large proportion of the excess profits is not to the taste of interested parties. One outcome of this has been that the Darracq company has formed a French company to acquire the French factory, the whole of the stock, with the exception of the small amount necessary to comply with the law, being held by the British company. The main advantage of this is that the French taxation of war profits will be lower than that of England; it will also facilitate the firm in a certain degree in the securing of French war contracts. Under the conditions brought about by the war, English firms with factories in France—there are about half a dozen of them in the automobile industry—were liable to taxation both by the French and by the British.

The greatest strength of the British motor industry is not revealed in the summaries of its financial situation. While reserve funds are being built up and adequate dividends are being paid on common stock, immense sums are being expended on improvements and additions to the factories. The new plant put down since the war costs more than in normal times, but in most cases its cost will be wiped off by the war contracts already in hand. The result is that the end of the war ought to find the automobile industry sounder financially than at any previous period, and at the same time in possession of more modern and more completely equipped establishments.

Despite this, British manufacturers are not particularly joyful. There is a haunting fear that the end of the war will find America in possession of the home and colonial markets; the goodwill and trade names which have taken years to build up, are gradually diminishing until they may become insignificant factors. In this connection the war is tending to place the smallest firm on a level with the best. All, big and little, have to face the fact that American makers who would normally never have found a footing on the market, have now secured a strong position and will have to be competed against. In consequence, the feeling toward the American automobile industry is far from cordial. Of this more can be stated later.

Vesta Electro-Mechanical Clutch Proves Good on Trial

By Darwin S. Hatch

CHICAGO, Feb. 4—Not uncommonly, new ideas that seem to offer much when viewed on paper fail, in an actual trial, to live up to the expectations aroused by a study of their plans. Constructional difficulties sometimes make it impossible to get expected results by the practical application of a good theory. Hence, it is a pleasure to record the results of a drive in a car equipped with the new Vesta centrifugal electric clutch which was described in THE AUTOMOBILE for Jan. 27, of which the design promised a number of advantages over conventional transmission systems in the way of easier control and smoother running.

Actual handling of the car equipped with the new system proved a revelation as to what extent it is possible to convert the irregular impulses of the gasoline engine into smooth, even torque at the rear wheels.

Clutch Combines Generator

To recall the features of the design which was explained in detail in the earlier issue, the Vesta centrifugal eelctric generating clutch is a combined motor-generator which replaces the clutch, lighting generator and starting motor of the conventional car. There is a gearset which offers two or three speed reductions for emergency use, but under ordinary conditions, starting and running are on direct drive.

The idea of the new design is the utilization of a combination of the electromagnetic drag between the armature and fields of any electrical machine with a direct friction connection, such as is obtained in the ordinary clutch. The armature of the instrument constitutes the flywheel of the engine and the field is mounted on the forward end of the propeller shaft with a unique constant-mesh gearset between it and the propeller shaft. The fields are within the armature, so that the commutator is internal, and the brushes, which revolve with the driveshaft, press outwardly against the commutator. They are mounted in such a way that they press more heavily against the commutator as the speed increases.

At low speeds, or whenever the resistance of the rear wheels is too great for the centrifugal force to prevent slippage between brushes and commutator, the fields will start to revolve more rapidly than the armature and this difference in speed causes a current to be generated in the armature. This current flows around the field poles, making magnets of them, the magnetic drag thus caused drawing the armature around with the field. The greater the slip, the greater the magnetic pull. The excess current produced by variation in speed between armature and field goes to keep the battery charged. No current for the operation of the clutch is taken from the battery except when the clutch is operated as a motor to crank the engine.

In view of the fact that there is no mechanical connection between engine and flywheel at low speeds, it is to be expected that the action of the car would be exceedingly smooth, and such proved to be the case. Even when starting with a cold motor, which missed and bucked as cold motors are wont to do, only the sound of the irregular explosions apprised us of the fact that the engine was not working smoothly. So far as the propulsion of the car was concerned, we might have had twelve cylinders under the bonnet instead of intermittent three and four.

The first view of a car equipped with the new system did not indicate much out of the ordinary. There was a slightly larger battery than usual. Also on the running-board there was a small metal box, which later was found to be the switch unit. The steering column offered the most to be seen. Under the steering wheel was a metal box, from the sides of which protruded four large buttons, about half the size of doornobs. There was neither gearshift nor emergency brake lever. Otherwise the car was normal.

Handling Is Easy

The handling of the car was very simple and easy, an overgrown button in the form of a knob was pulled out and the engine started. We pulled a second, or neutral button, which left the car ready to be started on high; then stepped on the accelerator and the car moved off, picking up in speed as the throttle was opened—and accelerating with surprising rapidity.

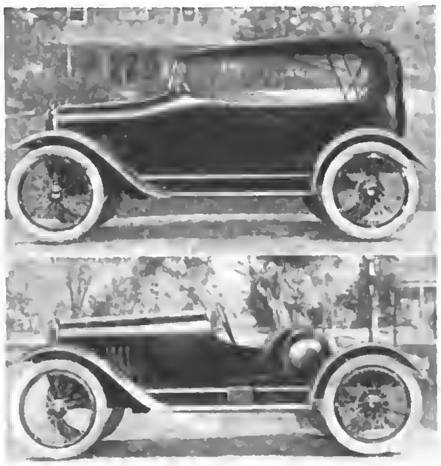
Then we tried to stall the engine. With a foot on either brake pedal and still on high speed we brought the car almost to a dead stop and still the engine kept running, even with the throttle fairly well closed. It is impossible to stall the motor by applying the brakes.

Running at 25 m.p.h. on high, we pushed another knob and without the slightest sensation of a jerk we were in low, the only evidence of the change being the slight click of the solenoid switch and the increased motor speed. There was no careful slowing down, holding out of clutch, shifting a lever, accompanied by grinding of geers, speeding up the engine, letting in the clutch, etc., that usually is necessary in dropping from a high to a lower speed with the conventional transmissions—we simply pulled knobs on the steering column and that was all. The gearset is operated electrically by knobs on the control box mounted on the steering column. Also it is of the constant-mesh type, so the gears

(*Concluded on Page* 299)

ACCESSORIES

Universal Specialties for Fords



Ford cars fitted with Universal Car Equipment Co.'s special bodies, wheels, fenders, etc. The tourabout, above, has a special top and windshield

THE Universal streamline tourabout body for Ford cars is of reinforced heavy gage steel, and the upholstery is deep and comfortable with spring cushions. Seats are wide and legroom is ample. Guaranteed Boston Artificial Leather Co. fabric is the upholstery material used and the equipment includes robe and foot rails, scuff plates, carpet, lock plates and knobs. Fifteen painting operations insure the durability and high quality of the finish, the standard color being black with gold stripe, with special colors $10 extra. The mohair khaki one-person top and rain-vision ventilating windshield, illustrated, are made especially for this body and will not fit the regular Ford type. The body sells for $150; with the top and windshield as illustrated, $38 extra. The Universal streamline radiator, of heavy steel well enameled and finished, with extra large cooling area, sells for $45, f.o.b. Detroit, including special crank, hood clamp brackets, bolts, etc. The Spranger wire wheel recently described in THE AUTOMOBILE is sold for $35 for a set of four wheels and five rims in red, green, black or yellow, including a rim wrench. These wheels, which are easily attached without bolts, front wheels coming complete with ball bearings and rear machined to proper taper and key seat, may be had in special colors for $5 extra. The special crown fenders illustrated sell for $14 a set.

The Universal streamline raceabout body for Fords, illustrated herewith, is similar in material and construction to the tourabout, having deep, comfortable upholstery. This body, finished in red with black trim, hood and fenders being black and radiator black or nickel, sells for $100, including 15-gal. fuel tank and spare tire carrier. Special colors are $10 extra. Radiator and wire wheels, as described, may be fitted with this body.

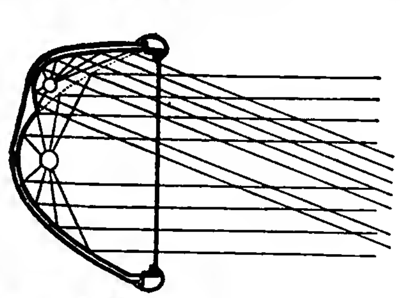
Another Universal accessory is the one-person top for the regular Ford body, which is of the best material and easily raised or lowered. With Jiffy or plain curtains, rubber cloth, mohair or khaki, including top boot, this top sells for $30. —Universal Car Equipment Co., Detroit, Mich.

Liquid Lustro Oil

This body polish is intended to prevent varnish from drying and cracking and is also claimed to neutralize the effects of alkaline soaps often used in washing cars by garagemen. The makers state that the polish may be used with impunity on any body surface as it will not injure lettering, crests or other ornamentations. The oil sells for 25 cents per 6-oz. bottle or 8-oz. can, or for 45 cents per pint can or 85 cents per quart.—Kenny & Moore, New York City.

Miller Double Focus Headlight

A new arrangement by means of which the dimming problem is handled by a double focus reflector and two lamps is illustrated herewith. The larger of the two lamps is intended for use only in country driving. The light from this lamp is directed horizontally and gives effective illumination of the road for a distance of 300 ft. or more according to the candlepower used. The smaller lamp, which is also in focus, gives a light of lesser strength and is directed downward at an angle so that the road is illuminated ahead of the car for 75 or 100 ft. No light is projected above the level of the lamp. In passing another vehicle the dim light can be switched on without removing illumination from the road.—W. M. S. Miller, Milwaukee, Wis.



At the left is the Miller double focus headlight, its principle of operation being illustrated above

Johnson's Cleaner

This cleaner, which is for use either with or without Johnson's prepared wax, is claimed by the manufacturer to entirely remove all stains, discolorations, scum, road oil, tar and grease from a car. Even spots that have been ground in and scratches on the surface which seemed permanent are said to disappear at once upon application of the cleaner. The cleaner cannot possibly injure or scratch the varnish, simply cleaning it so that a coat of the prepared wax will produce a high finish. For old cars, both the cleaner and wax should be used, the cleaner being applied two or three times a year and the wax every six or eight weeks. For new cars the wax is sufficient to protect the finish from the ravages of wear and weather.—S. C. Johnson & Son, Racine. Wis.

Bosch Systems for Small Cars

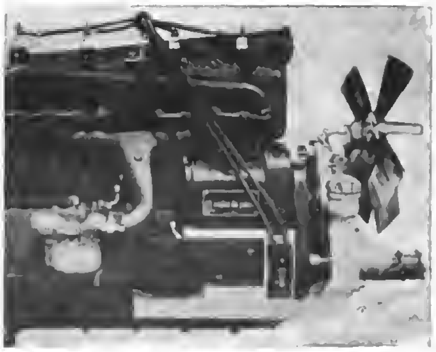
The ignition-lighting system for small cars combines the qualities of an independent high-tension magneto and a direct current, shunt-wound generator. Except that the two units are inclosed in one housing, they are distinct, either operating independently of the other, while the non-operation of one does not affect the other. The whole unit is 9¼ in. long overall, excluding the shaft, 8½ in. high and 4¾ in. wide, the weight of the unit being 25 lb.

The connections of the ignition section of the device comprise only the cables between the distributer and the spark plugs. There is no coil, no separate timer, no complication of wiring, etc., the battery being used only in connection with the lighting section of the device.

The generator section is a direct current shunt-wound type while charging, but has an extra series field connected in series with a lighting switch. Thus all the lighting current passes through the series field, increasing the output of the device when running under load. The wiring is simple, consisting of a cable from battery to generator and another cable from the generator to the distribution switch. The normal capacity of the generator is 10 amp. at 7½ volts, equal to 75 watts.

The starting unit is separate and entirely independent, being mounted as illustrated at the left side of the motor,

Bosch starting motor for small cars, showing mounting on Ford flywheel



Bosch lighting and ignition system for small cars. Note horizontal magnet

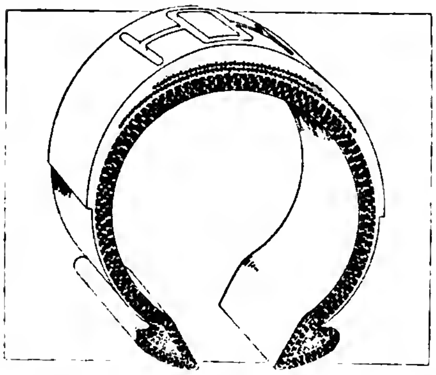
where it acts on a special split gear ring clamped to the flywheel.—Bosch Magneto Co., New York City.

Combination Tires

Combination tires are made with plain tread and in two styles of non-skid tread, both of the latter having depressed markings. Several layers of fabric are employed and in addition a double layer of fabric protects the cushion strip. The tread is of black rubber and a specially hand-constructed bead is employed which is said to be proof against rim-cutting or coming off the rim. Some of the list prices are as follows:

Size	Plain Tread	Hold-On Tread
30 x 3	$10.85	$12.70
30 x 3½	14.15	16.20
34 x 4	23.60	27.10
36 x 4½	33.35	39.20
37 x 5	38.85	48.90

The accompanying illustration gives an idea of the non-skid tread.—Combination Rubber Mfg. Co., Bloomfield, N. J.

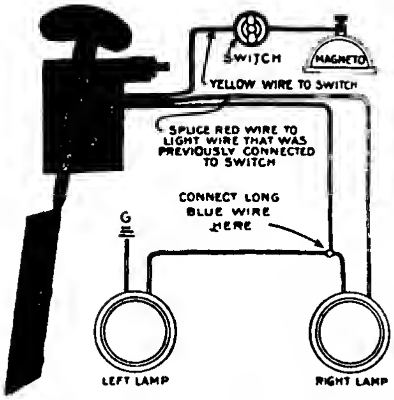


Combination Rubber Mfg. Co.'s depressed non-skid tread

New York Headlight Controller

With this advice the makers claim a Ford magneto can be made to deliver a brilliant strong light even when operating at the lowest speeds at which the car can run. The most novel feature of the device consists in the principle of utilizing the entire electrical output of the Ford magneto at all speeds below approximately 15 m.p.h. for the one headlight located on the left side of the car. Above this speed the two lights come into use, and at still greater speeds a resistance is automatically thrown into the circuits to prevent the lamp from becoming burned out. Every operation of the device is automatic, the driver having nothing to do with the system after it is once installed. The device depends for its operation upon the draught of air created by the fan, the instrument being placed about 8 in. to the rear of the fan, where it is secured to the top of the cylinder by means of one of the cylinder bolts. An arm which is counterweighted carries on one end an aluminum disk, which is in line with the left half of the fan. The air from the fan causes this disk to move away from it in direct proportion to the speed at which the motor is running. An adjustable spiral spring tends always to operate the arm and disk in the opposite direction. The arm carries a contact which forms a sliding connection or contact on three similar contacts secured in the solid metal base.

When the engine is turning at speeds below 15 m.p.h. the arm establishes connections to the one left lamp. As the speed increases to a point where the magneto is able to supply the two lamps with current, the air draft from the fan is sufficient to move the arm to the second contact, which cuts in two lights. A greater speed causes the device to throw in a resistance coil which prevents their being burned out. The device is simply installed.—New York Coil Co., Inc., New York City.



New York headlight controller for Fords

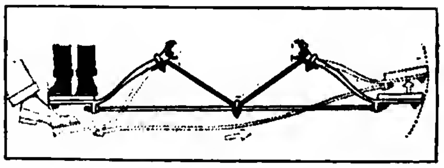
Harper Trailer

These trailers are built as No. 10, which has Timken roller-bearing axles for speeds up to 35 m.p.h., and No. 12 with plain spindles for speeds up to 20 m.p.h. Both models are 8 by 40 by 72 in., inside measurement, either with or without flareboards. Sills are ash and panels yellow poplar. Wheels are 34 by 1⅛ or 1¼ in., either steel or solid rubber tires being fitted. Axles are 1⅛ in., with a carrying capacity of 1000 lb., or 1¼ in., having a capacity of 1500 lb. Standard tread is 56 in. With steel tires the trailer weighs about 280 lb. and with rubber tires about 295 lb. Crating for shipment adds 100 lb. The Harper patent universal joint connection, as illustrated, is used. Standard finish is black with blue striping with lettering at extra cost, if desired. Prices are as follows:

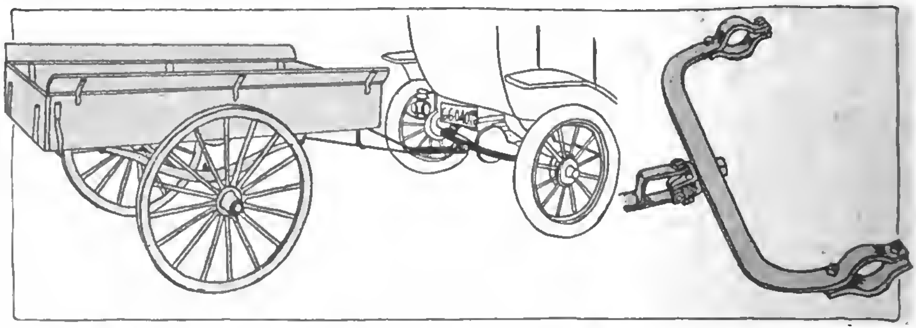
	Steel Tires		Rubber Tires	
Trailer	1⅛-In.	1¼-In.	1⅛-In.	1¼-In.
No. 10......	$60	$62	$65	$68
No. 12......	52	53	57	68

Casey Running-Board Brace

By the use of the Casey brace the running boards of a Ford are prevented from sagging when heavy weight is placed on them. The brace forms a triangular suspension and prevents buckling of the cross rod that runs from one board to the other. It is easily applied without drilling or fitting and without special tools. The brace sells for $2.—Kansas City Automobile Supply Co., Kansas City, Mo.



Casey running board brace for Ford cars



Left—Harper trailer, showing method of attaching to the rear of a Ford car. Right—Harper trailer universal joint type connection

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The Price of Steel and of Automobiles

IT is an almost universal law of commerce that the price of an article bear some relation to the demand for it. If the demand is small the price is high, because it is troublesome to make a thing not often desired. If the demand is steady, competition enters the field and prices come down, reaching a level fair to the manufacturer and to the ultimate buyer. If, after a period of steady and well balanced supply and demand, the latter should suddenly increase an hundredfold, then the price goes up, because the more ardent purchaser willingly offers a premium for the goods he needs.

So to-day is the case of the steel market. Steel, the staple product of America, is in ever-increasing demand, but the curve of demand is more like a flight of steps, or the approach to some great mountain peak, than it is like a well-graded hill. When the country is prosperous, when everyone has money to spend, then the demand for steel is high. When trade is bad, when money is short, then the demand for steel falls off.

At the present moment we see the demand for steel at a fury never before attained, and for *two* reasons. One reason is that Europe's need has caused an immense increase in the exportation of steel products, and the other, *which is the greater of the two*, is that the prosperity *begotten of that exportation* calls for more and more steel to cope with the domestic demand begotten of the prosperity of the U. S. A.

Look on one hand and we see great manufacturing communities earning more money than ever before in history. These same communities, prosperous and with overflowing bank balances, turn naturally to the automobile as a most desirable thing to buy with a portion of their surplus and unexpected wealth.

Look on the other hand and we see the automobile manufacturer distressed that he has to pay more for steel in order to supply the demand on him created by the prosperity of those other persons who have gained their ability to buy automobiles by reason of the prices which other people are willing to pay for steel in other forms.

Examine the position of the employees of a shell factory. They are prosperous because of the foreign demand for the product they are making. Being prosperous they desire to possess automobiles, and the automobile manufacturer finds that the prosperity which creates the demand in this way also has increased the price he has to pay for steel.

Worth Is Not Price

A diamond has no market price; it is worth merely what people can be found to pay for it. In prosperous times diamonds are worth far more than in times of want. In a general trade slump the Kohinoor itself might be worth but a tenth of what it would fetch if put up to auction in times such as those we are enjoying to-day.

Prosperity is a good thing; none but a misanthrope can debate the question, but like most good things it has its price. A manufacturing country desires exports, and more exports, for exports represent direct money earned by the country as a unit, and if a country as a unit is exporting in enormous excess over its imports it is piling up wealth, so long as it obtains a proper price for the goods sent overseas.

America to-day is drawing from Europe incredible sums of money. The impoverishment of Europe is the wealth of America, so if American automobiles are to cost a trifle more the balance still remains well upon the credit side of the ledger. We are all making *much* more money either directly or indirectly, so it is rational to pay a *little* more money for our automobiles, since our very prosperity is the reason for that slight increase in price.

In the past six months we have seen automobile manufacturers decreasing prices in order to tempt a larger market and to be able to increase their outputs. To-day it is clear that the outputs would have been increased just the same without the drop in prices. Obviously then, the wise thing to do is to return all the way or part of the way to the old prices, till such a time as the price of steel decreases. Give the public the credit for a reasonable intelligence and an ability to understand a state of affairs that is making them, collectively, prosperous beyond all dreams.

Kansas City Show Is Largest on Record—Huge Crowds at Opening

Show Claimed to Have Larger Floor Area than Chicago—Exhibits Valued at $3,000,000—Tractor Show, Held Simultaneously, Also Attracts Many Visitors

KANSAS CITY, MO., Feb. 8—The annual motor show of the Kansas City Motor Car Dealers' Association opened to-day in the J. I. Case Building, Twenty-first Street and Broadway, with ninety-six motor car exhibitors and fifty-six accessory dealers having space in the four floors given over to the showing. Officers of the dealer association point out that the Kansas City show has twelve more car exhibitors than the New York exhibition and, using 140,000 sq. ft. of floor space, exceeds in size the recent Chicago show.

The show is the largest in history, with 192 vehicles. There are thirty-two commercial vehicles and fifteen electrics. Many dealers have already arrived from western Kansas, Oklahoma and northern Texas. Many retail sales were reported to-day in spite of cold weather, and much larger attendance than last year is looked for. Buying has been better last month than a year ago. Closed car business has increased heavily. A very large crowd appeared to-night, all four floors of Case Building being crowded.

"Kansas City for the last three years has been the largest motor car distributing center in the United States," E. E. Peake, secretary of the association, explained. "This, however, is the first year the show has been the largest in America."

The Kansas City Tractor Club also opened its first annual show, in a big tent on the Union Station Plaza, to-day. It has twenty-six tractor exhibits and forty-nine accessory makers, using 40,000 sq. ft. of space, and opened with good crowds.

The two shows this week, it is predicted, will bring from 50,000 to 60,000 visitors to Kansas City from western Missouri, Kansas, Oklahoma, southern Nebraska, northwestern Arkansas, and northern Texas, which is, roughly, the district served by the distributing agencies here. More prosperous this year than for several seasons, dealers expect heavy sales throughout the territory and already the hotels are crowded by the incoming visitors.

Convention Hall here has housed the show every previous year. But despite the fact that it was large enough to hold the biggest crowd that heard President Wilson on his recent swing through the Central West, it is too small for the motor exhibit. The Case Building, an eight-story warehouse structure near the new Union Station, was obtained this year, as it offered more space and probably will be retained for future shows.

The exhibits at the show are given a valuation of $3,000,000—the Southwest this year will pay attention to nothing that does not speak in millions.

The first floor in decorations is strictly American, the second modeled after the Monte Carlo gardens, the third has been named the Casino de Vichy, and the fourth floor has been converted into a Japanese garden.

Jordan Motor Car Co. Takes Detroit Office

KENOSHA, WIS., Feb. 8—E. S. Jordan, president of the new Jordan Motor Car Co., announced to-day that an engineering office has been established in the Goldberg Building, Detroit, where preliminary design work of the new car is being carried out. The company has not decided on a factory location as yet.

To Build Entz Transmission in Fort Wayne Plant

NEW YORK CITY, Feb. 8—The Fort Wayne plant of the General Electric Co. is being tooled up to manufacture the Entz transmission in large quantities. The Entz Motor Patents Corp., which was organized primarily to own the patents known as the Entz patents, covering an electric transmission unit, has also acquired other patents owned previously by the General Electric Co., which has acquired a substantial interest in the Entz corporation.

Studebaker to Redeem 5 per Cent Serial Gold Notes

SOUTH BEND, IND., Feb. 8—The Studebaker Corp. has given notice that it will redeem on March 1, 1916, all of its outstanding 5 per cent serial gold notes by the payment of 101½ per cent of the principal thereof, together with the accrued interest thereon. After March 1, 1916, all interest on these notes will cease.

Kelly-Springfield Tire Has $1,706,744 Balance for Dividends

NEW YORK CITY, Feb. 8—The Kelly-Springfield Tire Co. reports for 1915 a balance for dividends of $1,706,744, equal to 29 2/3 per cent on the $4,834,000 common stock, against 23 1/5 per cent on $4,000,000 the previous year. The gross profits were $2,880,080 as against $2,203,761 in 1914.

The balance sheet, as of Dec. 31 last, shows cash on hand of $705,051, against $380,415 in the corresponding period a year ago; total current assets of $3,581,605, against $2,717,405 a year ago and total assets and liabilities of $11,607,761, contrasted with $10,525,153 on Dec. 31, 1914.

The report for the year ended Dec. 31, 1915, is as follows:

	1915	1914
Gross profit	$2,880,080	$2.203.761
Oper. expenses, etc.	1,195,874	1,014,016
Net income	$1,684,206	$1,189,745
Other income	22,538	16,476
Balance for dividends	$1,706,744	$1,215,144
Dividend, sink. funds, etc.	727,664	373,451
Surplus	$979,080	$841,693
Previous surpl's adjusted	1,147,659	292,946
Total surplus	$2,126,739	$1,134,639

Studebaker Reduces Hours

SOUTH BEND, IND., Feb. 8—Effective March 1, the regular working hours in the local plants of the Studebaker Corp. will be reduced from 55 to 50 hr. a week, divided into 9 hr. a day for 5 days, and 5 hr. on Saturday. In order to adjust wages to the new working hours all piece rates and hour rates will be increased 10 per cent.

This action affects about 4000 men and will cost the corporation about $360,000 per annum. The present pay roll is about $300,000 a month.

Princess Motor Car Co. Capitalized at $1,000,000

WILMINGTON, DEL., Feb. 7—The Princess Motor Car Co. of Detroit, Mich., has been incorporated under the laws of Delaware, with a capital of $1,000,000, to manufacture, sell and deal in and with motor cars and all parts. The incorporators are O. C. White of Detroit, and Isaac N. White and Frank W. Barbee, both of Pittsburgh, Pa.

Hathaway Pres. Stanley Belting Corp.

CHICAGO, ILL., Feb. 8—C. E. Hathaway has resigned as Chicago manager of J. H. Williams & Co., maker of drop forgings, and has been elected president of the Stanley Belting Corp., Dundee, Scotland, with headquarters in Chicago.

A. L. Whittemore, also formerly with the Williams company as assistant to Mr. Hathaway, has been elected vice-president. John Laurence was re-elected secretary. A. G. List was elected treasurer.

Rankin Heads Mahin Advertising Co.

CHICAGO, ILL., Feb. 8—J. L. Mahin, founder of the Mahin Advertising Co., has sold his interests to W. H. Rankin, and retires at once from the presidency of the organization. Mr. Rankin has been vice-president of the company during the past seven years.

S. A. E. Sections Expect Good Meetings

Detroit and Indiana Sections Anticipate Large Attendance at February Gatherings

New York City, Feb. 7—On Feb. 16 "The Trend of Automobile Design" will be the paper read before the Detroit section of the S. A. E. by A. Ludlow Clayden, Engineering editor The Automobile, and on Feb. 25 F. A. Cornell will read a paper entitled "Anticipating Complaints" before the Indiana section.

The Detroit paper consists of a candid criticism of the chassis and cars seen at the National shows, and contains some suggestions concerning lines along which automobile engineers will have to work in the future. Particular stress is laid upon the untried possibilities of the heavy oil engine for automobile work.

Mr. Cornell's paper deals with a quite different subject, being a dissertation upon how best the service department of a factory can anticipate troubles and assist the car owner by a proper system which will insure that the troubles be the minimum, and the attention of service men throughout is asked for.

Auto Shipping Breaks All Records

New York City, Feb. 7—Although affected by the famine in freight cars, the automobile industry in January broke all records for the shipment of automobiles, the official figures supplied by the Traffic Department of the National Automobile Chamber of Commerce, showing 18,054 carloads for last month, as against 8369 carloads in January, 1915, an increase of 115 per cent.

This unusual increase during the winter months is looked upon as one of the most favorable signs of a big spring trade. Moreover, the dealers say that with convertible tops and the constant need of the service which automobiles supply, the marketing of motor cars is now conducted on almost as heavy a scale in winter as in summer.

Chalmers Sells Its Boston Branch

Boston, Mass., Feb. 5—One of the biggest motor transactions in New England was completed this week when the Chalmers Motor Co. of Massachusetts was purchased by O. L. Halsey. The latter had been handling Packard cars at Kansas City for six years, but as he was formerly a Bostonian he wanted to return to the Hub. So he sold out there. He is a brother-in-law of Alvan T. Fuller, who has the Packard at Boston, Portland, Providence and Manchester. Harry Pyke, manager of the Chalmers branch, has gone to Detroit to confer with the factory officials about a position. F. E. Sumner, who was wholesale manager for the Saxon Motor Co., has joined the sales force of the new company, and F. P. Allen, retains his place as manager of the organization, a position he held with the Chalmers branch.

Alliance Motor Elects Officers

Alliance, Ohio, Feb. 7—The annual meeting of the stockholders of the Alliance Motor Car Co. resulted in the election of C. C. Mummert, president; C. G. Kline, vice-president; S. L. Geiger, secretary; J. O. Ellis, treasurer and O. R. Mummert, general manager.

Legalizes Sunday Work in Bay State

Boston, Mass., Feb. 5—The Massachusetts Legislature this week passed the bill to allow motor dealers and garage men to sell supplies like oil, gasoline, tires, etc., and to do necessary repair work on Sundays. Under the law as it stood it was illegal to make any repairs or sales on Sundays, and a Springfield judge convicted a garage man for doing it, warning him and others in that city to refuse to sell anything in future.

Cars in Gallery at Boston Show

Boston, Mass., Feb. 5—The problem of how to house all the applicants for space at the Boston Automobile Show is not yet solved, although a partial plan has been worked out. For the first time there will be cars in the balcony this year. A few years ago a couple of dealers exhibited a few cars upstairs, but not very many. This year seven exhibitors have so far been given space there. It is more advantageous than going into another building, for the balcony circles the main hall so that the cars may be seen.

At the present time just 107 exhibitors of passenger cars and trucks have been allotted space, and there are applications on file for at least 40 more. There will be 74 different makes of passenger cars and 33 makes of trucks so that all told more than 400 machines will be on view.

U-W Pull-Out Line Sells for $3.50

New York City, Feb. 7—In a description of the U-W Pull-Out line manufactured by the Upson-Walton Co., Cleveland, Ohio, in The Automobile for Jan. 27, the price was given as $2. This should have been $3.50.

French Import Tractors

Mankato, Minn., Feb. 8—The Mayer Bros. Co. has contracted to deliver in a 5-year period 186 of its light traction engines to a Paris automobile importing firm. The first shipment is being put together and is to leave soon. Announcement was made to the stockholders at their annual meeting Jan. 26.

261,800 Miles Wins Hyatt Contest

Winner Gets $500—Fifteen Other Prizes — Average Mileage 156,814 Per Car

Detroit, Mich., Feb. 4—F. E. Slason, Plainville, Kans., has been awarded the first prize, $500, by the Hyatt Roller Bearing Co. in its mileage contest among car owners to find the one whose automobile has traveled the greatest distance with its original set of Hyatt roller bearings.

The winner had covered 261,800 in a 1909 Buick up to October, 1915, at which time the car was turned over to the judges of the contest.

Besides Mr. Slason, fifteen other contestants have been awarded prizes, and the winning cars covered a total distance of 2,512,435 miles, which is equal to more than 100 times around the world. The average mileage of the sixteen contestants was 156,814 miles or more than six times around the world.

Of the sixteen winning cars, six are Mitchells, four are Fords, two are Buicks, the other four being a Logan, a Maytag, a Hudson and a Flanders. The oldest car was the Logan, which was a 1916 model. One of the Buicks and one of the Fords were of the year 1908. The winning Buick, three Mitchells, the Flanders and one Ford were 1909 models. Three Mitchells, the Hudson and the Maytag were made in 1910, while two Fords were of the 1911 production.

The regulations of the contest which closed Nov. 1, 1915, provided that any car is eligible provided it had its original equipment of Hyatt roller bearings. The winner was to be the one whose car showed the greatest mileage, and he was to receive $500. The next five prizes were respectively $200, $100, $50, $30 and $20, the next ten to receive $10 each.

THE WINNERS

1. F. E. Slason, Plainville, Kans.—1909-Buick; 261,800 miles.
2. James Lewis, Shelton, Conn.—1909-Mitchell; 218,734 miles.
3. J. W. Norman, Paint Rock, Tex.—1909-Mitchell; 183,837 miles.
4. Sam Deck, Darlington, Ind.—1910-Mitchell; 175,875 miles.
5. J. D. Albright, Bowie, Tex.—1911-Ford; 172,683 miles.
6. Earl G. Druding, Ellsworth, Wis.—1909-Ford; 171,418 miles.
7. S. T. & E. R. R., Stockton, Cal.—1909-Mitchell; 160,100 miles.
8. Jacob Stark, Chicago, Ill.—1906-Logan; 148,150 miles.
9. J. J. Moore, Philadelphia, Pa.—1911-Ford; 147,751 miles.
10. John Fraser, Jr., Milwaukee, Wis.—1908-Buick; 139,523 miles.
11. Geo. R. Mason, Des Moines, Ia.—1910-Maytag; 135,000 miles.
12. J. M. Bertolet, M. D., Reading, Pa.—1910-Mitchell; 127,681 miles.
13. Jas. W. Hines, Minneapolis, Minn.—1910-Hudson; 120,256 miles.
14. Linus Kiene — 1910-Mitchell; 120,000 miles.
15. L. N. Burnett, Dallas, Tex.—1909-Flanders; 116,557 miles.
16. F. I. Wiltse, Oneonta, N. Y.—1908-Ford; 113,061 miles.

Carter Carbureter Forms Sales Dept.

H. C. Weed to Be Vice-President of Carter Co.—Will Direct Sales

NEW YORK CITY, Feb. 7—The Carter Carbureter Co. of St. Louis, Mo., has cancelled the selling arrangements which it has had with the H. W. Johns-Manville Co. of New York for two years past and has arranged to market its products this year through its own sales department.

The H. W. Johns-Manville Co. will continue to sell Carter carbureters and Carter gravity tanks, but will no longer handle the sale of these commodities to automobile manufacturers.

H. C. Weed, general manager of the carbureter department of the H. W. Johns-Manville Co. will continue to direct the sales policy of the Carter company, in the capacity of vice-president and general manager with offices at the factory in St. Louis.

The company will make a specialty of service, with factory experts located in every large city in the country under the direct supervision of the service department at the factory. Sales to the trade will be handled entirely through jobbers and general distributors, the policy of the company being to absolutely restrict the sale of its products to the jobbing trade. R. V. Wright, formerly connected with the H. W. Johns-Manville Co. has been made eastern district sales manager, with headquarters at Philadelphia. J. K. Dalton, formerly of the Stromberg Motor Devices Co., will have charge of the Middle West territory, with headquarters at Indianapolis. G. M. Bicknell, assistant engineer of the company, will have permanent residence at Detroit, and will take care of Carter interests there.

Bossert to Enlarge

UTICA, N. Y., Feb. 5—The Bossert Co., manufacturer of automobile pressed steel metal parts, has arranged for the construction of an additional two-story, 180 by 58-ft., factory building. Business in 1915 was better than in any previous year. Orders now on the books are far ahead of the record of 1915 and make the extension of the plant a necessity.

Salem Rubber Co. to Make Tires

SALEM, PA., Feb. 7—The Salem Rubber Co., a concern with an authorized capital of $600,000, will shortly start operations in Salem, Lawrence county, in the plant formerly occupied by the American Case & Register Co. The new company will have a working force of 150 men and a daily output of 250 automobile tires. A. E. Gordon, of New Castle, will be the general manager of the new plant. C. E. Meyer, of Pittsburgh, is financially interested in the new plant.

The new concern will manufacture a standard guaranteed tire with "Salem" as its trademark. Mr. Gordon will bring with him to Salem an organization of trained men. The chief financial support for the new enterprise will be secured in New Castle, Canton, Youngstown and Pittsburgh.

Rutherford Succeeds Raymond as Goodrich Sales Manager

NEW YORK CITY, Feb. 7—W. O. Rutherford has succeeded H. E. Raymond as sales manager of the B. F. Goodrich Co., Akron, Ohio. Mr. Raymond, who is second vice-president of the company, will continue actively as vice-president, exercising general supervision over sales and advertising policies. Mr. Rutherford has been connected with that company for seventeen years.

Lakeside Foundry 100% Stock Dividend

DETROIT, MICH., Feb. 7—The stockholders of the Lakeside Foundry Co. will receive a 100 per cent stock dividend to be paid from accumulated surplus. The capital stock of the company will also be increased from $40,000 to $120,000.

Hoffman, Sun Engineer, Resigns

ELKHART, IND., Feb. 5—R. C. Hoffman, engineer and designer for the Sun Motor Car Co., Elkhart, Ind., has resigned to devote his time to developing a semi-Diesel type of tractor motor.

Republic Output 600 Monthly

ALMA, MICH., Feb. 5—More trucks will be made and shipped during February by the Republic Motor Truck Co., according to general manager F. W. Ruggles, than during the first eighteen months the company was in business. The production schedule has been arranged on a basis of at least twenty-five trucks per working day and at least 600 for the month. Materials for an output of more than 800 trucks were on hand at the beginning of the month, it is said.

New Truck Co. for Bay City

BAY CITY, MICH., Feb. 3—A two-ton truck designed by Howard P. Woodworth, formerly with the Republic Motor Truck Co., Alma, Mich., will be made here by a new truck company now being organized. This was decided at a meeting of business men at the Board of Commerce. Ten men agreed to furnish capital and James R. Tanner was appointed to look after all the necessary preliminary work.

Crude Oil Price No Explanation

Secretary Lane Puts Onus on Standard Oil for Gasoline Price Increase

CHICAGO, ILL., Feb. 7—Word has reached Chicago that Secretary of the Interior Lane has reported to the Senate that the Standard Oil Co. is to blame for the existing high price of gasoline. While the secretary admits that the production of gasoline has not kept pace with demand, he says there is no relation between the price charged by the oil companies for gasoline and the price they paid the producers for the crude oil. He further declared that through their system of refineries and pipe lines, and especially because of their powerful financial backing, the Standard Oil companies are able to profit both on a rising and falling crude oil market.

The secretary's report was in response to a resolution passed by the Senate several weeks ago directing him to institute an inquiry. He submitted figures showing that production was 41,600,000 barrels in 1915, and that consumption in 1914 was 25 per cent more than 1913 and in 1915, 35 per cent more than in 1914. Exports of gasoline, he said, increased 500,000 barrels in 1914 over 1913 and 1,500,000 barrels in 1915 over the preceding year. Crude oil cost the oil companies less in 1915 than in 1914, he said. In conclusion, the secretary said that the increase in the price of crude oil between January, 1915, and the present was from $1.45 a barrel on the first date to $2.25 at present, gasoline rising in the meantime from 12 to 31 cents.

Protests are being made against the skyrocketing prices in several States, the latest to be heard coming from Missouri, where every car owner in the State is being urged by the independent oil dealers to use their influence with their Congressmen toward defeating the proposed bill for taxing gasoline.

Cram Goes to Overland

DETROIT, MICH., Feb. 8—J. M. Cram, for fourteen years with the Mitchell-Lewis Co., and who was vice-president and sales manager of the L. P. C. Motor Co., Racine, Wis., has joined the sales department of Willys-Overland.

Overland Makes Shipping Record

TOLEDO, OHIO, Feb. 8—The Willys-Overland Co. on Jan. 31 last established a new shipping record when 722 automobiles were sent out from its plant that day. During January, 1915, the total number of cars that left the factory amounted to 4613, as compared with 12,393 for the same month this year.

A year ago the daily shipments from the Overland factory averaged 150 cars, or less than one-fourth of its present output. The manufacturing facilities have been increased in one year so that it is now possible to build 1000 cars every 24 hr. The present floor space available for manufacturing purposes is 103 acres. This is fourteen times the size of the original plant when taken over by Mr. Willys eight years ago.

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Sutcliffe Edison Advertising Manager

ORANGE, N. J., Feb. 7—Paul Sutcliffe has been appointed advertising manager of the Edison Storage Battery Co., Orange, N. J. Mr. Sutcliffe got his earlier advertising and selling experience in California. On coming East in 1912 he joined the Edison interests, but resigned at the end of a year to become secretary of the W. S. Hill Advertising Co., Pittsburgh, Pa. He has been in the advertising department of the Edison Storage Battery Co. for the past year.

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Galion Co. to Make Tractor Plow

GALION, OHIO, Feb. 5—The Motor Driven Implement Co. of Galion, Ohio, was incorporated at Columbus recently, with $50,000 capital. The incorporators are E. P. Rayle, Dr. E. D. Helfrich, B. E. Place, S. A. Wheatcraft and H. L. Bodley. The principal output of the company has been in process of perfection for nearly two years, and is now ready for the market. It is a light draft tractor plow, with the plow built into the tractor, the whole to be built so as to sell at a reasonable price. The plow has been tested in all kinds of soil and under all sorts of conditions and is said to have stood the test in every instance.

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New Capital for American Tire & Rubber Co.

AKRON, OHIO, Feb. 6—Stockholders and directors of the American Tire & Rubber Co. voted to reorganize the company with capital to be furnished by the Mauger-French Co. of Massillon, an investment brokerage firm. Contracts for the transfer of the stock, share for share, were settled and the deal was practically completed.

The American Tire & Rubber Co. has been completely overhauled during the past few weeks by H. A. Croxton and associates, a firm of engineers, hired by the American Tire & Rubber Co., to place its property on a basis so it could be considered by brokers for reorganization.

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INDIANAPOLIS, IND., Feb. 4—The Premier Motor Corp. of Del. has announced that $1,710,000 of its total capital of $2,500,000, is to be represented in Indiana.

Great Northwest Wants More Cars

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100,000 Automobiles Is Estimated Requirement of Farmers in Territory

MINNEAPOLIS, MINN., Feb. 6—More than 100,000 farmers in Minnesota are open to buy automobiles. Of the entire registration in the State on Nov. 1, 1915, more than 54 per cent are now owned by farmers. A study of nineteen towns from which cars are registered shows that the most cars are owned in towns supported chiefly by farming or dairying.

For six seasons the coming census of automobiles has been awaited with interest, each season by manufacturers and distributors as a basis for estimate of future sales. This annual digest has been issued for 1915 by the *Farmer*, St. Paul. It places the total registration on going to press at 93,111.

Of the total, when the figures were made, cars registered from Minneapolis, St. Paul and Duluth were altogether 20,541, based on a combined population of 722,871, or thirty-five to the car. Outside these big cities the estimated population of the towns is 640,177, and the registration of cars in the State outside the tri-cities is 64,852. On the basis of thirty-five to the car the actual town ownership of cars is 18,290, leaving 46,562 in the hands of farmers.

In the State there are 155,000 farms with an average wealth of more than $9,000. With the expectation that absence of cars on farms will soon be a rarity, the opportunity to sell automobiles is more than 100,000. Sales increased, according to the table, 33 per cent in 1915.

A number of other details concerning the Northwest territory are given on pages 267, 268 and 269. The tables below, perhaps speak more loudly still.

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Firestone Rim Business Expands

AKRON, OHIO, Feb. 7—The rim factory of the Firestone Tire & Rubber Co. now occupies more floor space than the whole company did in 1910, according to figures just given out, on expansion of the business at the plant.

The demand for rims for the coming season will be for nearly 1,000,000, and this means a large addition to the present rim plant, the company says. The tire plant has been increased to give a daily output of 12,500 tires a day this year instead of 7500, last year's output. The biggest business in the history of the company is anticipated in 1916.

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Firestone Heads Rubber Club

NEW YORK CITY, Feb. 3—The Rubber Club of America has elected the following officers: President, H. S. Firestone, Firestone Tire & Rubber Co.; first vice-president, Van H. Cartmell, Kelly-Springfield Tire Co.; second vice-president, H. L. Hotchkiss, United States Rubber Co.; and secretary, H. S. Vorhis.

CROP VALUES IN MINNESOTA, MONTANA AND THE DAKOTAS

	1915	1914	1915	1914
	MINNESOTA		SOUTH DAKOTA	
Wheat	$66,078,000	$43,834,000	$54,835,000	$29,672,000
Corn	38,502,000	47,320,000	46,182,000	39,000,000
Flaxseed	5,544,000	3,750,000	2,756,000	2,952,000
Oats	43,000,000	34,048,000	20,280,000	16,738,000
Rye	4,738,000	4,668,000	1,334,000	796,000
Potatoes	11,782,000	9,850,000	2,737,000	2,665,000
Hay	20,538,000	20,093,000	6,466,000	4,845,000
Barley	20,176,000	16,798,000	11,040,000	9,775,000
	NORTH DAKOTA		MONTANA	
Wheat	$132,214,000	$82,408,000	$26,384,000	$16,704,000
Flaxseed	11,631,000	8,924,000	1,352,000	1,064,000
Corn	6,561,000	8,120,000	3,213,000	3,072,000
Oats	26,460,000	24,014,000	9,984,000	7,234,000
Rye	2,133,000	1,882,000	146,000	147,000
Potatoes	2,958,000	3,205,000	3,022,000	3,315,000
Hay	3,762,000	3,016,000	11,625,000	15,225,000
Barley	19,712,000	12,724,000	1,306,000	1,132,000

	TOTAL 1915 CROP VALUES OF NORTHWEST, $589,429,000				TOTAL CROP VALUES OF EIGHT CROPS 1915 FOR ALL U. S. A.	
	Minn.	N. D.	S. D.	Mont.	1915	1914
Corn	$38,502,000	$6,566,000	$46,182,000	$1,352,000	$930,000,000	$878,680,000
Spring wheat	65,025,000	132,214,000	52,632,000	12,168,000	1,755,859,000	1,722,070,000
Flaxseed	5,544,000	11,631,000	2,756,000	3,213,000	24,080,000	19,540,000
Oats	43,000,000	26,460,000	20,280,000	9,984,000	555,569,000	499,431,000
Rye	4,738,000	2,133,000	1,334,000	146,000	41,295,000	37,018,000
Potatoes	11,782,000	2,952,000	2,737,000	3,022,000	221,104,000	198,609,000
Hay	20,538,000	3,762,000	6,466,000	11,625,000	912,320,000	779,068,000
Barley	20,176,000	19,712,000	11,040,000	1,306,000	122,499,000	105,903,000
Winter wheat	1,053,000	0,000,000	2,203,000	14,216,000	....	....
	$210,368,000	$205,430,000	$145,630,000	$57,032,000	$4,662,926,000	$4,235,319,000

Vanderbilt Cup Not for Speedway

Refusal to Grant Race to Corona May Reduce New York's Chances

CHICAGO, Feb. 7—Neither the grand prize nor the Vanderbilt cup will be hung up for speedway competition. This is the announcement brought west from New York by G. R. Bentel, manager of the Los Angeles speedway and representative of the Corona Road Racing Assn., who traveled across the continent in hopes of securing the grand prize for the Corona contest, which has been classified as a boulevard or semi-speedway race by the contest board of the A. A. A.

As a consequence, Bentel's long trip was futile as the Motor Cups Holdings Co., which controls both the grand prize and the Vanderbilt cup, refused to grant Corona's request for a grand prize race sanction. The ruling in regard to the historic trophies may alter plans of the New York speedway directors to hold the Vanderbilt cup classic on the Sheepshead Bay course this season.

Corona will run a grand prize race, however, which will be known as the Corona grand prize. In addition to the $12,000 in prize money that has been voted, the Flagler trophy will go to the winner. The contest will be a free-for-all and the distance the same as in 1914, 301 miles. The purse will be split as follows: First, $5,000; second, $3,000; third, $2,000; fourth, $1,000; fifth, $700 and sixth, $300.

Upon his arrival in Chicago yesterday, Bentel received a telegram from Corona acquainting him of the fact that the date of the Corona race had been changed from March 17 to April 8 so that the Corona event will not conflict with the series of meets to be held on the Los Angeles speedway, all of which will be run prior to April 1. The Los Angeles promoters already have received a sanction for a February 22 race and have reserved two additional dates in March. Each of the three events probably will be 100 miles in distance and for $5,000 in purses.

Indianapolis Seat Prices Lowered

INDIANAPOLIS, IND., Feb. 7—A general reduction in admission and seat prices has been made for the coming Memorial 500-mile race on the Indianapolis Speedway on May 30. This year the admission prices have been changed. Instead of the general admission being $2 at every entrance, this price will prevail only at the main gate. Entrance fee at the eastern entrance has been cut to $1. Prices for seats after one is in the grounds have been lowered. The list follows: Box seats in the paddock stand and Stand E formerly sold for $7 and $10. This year the prices for the same seats are $5 and $7. Box seats in Grand Stands A and B remain the same, $7 and $10. Reserved individual seats in these stands are $2.50, the same as last year. Reserved seats in Grand Stand C sold for $2 last year. This year they will be priced at $1. All other seats will call for the expenditure of $1.

Maintenance of Resale Prices Favorable to National Chamber Directors

WASHINGTON, D. C., Feb. 8—The board of directors of the Chamber of Commerce of the United States have voted that the report of a special committee of the National Chamber on the maintenance of resale prices shall be submitted to referendum. The committee had reported to the board that it was not able to present a unanimous report to the board.

A majority recommendation favoring legislation permitting price maintenance was signed by seven of the ten members, two of them, however, modifying their assent by the filing of a supplementary report. With the majority report came the comment that a National Chamber committee had rendered a report last February favorable to the principles of price maintenance and the majority members saw no reason in any way to modify the conclusions arrived at and given to the Chamber at that time.

"But on the contrary," the comment continues, "after additional exhaustive investigation by consulting a large number of organizations, composed of many thousands of members in all branches of trade and industry, as well as many individual producers, distributors and consumers, and after having collected evidence from a great many sources, we repeat the language of the committee's previous resolutions of February, 1915, as our report and conclusions, viz.:

" 'Your committee is convinced that legislation permitting the maintenance of resale prices, under proper restrictions on identified merchandise, for voluntary purchase, made and sold under competitive conditions, would be to the best interest of the producer, the distributor and of the purchasing public, or consumer.' "

Saxons in Strong Demand

DETROIT, MICH., Feb. 5—During January the Saxon Motor Car Co. reports to have received orders for 6792 cars for immediate shipment, which is more than double the former biggest Saxon month, May, 1915, when 3318 orders were received. Shipments of cars in January was 120 per cent greater than in the first months of 1915.

Many Suggested Laws for Mass.

Fifty Bills Affecting Automobiles to Be Discussed in Next Few Weeks

BOSTON, MASS., Feb. 5—There are about fifty bills affecting motor vehicles in one way or another before the Massachusetts Legislature at present. Hearings began on the first of them last week, and it is expected that before the show opens in March they will have all been heard so that the dealers will not be worried about them. The Committee on Roads and Bridges will hear the greater number of them. This committee last year did its work better than any previous committee that ever handled motor legislation. Senator John Haigis is the Senate chairman and Harry Foster the House chairman. Those who have watched the career of Senator Haigis since he entered the Legislature a few years ago believe that he will some day be Governor, for he has a most intelligent grasp of matters, and he knows how to handle men and problems without friction.

Women Drivers Unrestricted

At the sessions Tuesday the first surprise came when the Safe Roads Assn. withdrew its bill that would prevent women driving cars of more than 30 hp. There were nearly 200 women motorists on hand to oppose it. Hearings were held on bills to increase the penalty for driving cars while drunk so that the prison terms would be longer and the Highway Commission suspensions would be greater. The motorists felt that they were willing to do anything possible to check such drivers, but it was argued that legislation would not accomplish very much.

The suggestion was made by James T. Sullivan of the Bay State A. A. that a conference of the motor bodies be held to try to arrange some plan to eliminate the drunken, reckless driver and one was planned to take place.

There is a measure to make the Highway Commission examine every applicant for a license. Another would make the owner responsible for any damage caused by a chauffeur if the owner were in the car at the time. There are bills requiring the Highway Commission to appoint 500 road monitors; another to have all cars use safety devices on front and rear; one to have all vehicles light lamps half an hour after sunset as motor vehicles are required to do now; a bill to make all transportation companies note the maker's and the motor number of every car they handle to trace stolen machines; others call for bond by owners before being allowed to drive, and also for jitneys; for a State motor corps for the militia; for changing the registration fees; to prevent gasoline and kerosene being carried by the same wagon; to prevent contractors spreading tar over the entire width of the highway; to make the Highway Commission grant hearings before revoking a license; to allow motor cars to be operated on the island of Nantucket; to prevent motor cars being driven faster than street cars in cities and towns; to increase the fees on motor trucks; to establish a motor vehicle commission; to appoint motor patrolmen on the roads; to designate cross walks in cities and towns, etc.

There are other bills that have not yet been printed so that their contents are unknown. The motor representatives have been busy lining up to fight the adverse legislation and it is not expected that there will be any bills enacted that will seriously interfere with the motor industry.

Tractor Co. to Be Ford's Personal Property

DETROIT, MICH., Feb. 6—To-day the stockholders of the Ford Motor Co. assigned and quit-claimed to Henry Ford all their rights and interests in the farm tractor business which the latter promoted last year. It means that this business will be conducted as a personal business of Henry Ford and his son Edsel B. Ford, or rather by the firm Henry Ford & Son, which was formed last year.

It was first announced in THE AUTOMOBILE, May 13, 1915, that the Ford Motor Co. will make farm tractors, and in its issue of June 24, the detailed plans for the tractor business were given, it being stated among other things, that Mr. Ford hoped to employ 20,000 men and expected to build 500,000 tractors a year.

At the plant in Dearborn, Mich., where the first tractors were made, it is said that quite a number of new tractors have recently been completed, but only for further testing and experimental purposes. It will probably be many months before the Ford tractor will be ready for the market. It is being further improved, but full particulars will not be given out now.

Kelsey Wheel Increases Stock 50 per Cent

DETROIT, MICH., Feb. 4—The Kelsey Wheel Co., manufacturer of automobile wheels, rims, hubs, etc., has increased its capital stock from $1,000,000 to $1,500,000. Holders of the $600,000 common stock of the original capital will receive a 50 per cent stock dividend, payable from accumulated surplus. Of the new capital $600,000 will be retained in the treasury. The $137,000 outstanding preferred stock will be retired through purchase.

Registrations Up 53% in Colorado

28,254 Automobiles in 1915 Compared with 18,433 in 1914 —Dealers Used 1000 Cars

DENVER, COL., Feb. 3—Complete returns from the entire State just received and checked over by Secretary of State Ramer show 28,254 motor cars registered in Colorado for 1915, as against 18,433 for 1914. This is an increase of 9821 cars, or 53 per cent. Of this total number, 25,188 were for regular owners and 1001 for dealers, showing an increase of 324 over the number of dealers' licenses issued in 1914. Of the total registration, 8338 belonged to Denver. The total number of drivers' licenses was 3533, a substantial gain over the 2058 for 1914. The license revenue from motor cars, which goes to the State and county road funds, was $107,664.70, a gain of $37,282.70 over the $70,382 received from 1914 fees. A total registration of at least 40,000 is predicted for 1916.

There were 1643 licenses reissued for cars bought during the year by owners who took out their license originally for another car, as compared with 482 for 1914, indicating a heavy increase in new car sales to persons already owning cars.

While a surprising share of this increased showing in registration numbers and revenue is believed to be due to the rigid inspection of licenses adopted by Secretary of State Ramer, the bulk of the showing is clearly due to an immense increase in sales during the last year. This inspection uncovered 2071 cases where owners had either failed to take any license whatever or had registered their cars at wrong horsepower and thus paid a lower fee than the law required; 176 non-registrations and improper registrations under the dealers' class; 917 chauffeurs, demonstrators and other persons driving cars belonging to others without required drivers' license; and 685 cases where owners had bought other cars, often of greater horsepower and requiring a higher fee than the car originally registered, and had merely transferred their tag to the new car without having the license reissued and properly recorded. These cases brought the State $8,280 from the first class, $840 from the second, $917 from the third and $1,731.50 from the reissues brought in by the inspectors, making a total of $11,768.50 in fees dodged in different ways by car owners, dealers and drivers.

In a few cases, these evasions of the law took the bold and rather crude form of homemade license tags, which were detected through duplication of some number issued to another person, and through defects in painting, etc. Several taxicab companies, real estate firms and other concerns having a large number of cars were also caught with dealers' licenses and compelled to take out regular owners' licenses as required by law and to pay whatever additional fees were involved.

Weston-Mott Honors Its President

FLINT, MICH., Feb. 3—In a quiet way officials of the Weston-Mott Co., and of other concerns controlled by the General Motors Co., remembered to-day the twentieth anniversary of the connection of President Charles S. Mott with the first named concern. It was on Feb. 3, 1896, that the Weston-Mott Co. was organized, the interest of the Weston family having been bought out by the members of the Mott family. The business was originally started in 1884 in Jamesville, N. Y., wire wheels being made. In March, 1896, Mr. Mott was elected a director. In 1898 the business was moved into a new plant in Utica, N. Y. In June, 1906, a plant was built in Flint and the company moved there in 1907 and incorporated under the laws of Michigan. While the plant was in Utica, Mr. Mott was superintendent. From the time the new plant was started in Utica, Mr. Mott took an active part in the company, holding such positions as superintendent, general manager, vice-president and later president.

Detroit Steel Products to Enlarge

DETROIT, MICH., Feb. 5.—A large addition which will provide 60,000 sq. ft. more floor space will be erected at once by the Detroit Steel Products Co. At the annual meeting of the directors the following officers were elected: Walter S. Russel, president; Robert S. Drummond, vice-president; J. G. Rumney, secretary-treasurer and general manager. The officers and Leo M. Butzel, M. P. Rumney, and C. H. O. Meyer, form the board of directors.

The second of a series of conventions will begin Feb. 7. Instead of a single convention at which all the representatives of the company throughout the country take part, as in former years, there will be probably half a dozen conventions this year. At each of them there will be ten to twenty men coming from a certain district or section of the country. For instance, at next week's meetings there will be the representatives of the Detroit Steel Products Co., from New York, Boston, Philadelphia and other eastern cities.

KALAMAZOO, MICH., Feb. 2—It is stated that the Light Car Axle Co., Chicago, has leased part of the old Michigan Buggy Co.'s plant here, and will locate here within the next three weeks. About seventy-five men are employed.

Gasoline Continues Upward Trend

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Census Bureau Makes Report of Petroleum Refining in U. S.—176 Plants

New York City, Feb. 7—Last week the general feeling with regard to the gasoline price situation was that things were rather uncomfortable and there was no relief in sight. To-day gasoline went up another cent to 23 cents, tank-wagon, in New York, and there are rumors of cent-a-week boosts for several weeks. "There is no money in gasoline even at 23 cents," according to one of the refining companies. As usual, Jersey City, across the Hudson, is just a cent behind New York. In Philadelphia there has been an increase of 2 cents, making the price 23 cents at the wagon; garages are charging from cost up to 26 cents.

In Boston the price, which was 23 cents last week, has gone up a cent to 24, making the retail prices 26 and 27 cents. Last winter gasoline was selling in Boston for 13 cents wholesale; the last increase is the eleventh since then.

In connection with the rising price of gasoline there is particular interest attached to the Census Bureau's summary for the oil refining industry for 1914 as compared with 1909. This report has just been made public and shows a marked increase of production—in some instances an enormous increase.

Production Increased 170 Per Cent

The 176 establishments reporting for 1914 used 191,262,724 barrels of crude petroleum, as compared with 120,775,439 barrels in 1909, the increase being 70,487,285 barrels, or 58.4 per cent. The cost of the crude petroleum, as reported for 1914, was $249,727,856, an increase of $97,420,816, or 64 per cent, over 1909.

The production of naphthas and lighter products, chiefly gasoline, increased from 10,806,550 barrels in 1909 to 29,200,764 barrels in 1914, or by 170.2 per cent, while the value increased from $39,771,959 to $121,919,307, or by 206.5 per cent.

The statement shows the production of casing-head gasoline in 1914 and includes a summary of the production of crude petroleum by fields in that year as reported by the United States Geological Survey.

The gasoline product of the petroleum refineries does not include casing-head gasoline condensed from natural gas at the gas wells. The total gasoline production, including casing-head gasoline, was 24,711,565 barrels of 50 gal., or 1,235,578,250 gal.

The production of lubricating oils here reported does not include that of establishments engaged in the compounding or blending of petroleum oils, but only the output of petroleum refineries.

Of the 176 refineries in 1914, 48 were in Pennsylvania, 38 in California, 23 in Oklahoma, 13 in Kansas, 9 in Texas, 9 in Illinois, 8 in New Jersey, 7 in Ohio, 6 in New York, 4 in Colorado, 3 in Maryland, 3 in West Virginia, 2 in Wyoming, and 1 each in Indiana, Louisiana and Missouri.

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Velie Will Not Change Bodies

Moline, Ill., Feb. 4—The Velie Motor Car Co. has circularized its dealers to the effect that there seems to be some misunderstanding regarding the situation pertaining to model 15 cars. Actually the model 15s coming through the factory at this time are equipped with the same style bodies as have been used in the past. It is expected to furnish a different body for this chassis, but raw material deliveries are so uncertain that it is hardly possible to supply the new bodies before July 1 or thereabouts.

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Aluminum Shortage Halts Plant

Manitowoc, Wis., Feb. 7—The first important instance of the effect of the rapidly diminishing supply of aluminum was the necessity encountered by the Manitowoc (Wis.) foundry of the Aluminum Castings Co. of closing down t
plant for several days to await the a
rival of new stocks of raw material. T
Manitowoc foundry, like all divisions
the Aluminum Castings Co., has be
working at full speed for several mont
to fill orders, principally for motor ca
ings and parts. The supply of raw
terial has gradually been diminishing a
the available supply advancing shar
in price. The company is assured
ample stocks for its requirements,
has met with some difficulty in gett
prompt deliveries. The delay caused
the temporary cessation of work has b
made up and deliveries of castings
going forward according to schedule.

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Burman to Drive Premier

Indianapolis, Ind., Feb. 3—Bob
man has signed a contract to d
Premier racing cars, which will be
in time to enter the 300-mile Indiana
Speedway race on May 30. It is st
that he will have a voice in the cons
tion of the car which he will drive.
ing his stay on the Pacific Coast w
he will drive in the Ascot Park race,
22, he will build several parts fo
Premier car, and will devote practi
all of his time helping to complete a

PETROLEUM REFINING IN THE UNITED STATES—COMPARAT STATISTICS: 1909 AND 1914

	1914	1909	P c 19
Number of establishments	176	147	
Crude petroleum used:			
Barrels (42 gallons)	191,262,724	120,775,439	
Cost	$249,727,856	$152,307,040	
PRODUCTS			
Total value	$396,361,405	$236,997,659	
Naphthas and lighter products:			
Gasoline (from crude petroleum)—			
Barrels (50 gallons)	23,908,242	10,806,550	
Value	$106,140,170	$39,771,959	
All other—			
Barrels	5,292,522		
Value	$15,779,137		
Illuminating Oils:			
Barrels	38,705,496	33,495,798	
Value	$96,806,452	$94,547,010	
Fuel oils:			
Barrels	74,669,821	34,034,577	
Value	$84,017,916	$36,462,883	
Lubricating oils:			
Barrels	10,348,521	10,745,885	
Value	$55,812,120	$38,884,236	
Residum or tar, including liquid asphaltic road oils:			
Barrels	2,696,887	1,787,008	
Value	$4,017,858	$2,215,623	
Greases:			
Barrels	280,128	138,302	
Value	$3,536,491	$1,567,647	
Paraffin wax:			
Barrels	1,150,776	946,830	
Value	$8,897,106	$9,388,812	
Asphalt, other than liquid asphalt:			
Tons (2,000 pounds)	465,157	233,328	
Value	$4,867,213	$2,724,752	
All other products, value	$16,486,942	$11,434,737	
Gasoline from natural gas (casing-head gasoline)—barrels (50 gallons) (United States Geological Survey)	†853,053	....	
Total gasoline production, excluding duplication as far as possible, barrels (50 gallons)	24,711,565	....	
CRUDE PETROLEUM PRODUCTION (United States Geological Survey)			
Total production, barrels (42 gallons)	265,762,535	183,170,874	
California	99,775,327	55,471,601	
Mid-Continent (Kansas, Oklahoma, etc.)	97,995,400	50,833,740	
Pennsylvania grade (Appalachian)	24,101,048	26,535,844	
Illinois	21,919,749	30,898,339	
Gulf	13,117,528	10,883,240	
Lima-Indiana	5,062,543	8,211,443	
Colorado, Wyoming and other fields	3,790,940	336,667	

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*A minus sign (—) denotes decrease. †Not included in refinery products.

Chevrolet Output To Be Doubled

Production To Be Stepped Up Monthly Until Plants Turn Out 460 Cars Daily

DETROIT, MICH., Feb. 9—President W. C. Durant has announced that within the next six months the daily output of the Chevrolet Motor Co., Flint, Mich., is to be doubled. It is at the rate of 230 cars a day now and is to be stepped up monthly until the plants are producing 460 daily in August. It is further stated that a new axle plant will be started here at once, while the work on the new assembling plant, an enlargement of the Mason motor plant and the new assembling plant in Oakland, Cal., also soon will be under way.

The assembling of the Chevrolet cars will be gradually concentrated at the assembling plants in New York City, Tarrytown, N. Y., St. Louis, Oakland, and Oshawa, Ont. All motors, axles and most of the parts needed will be made at the parent plant in Flint. In order to be able to get more workingmen the Chevrolet Co. will also put up about 100 homes.

Ascot Park Race March 5

NEW YORK, Feb. 9—The racing season will probably commence with the George Washington Sweepstakes, a 100-mile free-for-all on the Ascot Park Speedway in Los Angeles. A series of sprint races will be held at Ascot on March 5, and a 200-mile free-for-all on March 19. Prizes approximating $18,000 have been hung up for the three Ascot meets.

The drivers, while in the West, will be able to compete in the Corona Grand Prize, which will be held over the 2.7-mile circular boulevard on April 8. The Corona classic is for a purse of $12,000 and the distance is 301 miles.

George R. Bentel, well known in Pacific Coast racing circles, and Frank Lowry, who has been named starter of the four western races, are now in New York arranging details with the American Automobile Association.

Splitdorf Net Profits for 1915 Are $745,107.55

NEWARK, N. J., Feb. 5—The Splitdorf Electrical Co., this city, reports net profits for 1915 of $745,107.55, or a little over 16 per cent on its capital stock of $4,393,000. The assets amounted to $6,451,362.59, and the liabilities to $5,317,333.20, leaving a net profit of $1,134,029.39 to Dec. 31, 1915. The net profit to Dec. 31, 1914 was $388,921.84.

The company received $52,500 in dividends from its subsidiaries, which report earnings totaling $131,597.97, beside the dividends paid and excluding the operations of the Sumter Works, Sumter, S. C., belonging to the Apple Electric Co.

Locomobile Wins Patent Suit

PHILADELPHIA, PA., Feb. 5—Judge Buffington in the Circuit Court of Appeals sitting in this city reversed the decision of the lower court in the case of the Locomobile Company of America vs. Joseph W. Parkin, deciding the case in favor of the Locomobile Company. The case was decided in the lower court in favor of Parkin because of the alleged infringement of certain claims in a patent for a carbureter manufactured by Parkin. The decree was reversed on the grounds that no invention was involved in the patent and the cause was remanded with instructions to dismiss the bill.

Chalmers to Have New Branch

DALLAS. TEX., Feb. 6—Announcement was made in Dallas to-day that the Chalmers Motor Car Company of Detroit, Mich., will in the very near future establish a big branch house in Dallas. The company will also establish a warehouse in which will be kept the various materials: these will be sent to the various representatives in Texas. High officials of the company are expected in Dallas within a few days when a more detailed announcement will be made. This means a big addition to Dallas' Automobile Row, it is said.

Studebaker Plant in Dallas

DALLAS, TEX., Feb. 4—Contract has been awarded by Clarence Linz and M. B. Shannon of Dallas for the erection of a big brick building in Dallas to be occupied by the Studebaker company. This automobile concern, it is said, plans to establish a plant in this city that will cost upward of $150,000. The plant will be located on South Harwood Street and Santa Fe Avenue. The total floor space will be 128,000 sq. ft. It will be the largest assembling plant in the State, it is said, employing several hundred men.

Syndicate to Market $2,000,000 Peerless Truck Bonds

NEW YORK CITY, Feb. 8—About $2,000,000 in Peerless Truck & Motor Corp. 6 per cent convertible gold bonds are to be marketed by a syndicate, composed of Hodenpyl Hardy & Co., this city.

The notes are dated Nov. 10 and mature Nov. 10, 1925. They are convertible at par on and after Nov. 10, 1916, at the option of the holder into common stock, par value $50, of the corporation. They are part of a total outstanding issue of $5,000,000.

Texas Obtains Injunction

Automobile Manufacturer May Not Limit Territory of Dealer Is Court Ruling

DALLAS, TEX., Feb. 2—Indications are that the State of Texas has considerable evidence in its alleged anti-trust suits against the Olds Motor Works and Turner and Davis and Cadillac Motor Car Co., Houston Motor Car Co. and the Munger Automobile Co. of Dallas, as injunctions were granted to-day, Feb. 2, in the district court at Austin. Defendants must also pay the court costs. This means that an automobile concern has not the right to restrict its agents to the sale of cars in a specified district in Texas. The suits were filed two weeks ago through the attorney general's department. No penalties were asked. The State got all it asked for.

Whitaker an Automobile Patent Expert

WASHINGTON, D. C., Feb. 8—During his connection of several years with the United States Patent Office as assistant examiner, N. T. Whitaker examined hundreds of applications for patents for automobile structures, particularly applications on internal combustion engines. He was connected with the division of the patent office where patents on automobile inventions are classified and examined. He has given special study to all inventions pertaining to every form of the automobile industry. Since leaving the patent office, about a month ago, Mr. Whitaker has opened an office in Washington and is making a specialty of patent work.

$1,500,000 in Briscoe 7 Per Cent Cumulative Pref. Offered

DETROIT, MICH., Feb. 8—Andrews & Co. of this city, Cleveland and Chicago, is offering for subscription $1,500,000 7 per cent cumulative preferred stock of the Briscoe Motor Corp. The shares are offered at $105 with a bonus of 20 per cent in common stock. The capital stock of the corporation is $1,500,000 preferred stock and $4,000,000 common stock.

Tobin New Globe Tire President

TRENTON, N. J., Feb. 4—Horace B. Tobin was elected president of the Globe Rubber Tire Mfg. Co., this city, at the annual meeting of the company at Wilmington, Del., Feb. 1, succeeding W. H. Linburg. The other officers were reelected as follows: Vice-presidents, J. S. Broughton, H. L. Joyce; treasurer, H. B. James, and secretary and assistant treasurer, J. P. Hall.

Four More Tire Prices Raised

Kelly-Springfield Lowers Quotations 10 Per Cent—Swinehart Still Unchanged

New York City, Feb. 7—Kelly-Springfield tire prices have been reduced 10 per cent on the popular sizes, making the present list about 15 per cent higher than the old prices in effect before announcement of its rise on Jan. 1. The 30 by 3 size, plain tread, is now listed at $15.20 as compared with $16.35; 34 by 4 is $29.65, the former price being $32.95; and the 36 by 4 is now $31.50 as against $35, formerly. On the non-skid types, the 30 by 3 is $18.10, the 34 by 4 is $36.25 and the 36 by 4 is $38.20.

Nassau prices have been raised 10 per cent. Portage tires are also 10 per cent higher. The tubes have been raised 15 per cent. Braender has raised its prices 15 per cent. These prices apply only to the Eastern States, the quotations in the West being higher on account of freight rates. Combination prices have risen 10 per cent.

Swinehart is one of the few companies which still adheres to its old prices. It is stated that no changes in the near future are contemplated.

The following list of prices gives the present quotations on several of the popular-sized tires whose prices have been revised:

	Plain Tread		Non-Skid	
	New Price	Old Price	New Price	Old Price
PORTAGE				
30 x 3½..	$14.10	$12.80	$16.15	$14.70
34 x 4 ..	23.60	21.45	27.15	24.70
37 x 5 ..	38.85	35.30	44.65	40.60
BRAENDER				
30 x 3½..	13.35	11.60	15.36	13.35
34 x 4 ..	22.30	19.40	25.65	22.30
36 x 4 ..	23.60	20.50	27.15	23.60
KELLY-SPRINGFIELD				
30 x 3½..	15.20	16.35	.....	.....
34 x 4 ..	29.65	32.95	.....	.....
36 x 4 ..	31.50	35.00	.....	.....
COMBINATION				
30 x 3 ..	10.85	9.85	12.70	11.55
34 x 4 ..	23.60	21.45	27.10	24.65
36 x 4½..	33.35	30.30	39.20	35.65

V Motors Oust Star Type in French Tests

Paris, Dec. 30—Perfection of the automobile organization has made it possible for the French Military authorities to become more exacting in their tests of aeroplane motors. Until recently motors were subjected to a 10 hr. bench test under full load, no motor being considered unless it had gone through this test without a falter. Under the new regulations, motors must undergo a 50-hr. bench test. This is divided into two stages: 25 hr. at nine-tenths load and 25 hr. at full load. The first motor to go through this test successfully was a De Dion Bouton eight-cylinder water cooled model. De Dion Bouton was the first to commercialize the eight-cylinder motor in France; it has been used on this firm's cars for more than three years, and attention has always been given to the same type of motor for aviation purposes. It was not until the war that the firm took up the aviation eight on a big scale.

There are a number of other new motors waiting to undergo their 50 hr. test. The majority of these are V-types, with either eight or twelve cylinders; a few are six-cylinder verticals. As the 10 hr. bench test under full load was looked upon as a serious undertaking, and was not passed by all competitors at the first attempt, the appearance of each engine for the 50 hr. test is being watched with more than ordinary interest. The fact that it is possible, under war conditions, to impose such a test, is proof that the authorities have developed output to such a degree that they can afford to refuse all but the very best motors. The fact that no more rotating cylinder motors are coming up for test, and that V motors are in a majority over all other type, is also significant as an indication of the trend of design.

Favor Horsepower Tax in D. C.

Washington, D. C., Feb. 5—The district commissioners have made a favorable report on the bill introduced in Congress by Representative Page, of North Carolina, to impose a special tax on automobiles in the District of Columbia, based upon horsepower. The commissioners, however, recommend that the bill be so amended as to provide for the elimination of the personal tax on motor vehicles.

The advisability of providing for a double tax is questioned by the commissioners. They believe that only one tax should be imposed, the amount of that to be determined on the horsepower basis. It is declared the double tax proposed by the bill would be excessive and burdensome. They say, for instance, the owner of a 25-hp. car valued at $500 would, under the terms of the bill, be required to pay annually a license tax of $7.50 and a personal tax of like amount. Because of the limited area in this jurisdiction, whether a car is used either for business or pleasure, it is pointed out, it is practically necessary to have a Maryland tag. This would mean, it is declared, in addition to the $15 paid by the owner of the car under the bill, a further payment of $15 would have to be made for the Maryland license. This amount the commissioners believe excessive and burdensome and therefore the elimination of the personal tax was recommended.

Municipal Cars Need License

Only Fire and Police Department Machines from License and Speed Laws

Milwaukee, Wis., Feb. 8—The question of whether or not public motor vehicles are amenable to the statutes requiring the licensing of such vehicles or the rules of speed, has practically been settled in Wisconsin by an opinion of the attorney general. Marc Catlin, district attorney of Outagamie County, Wis., asked if it is necessary for municipalities to register and obtain licenses for municipally-owned cars, and if such cars could exceed the established speed limits of 15 miles in cities and 25 m.p.h. in the country.

The attorney general states that fire and police departmental vehicles are exempt from both the licensing and speed limit requirements, but cars owned by cities and used for other municipal departments or divisions are not exempt from the State law. The opinion is based on the acknowledged principle of public necessity, which requires excessive speed. Fire and police cars are so distinguished as such that license plates are not needed to identify them.

New York State Registrations Increase 36 Per Cent

New York City, Feb. 3—Automobile registrations in this State increased 36 per cent in 1915 over the preceding year. Chauffeur licenses increased 21 per cent and the amount of money paid by owners increased 24 per cent. With the money from fines included, the total from the operation of motor vehicles to be set apart in 1916 for the maintenance of improved highways will be close to $2,000,000.

All told, motoring credentials were issued to 316,185 persons. Of this number, 231,831 were owners, representing 208,421 passenger cars and 23,411 commercial vehicles; 82,153 chauffeurs were licensed and 2201 dealers received certificates. The fees aggregated $1,913,175. The 1914 credentials totaled 235,602; passenger cars, 151,030; trucks, 17,193; chauffeurs, 66,636; dealers, 1743. The fees amounted to $1,529,852, a big increase over 1913.

Maxwells Cheaper in Canada

Windsor, Ont., Feb. 5—Canadian prices of the Maxwell have been reduced by the Maxwell Motor Co. of Canada, Ltd. The touring car is now listed at $850 instead of $925 and the roadster sells for $830 instead of $900.

Detroit Fights Mich. Auto Law

Validity is Upheld in Test Case in Wayne County Court

DETROIT, MICH., Feb. 8—To-day the Wayne County Circuit Court upheld the new Michigan automobile tax law as being constitutional. The case will, however, be carried to the supreme court by the City of Detroit. Every one of the city's claims and reasons given that the law should be considered invalid was decided adversely by the judges. Should the highest court also uphold the law, it means that $15,000,000 in personal property will be taken from the city's assessment rolls. According to this new law motor vehicles are taxed according to horsepower and weight. The money raised from the tax goes into the State's treasury and no other tax on automobiles is to be levied, which deprives the city of Detroit of a large amount formerly collected. One of the city's aldermen and the city prosecuting attorney filed suit against the Detroit Board of Assessors asking the court why a peremptory mandamus should not be issued by this court against the assessors.

Among the many reasons given why the new auto tax law should be considered invalid are the following: That the law discriminates in favor of manufacturers and dealers; that those in the taxicab business and manufacturers and dealers in other lines of business who own large numbers of motor vehicles are required to pay more taxes or a greater amount than the automobile manufacturer or the dealer in automobiles; that the value of the automobile is not taken into consideration in fixing the tax, for instance a motor vehicle several years old of high power is taxed more than a new automobile of less horsepower, yet of greater value, etc.

Georgia Legislature Sets 30 M.P.H. as Speed Limit

SAVANNAH, GA., Feb. 3—A number of radical changes in the automobile laws were made in the motor vehicle act at the recent special session of the legislature, and motor car drivers will have many new things to learn in order to comply strictly with the law.

The State law has no effect on municipal laws not in conflict, but sets a State speed limit of 30 m.p.h., with due regard to width, grade, traffic and common use of the highway. Ten miles an hour is the limit on curves, bridges, railroad crossings, deep descents, etc.

A provision of the law, applying both to automobiles and motorcycles, and based on laws previously in force in several cities, prohibits the passing of any street car, interurban or other passenger train, while the same is standing still for the purpose of taking on or letting off passengers.

The provisions requiring the driver of a motor vehicle to slow down or stop when signalled by the driver of a horse-drawn vehicle and requiring motor vehicle drivers to slow down and give warning by their horns when approaching horse-drawn vehicles, are included in the act.

Any violation is made a misdemeanor.

Electrics Grow in England

NEW YORK CITY, Feb. 7—According to reports received by the Electric Vehicle Assn., recently from an English engineering firm, Heenan & Froude, Ltd., the use of electrics there has increased greatly in the past year, the number from 150 a year ago to 660 to-day. The use of electrics has been stimulated to a great extent by the war, for due to the numbers of men who have been taken from commercial occupations by the wholesale enlistments, the majority of the truck drivers in England to-day are women. The electric is simpler to operate than the gasoline truck, and therefore better adapted to use with female labor.

Another effect of the war has been to effect almost universal withdrawal of certain classes of gasoline trucks, through commandeering, so that to protect themselves, many firms have adopted electrics, for which the government has no need.

3,000,000 Hayes Wheels for 1916

JACKSON, MICH., Feb. 5—During 1915 there were made at the local plant of the Hayes Wheel Co., a total of 1,723,490 wheels, or more than twice as many as in 1914 and more than five times as many wheels as in 1913. There were on the average 1000 men on the company's payroll during the year, but at times the number of shop workers was close to 1400.

The company expects that its estimate of 3,000,000 wheels for 1916 will be below the actual output when the year ends. The production has been remarkably rapid. In 1909 only 81,416 wheels were made at the plant; in 1910 the total was 145,660; in 1911 it was 299,576; in 1912, 322,599; in 1913, production was 333,523; in 1914 the total was 844,609. The total production during those seven years was thus 3,750,872 wheels, or at the rate of four wheels to an automobile, wheels for 937,718 automobiles.

Besides its main plant here, the Hayes company operates a large plant in Anderson, Ind., and has its hub factory in Albion, Mich. These plants employ several hundred men.

Britain Prevents Driver Shortage

London Omnibus Co. Institutes Army School—Lighting Restrictions Very Severe

LONDON, Jan. 15—No more automobile drivers can now be enlisted direct into the mechanical transport service of the British army. The shortage of drivers for civilian purposes has become so acute that users have protested and pointed out that the essential trade of the nation is likely to be paralyzed if more skilled drivers are taken off their ordinary jobs and put into the army. In consequence of this the army has undertaken to train its own drivers and for this purpose has entered into an agreement with the London General Omnibus Company.

At the main depot of this concern recruits, many of whom have never previously sat behind a steering wheel, are now being initiated into the mysteries of the internal combustion motor and taught to drive in regulation convoy formation. The Omnibus company has all the machinery necessary for this training and ought to be able to turn out efficient men in bigger quantities than is possible by any other group. It is understood that these recently trained men will be used to dilute the ranks of skilled drivers. Thus no formation will be composed entirely of new men, but a certain proportion of old and experienced drivers will be retained in each.

No information is allowed to get out regarding the number of men who are being trained in this way, but it is known that the force is considerable. One result of this scheme will be a certain cash saving. Specially enlisted drivers, thousands of whom were taken on during the first months of the war, were paid at the rate of $1.44 per day; the men who are being trained to drive get 24 cents.

Darkness Almost Absolute

During the last few days drastic anti-lighting regulations have gone into force in the greater part of England. It requires a lawyer's training to understand the details of the order, for it is divided in a complicated manner into schedules and the whole of the country divided into areas, each one of which has its special restrictions. Briefly, no brilliant lights are allowed anywhere in England, and around the coast is a strip varying in width from six to 100 miles, within which automobiles must reduce lights to a mere glimmer. Even at Warwick, Coventry and Leamington, in the heart of England, special regulations are in force against lights on vehicles. In the London district headlights are tabooed and side lamps have to be reduced in intensity until they are absolutely useless to the driver. While automobiles have to reduce their lights, other vehicles which formerly carried no light at all must now display a glimmer at the rear. This applies to bicycles, which must show a white light in front and a red light behind, and also to baby carriages.

Automobile drivers are protesting energetically but uselessly against the new regulations. Wherever possible the simplest plan is not to use an automobile at all after dark, but this is not possible in the case of commercial vehicles, and is only applicable with difficulty to certain professions. Doctors are threatening that they will not respond to night calls if there is not some relaxation in the lighting regulations.

There is no doubt that the British authorities have become scared as the result of the last Zeppelin raids over various parts of the country. Lighting has now been reduced to such a degree that the remedy is undoubtedly worse than the disease. Many towns in the heart of England are darker than French towns within artillery fire of the German lines. The London restrictions regarding automobile lights are much more severe than those in Paris and district, although the French capital is only sixty miles from the German front line trenches.

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Britain Makes Accessories Contraband

WASHINGTON, D. C., Feb. 5—According to a proclamation of Jan. 27 the British Government has made several changes on its lists of absolute contraband, among them being, in regard to item 26, motor vehicles, etc., "there shall be added after the word 'parts,' the words 'and accessories.'"

Overland Features Securities

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Common Rises 19 Points—Studebaker Stronger—General Motors Down to 445

NEW YORK CITY, Feb. 8—Automobile securities last week were fairly active with a majority of them subject to large gains and losses. Violent trading in these stocks has subsided during the past few weeks. Willys-Overland during the latter part of last week was active, reaching 220 on Saturday with a 19-point gain. This issue together with a 10½-point gain in Packard common, featured the stock exchange activities in automobile stocks. Studebaker pulled itself out of last week's loss by registering a 4-point gain on its common and 1 point on the preferred. These stocks have been active on account of dividend action taken by the directors of the company this week. Maxwell common and second preferred were strong last week with substantial gains.

General Motors Drops 15 Points

Losses last week ranged from a fraction to 15 points. General Motors, which has been steadily declining during the last few weeks dropped 15 points to 445 with little activity. Chalmers common went down 10 points. Kelly-Springfield common and the new common declined 8 and 2 points, respectively. Incidentally a ruling has been made in regard to the new common stock of Kelly-Springfield by the New York Curb Market Assn. This ruling states that Feb. 8 shall be the date of delivery in settlement of all
standing when, as and if issued
tracts in the new $25 common stoc
that company, without further no
Holders of the $100 par value com
stock certificates may exchange them
the new ones at the Equitable Trust
from now on.

The Detroit issues were more or
constant during the week with s
changes. General Motors quoted
Saturday at 445, just 5 points hi
than a week before. This was the
est gain of the week in the active st
The rest of the gains ranged from a
tion to 1¼ points. The losses were
ranging from 1 to 2½ points. Th
active stocks were strong. Kelsey
rose 135 points.

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Steel Up $2 a Ton

NEW YORK CITY, Feb. 8—The ri
$2 per ton in Bessemer and open-h
steel featured the material market
week. Bessemer steel is now selli
$34 a ton and open-hearth steel a
Aluminum and copper have also
the former rising 1 cent to 54 a
and the latter 1½ cents to 27½ a
The supply of copper at prese
scarce. Spot copper is now comma
a premium of a ½ cent to a cen
the future quotation. Leading
report that unsold supplies for fo
delivery are exceedingly small a
problem of meeting the demand
more serious each day. There is a
demand for aluminum. Lead h
ceded to $6.13 a 100 lb. Tin ha
gone down, reaching $41.50 per
yesterday, just 38 cents lower
week ago.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Ajax Rubber Co. (new)	..	..	68¼	69	— ¼
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	..	85	85	87	—1
Chalmers Motor Co. com	..	94	110	140	—10
Chalmers Motor Co. pfd	91	94	99	101	—1
Chevrolet Motor Co	..	..	126	130	+1
Electric Storage Battery Co	47½	48½	62	63	+1
Firestone Tire & Rubber Co. com	370	375	730	..	..
Firestone Tire & Rubber Co. pfd	109	111½	112	..	..
General Motors Co. com	93½	94½	445	455	—15
General Motors Co. pfd	94½	95½	110	112	—1½
B. F. Goodrich Co. com	32	32¼	71	72	+2
B. F. Goodrich Co. pfd	96¼	97	112	114	+ ½
Goodyear Tire & Rubber Co. com	193	196	337	341	..
Goodyear Tire & Rubber Co. pfd	101	102½	115½	116½	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	22	25	..
International Motor Co. pfd	..	..	35	40	—3
Kelly-Springfield Tire Co. com. (old)	104	105	280	290	—8
Kelly-Springfield Tire Co. com. (new)	..	..	70	74	—2
Kelly-Springfield Tire Co. 1st pfd	82	83	95	97	..
Kelly-Springfield Tire Co. 2d pfd	115	117	71	73	+4
Maxwell Motor Co. com	17⅝	18	70½	71½	+3½
Maxwell Motor Co. 1st pfd	58½	58¾	87	89	..
Maxwell Motor Co. 2d pfd	21¾	22¼	53	54½	+1½
Miller Rubber Co. com	158	165	274	278	+4
Miller Rubber Co. pfd	101	103	113	115	..
New Departure Mfg. Co. com	117	122	110	..	..
New Departure Mfg. Co. pfd	105	107	..	81	..
Packard Motor Car Co. com	..	100	167½	177½	+10½
Packard Motor Car Co. pfd	93	..	102	†104½	— ½
Paige-Detroit Motor Car	..	..	..	700	..
Peerless Motor & Truck Corp	..	..	26	26¼	—1
Portage Rubber Co. com	30	36	65	70	—5
Portage Rubber Co. pfd	80	86	107	109	—5
Regal Motor Co. pfd	..	..	12	..	— ½
*Reo Motor Truck Co	11½	12½	27	28½	—1¼
*Reo Motor Car Co	24½	25½	34¼	35¼	+ ¾
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	49½	50½	85	87½	—3

	1915 Bid	1915 Asked	1916 Bid
Stewart-Warner [illegible] pfd	100	103	108
Studebaker Corp	45½	50½	149
Studebaker Cor	94	103	111
Swinehart Tire	69	71	[illegible]
Texas Co.	131	135	[illegible]
U. S. Rubber	56¼	57	[illegible]
U. S. Rubber C	101½	103	[illegible]
Vacuum Oil Co	193	196	[illegible]
White Motor C	..	..	[illegible]
Willys-Overland	95	97	[illegible]
Willys-Overland	95	97	[illegible]

OFFICIAL QU [illegible] THE DETROIT

[illegible]VE STOCKS

	1915 Bid	1915 Asked
Chalmers Motor	..	[illegible]
Chalmers Motor	..	[illegible]
Continental Moto	175	[illegible]
Continental Moto	70	[illegible]
Ford Motor Co.	500	[illegible]
General Motors	93¾	[illegible]
General Motors C	94	[illegible]
Maxwell Motor Co.	17½	[illegible]
Maxwell Motor Co.	58	[illegible]
Maxwell Motor Co.	[illegible]	[illegible]
Packard Motor Car	..	[illegible]
Packard Motor Car	93	[illegible]
Paige-Detroit Mot	[illegible]	[illegible]
*Reo Motor Car	[illegible]	[illegible]
*Reo Motor Truck	[illegible]	[illegible]
Studebaker Corp.	[illegible]	[illegible]
Studebaker Corp. pr	[illegible]	[illegible]
*Atlas Drop Forge C	[illegible]	[illegible]
Kelsey Wheel Co.	[illegible]	[illegible]
*W. K. Prudden Co.	[illegible]	[illegible]
Regal Motor Car Co.	[illegible]	[illegible]

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*Par value $10. †A

No material changes in prices in crude rubber occurred last week. This product is, however, more active with a firmer tone. Reports from London state that there is now a more plentiful supply of spot rubber, which is calculated to remove all apprehension among consumers for the near future. Para is now quoting at 75 while Ceylon Pale Crepe is a little higher at 83.

Gasoline in this city went up 1 cent yesterday in price to 23 cents a gallon, wholesale. Jobbers throughout the city are selling gasoline at prices running from 25 to 28 cents.

Copper Rise Affects Carbureters

CHICAGO, ILL., Feb. 5—What the increased metal prices is costing the motor car and accessory business is well indicated by the increased price of copper now selling at 26 cents per pound as compared with 14 cents in June. As a result of this increase the carbureter industry will during the coming calendar year pay approximately $750,000 additional for copper alone. This bill would be much greater were it not that many of the carbureters which were water jacketed last year are made without water jackets this season, the result being considerably less copper used in the casting.

Averaging the copper increase at 10 cents per pound, which is conservative, and calculating on 1,200,000 carbureters being needed for 1916, for cars, motorcycles and motorboats, and allowing an average of 5 lb. per carbureter, the total of 6,000,000 pounds of copper is obtained. This at 10 cents per pound increase gives a total advance of $600,000.

Holland Prohibits Rubber Exportation

THE HAGUE, Jan. 27—The exportation of rubber from Holland is prohibited by royal decree to-day. It is understood that as this measure will cut off exports to Germany, Great Britain will order no further interference with shipments of rubber to Holland. In the past rubber cargoes have been held up until it was proved conclusively that they were not consigned to German agents in Holland.

Russell-Overland Merger Made

Deal Long Talked of Now Complete—New Co. is Willys Overland, Ltd.

MONTREAL, CAN., Feb. 3—T. A. Russell of Toronto was a guest of the Montreal Automobile Trade Association on the occasion of the opening of the automobile show Saturday. Mr. Russell stated in an interview that the amalgamation of the Russell Motor business and the Willys-Overland of Canada has now been completed. A charter has been granted for the new company, to be known as Willys-Overland, Limited, of which John N. Willys is president, and Mr. Russell, vice-president.

The factory at West Toronto is being extended and enlarged with the idea of taking care of exports of Overland cars for the British Empire, as well as the Canadian trade, so as to secure a greater volume of production. The policy of maintaining branches with service stations in each province will be continued. Commencing with Feb. 1 the Russell branch in Montreal will take over the combined Overland and Russell business for the entire province of Quebec. J. R. Marlow will manage the business as formerly.

For the present the branch will remain at 5 Park Avenue and will be known as Willys-Overland, Limited, Montreal branch. A track warehouse has also been secured in the shipping district, and it is intended to keep up factory production during the winter months, sending the cars into storage for early spring shipment. In this way 300 to 400 cars will be accommodated in Montreal.

Chandler Stock on 6 Per Cent Basis

CLEVELAND, OHIO, Feb. 7—The Chandler Motor Car Co., this city, has declared a quarterly dividend, payable April 1 to stockholders of record March 7, of 1½ per cent on the stock, thus placing it on a 6 per cent annual basis. The company has no bonds or preferred stock outstanding, and the directors state that they believe the 6 per cent rate is conservative as earnings before April 1 will be equal to 6 per cent on the stock.

On Feb. 4, the company had a cash balance of $1,593,675, which is equivalent to more than $20 a share on its outstanding stock. Sixty cars are being shipped daily, and the output will be materially increased by March 1.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.53	.53	.53	.53	.53	.54	+ .01
Antimony	.43½	.43½	.43½	.44	.44	.44	...
Beams and Channels, 100 lb.	2.17	2.17	2.17	2.17	2.17	2.17	...
Bessemer Steel, ton	32.00	32.00	34.00	34.00	34.00	34.00	+2.00
Copper, Elec., lb	.26	.26½	.26½	.26½	.26½	.27½	+ .01½
Copper, Lake, lb	.26	.26½	.26½	.26½	.26½	.27½	+ .01½
Cottonseed Oil, bbl	9.10	9.13	9.21	9.24	9.32	9.27	+ .17
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menbaden, Brown	.51	.51	.51	.51	.51	.51	...
Gasoline, Auto, bbl	.22	.22	.22	.22	.23	.23	+ .01
Lard Oil, prime	.94	.94	.94	.94	.94	.94	...
Lead, 100 lb	6.15	6.12½	6.15	6.15	6.15	6.13	— .02
Linseed Oil	.73	.73	.73	.73	.73	.73	...
Open-Hearth Steel, ton	33.00	33.00	35.00	35.00	35.00	35.00	+2.00
Petroleum, bbl., Kansas, crude	1.30	1.30	1.30	1.30	1.30	1.30	...
Petroleum, bbl., Pennsylvania, crude	2.35	2.35	2.35	2.35	2.35	2.35	...
Rapeseed Oil, refined	1.00	1.00	1.00	1.00	1.05	1.05	+ .05
Rubber, Fine Up-River, Para	.74	.74	.74	.76	.75	.75	+ .01
Rubber, Ceylon, First Latex Pale Crepe	.76	.81	.80	.83	.82	.83	+ .07
Sulpburic Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	41.88	41.50	41.38	41.63	41.63	41.50	— .38
Tire Scrap	.05¼	.05¼	.05¼	.05¼	.06	.06	+ .00¼

Convention to Discuss Ohio Laws

AKRON, OHIO, Feb. 6.—Reforms in Ohio's traffic and highway code are to be discussed at the annual convention of the Ohio State Automobile Association, which is to be held at Akron, March 31 and April 1.

It is forecast that another movement will be inaugurated to have a general lighting law enacted in Ohio. Since the last session of the legislature there has been a considerable increase in sentiment for the carrying of lights by all vehicles. A recommendation to this effect has been made by State Highway Commissioner Cowen, and the motor organization, in combination with other associations, will seek to have this enacted into the state code.

Vesta Clutch Proves Good

(Concluded from page 284)

are not slid into mesh; consequently there is no clashing or grinding of the gears.

After reaching a speed of 20 m.p.h., the neutral button was pushed in, which broke all electrical connections in the car. It was then demonstrated that the centrifugal force was sufficient to drive the car, as well as to pick up to any higher speed desired, this being done without the aid of any electric or magnetic connection whatever.

Threading the city's traffic at a time when the homeward-bound motorists and pedestrians and the long lines of street cars offer the severest test of a car's handling qualities, we negotiated the streets, at a snail's pace, stopped and started again in obedience to the policeman's whistle and did it all on high. Also we did it with the smoothness and ease of an electric.

In just what way the Vesta Accumulator Co. will market the new device is not fully determined as yet. Officials express the intention to license the Morrison patents to car builders. In addition it is expected that the Vesta people will be building a car before the middle of summer, which will have the new system as the feature.

Factory Miscellany

Covert Motor Vehicle to Build—A contract for the erection of a four-story building at Lock and Grand Streets, Lockport, N. Y., has been awarded by the Covert Motor Vehicle Works. The building will be of concrete and will be 150 by 150 ft.

Tire Plant for Wakefield—T. E. Dwyer has succeeded in getting the Motor Tire Reconstruction Co. of New York to build a factory at Wakefield, Mass., for its New England branch, work being started on a structure on Broadway so designed that it may be enlarged from time to time.

Goodyear to Build Garage—The Goodyear Tire & Rubber Co., Akron, Ohio, has purchased a large tract on Market Street, opposite its plant, where a large garage is to be erected. Tentative plans call for an expenditure of $50,000 for the garage. The B. F. Goodrich Co. took similar action some time ago, having purchased a site upon which a large garage is being erected.

Celfor Tool to Enlarge—Several thousand dollars are to be spent by the Celfor Tool Co., Buchanan, Mich., on different enlargements of the plant. There will be a new shop building, a new office building, a storehouse, a new boiler plant and a 73-ft. smokestack. It will take about four months to complete the enlargements.

Continental Rubber Co. Formed—L. J. Weadock and C. E. Sprague of Toledo; G. W. Doerzbach, J. J. Daach, J. T. Sloat and Sidney Frohman of Sandusky, have incorporated the Continental Rubber Co., Sandusky, Ohio, with a capital of $500,000, to manufacture automobile tires. The company has made arrangements to take over the now unoccupied plant of the Erie Reduction Co., in the southwestern outskirts of the city.

Briscoe Building—Construction of a new one-story office building, 300 ft. long, will be started shortly by the Briscoe Motor Co., Jackson, Mich. An addition is now being erected to the motor department, also a one-story stock room, between the motor and assembly rooms. Gradually other enlargements will be made and by the end of July it is expected that there will be room to give employment to at least 2000 men.

Battery Plant for Peoria—Frank B. Kamarke, will open a manufacturing plant in Peoria, Ill., for storage batteries. It is claimed that batteries can be constructed as economically in central Illinois, as in the East. The plant will be located on Knoxville Avenue and will be ready for business early in February. Mr. Kamarke was for a number of years connected with the Fashion garage of Peoria and has specialized in batteries.

K. C. Tire Plant Progressing—The work of remodeling the factory building recently leased by the newly-organized Kansas City Tire and Rubber Corp., Kansas City, Mo., has gone ahead so successfully that the announcement has been made that the company will be producing five hundred tires daily within the next month. The company also controls a plant in Chester. It will be continued as a part of the Kansas City company, manufacturing the Chester and Traveler tires. The local plant is being constructed with a capacity of one thousand tires daily, but this output will not be attempted for several months. Five hundred men will be employed here.

The Automobile Calendar

Feb. 7-12	Kansas City, Mo., Show, J. I. Case, T. M. Bldg., Kansas City Motor Dealers' Assn.
Feb. 7-12	Duluth, Minn., Show, Armory, Duluth Automobile Dealers' Assn.
Feb. 8-11	Grand Forks, N. D., Show, Auditorium.
Feb. 8-12	Freeport, Ill., Show, Freeport Auto Dealers and Garage Owners' Assn., Henney Buggy Plant.
Feb. 9-12	Peoria, Ill., Show, Coliseum, Peoria, Automobile and Accessory Assn.
Feb. 12-19	Albany, N. Y., Show.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Elmira, N. Y., Show, Elmira Auto Club.
Feb. 14-19	Nashville, Tenn., Show, Hippodrome. J. A. Murkin, Mgr.
Feb. 14-19	Des Moines, Iowa, Show, Des Moines Auto Dealers' Assn.
Feb. 14-19	Winnipeg, Man., Show, Ford Plant, Winnipeg Motor Trades Assn.
Feb. 16-19	Rockford, Ill., Show, Coliseum, Motor Car Dealers Assn.
Feb. 17-19	Racine, Wis., Show, Lakeside Auditorium.
Feb. 19	Newark, N. J., Show, First Regiment, Armory, C. G. Fitzgerald, Mgr.
Feb. 19-26	Harrisburg. Pa., Show, Emerson-Bruntingham Co.'s Bldg., Capital City Motor Dealers' Assn.
Feb. 20-27	Grand Rapids. Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory. B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 23-26	Bay City, Mich., Show, Bay City Automobile & Accessory Dealers' Assn.
Feb. 28-March 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Cedar Rapids, Ia., Show, Cedar Rapids Automobile Dealers' Assn.
Feb. 28-March 4	Paterson, N. J., Fifth Annual Show, Auditorium.
Feb. 29-March 4	Ft. Dodge, Iowa, Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March 5	Los Angeles, Cal., Speedway Race, Ascot Speedway Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
March 8-11	Mason City, Iowa, Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 15-18	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 10-15	Seattle, Wash., Show, Arena.
May	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 30	Indianapolis Speedway Race.
June 10	Chicago Speedway Race.
June 28	Des Moines, Iowa, Speedway Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress. Detroit Board of Commerce Bldg.
July 4	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Minneapolis Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
Aug. 5	Tacoma Speedway Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Race.
Sept. 4	Indianapolis Speedway Race.
Sept. 16	Providence Speedway Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race. Indianapolis Motor Speedway.

The Week in the Industry

Anderson Joins Sun—John Anderson has joined the Sun Motor Car Co., Elkhart, Ind., as assistant factory manager. He formerly occupied a similar position with Chandler Motor Car Co., Cleveland.

Jones Beaver Superintendent—Frank Jones has been engaged by the Beaver Manufacturing Co., Milwaukee, Wis., as factory superintendent, succeeding W. A. Carroll, resigned. Mr. Jones took charge Feb. 4.

Sehl Joins Studebaker—J. P. Sehl, commercial body designer, Pierce-Arrow Motor Car Co., Buffalo, N. Y., has resigned to accept a position in the body designing department of the Studebaker Corp., Detroit.

Corman Makes New Connection—E. W. Corman, who was advertising manager of the Saxon Motor Co., has become sales and advertising manager of the Wetmore-Quinn Co., Detroit distributor for the Saxon and Paige.

Bowman White's Columbia Mgr.—F. P. Bowman, formerly of Chicago, Ill., has succeeded R. D. Lampert of this city as manager for the White Co., Cleveland, Ohio, in Columbia, S. C., handling the State. Mr. Lampert has engaged in business for himself.

Grimes Joins National—C. P. Grimes will on Feb. 15 become assistant in charge of the experimental department of the National Motor Vehicle Co., Indianapolis, Ind. Mr. Grimes has for the past 4½ years been connected with Wheeler & Schebler, Indianapolis, in the capacity of technical engineer.

New Braender Tire Managers—The Braender Rubber & Tire Co., Rutherford, N. J., has opened branches in Chicago, Ill., at 1350-54 South Michigan Avenue, and in Philadelphia at 1327 Race Street. The Chicago branch is under the management of W. J. Heathcock and the Philadelphia branch is under W. L. Porter.

Smith Heads American Malleables Office—The American Malleables Co. has opened offices at 1607 Kresge Building, Detroit, Mich., in charge of P. G. Smith, assistant sales manager of the company. The company has two plants, located at Lancaster, N. Y., and Owosso, Mich., and makes a specialty of nothing but malleable castings for the automobile trade.

Elwood Joins Remy—J. L. Elwood, formerly superintendent of the Eureka Electrical Mfg. Co., North East, Pa., has been appointed director of service for the Remy Electric Co., Anderson, Ind. Mr. Elwood has been engaged in the electrical manufacturing business for quite a number of years, having previously been with the Remy company in the production end of the business.

Motor Men in New Roles

Zeigler Co. Starts Operations—The Zeigler Manufacturing Co., Alexandria, Ind., is just starting operations. It has secured the American Wheel Works plant at Alexandria, Ind., which is well equipped for the manufacture of steel stampings and machine products, suitable for the automobile trade. Sales offices have been opened at 910 Merchants' Bank Building, Indianapolis.

Radford Succeeds Gloetzner—W. H. Radford has been appointed assistant engineer in charge of design by the Chalmers Motor Co., Detroit, Mich. He succeeds A. A. Gloetzner, who recently resigned.

K. M. Wise was appointed assistant engineer in charge of the experimental division. He was formerly with the Studebaker Corp. and the Crucible Steel Co. of America.

New Interests in Cleveland Cole—S. S. Mier and E. J. Arnstine have secured a controlling interest in the Cole-Cleveland Co., Cleveland, Ohio, distributor for Cole cars in sixteen counties in northern Ohio. Mr. Mier has been made president of the company and Mr. Arnstine secretary and treasurer. J. M. Smith, former local manager of the company, will continue with it. There will be no change in the line or in the territory and the policy of the company will be continued as in the past.

Fagersten Jeffery Foreign Rep.—Wallis Fagersten of Rockford, Ill., has accepted a position with the Thomas B. Jeffery Co., Kenosha, Wis., to enter its foreign service as traveling representative. He will spend two months at the Kenosha factory in order to become acquainted with the manufacture of trucks suitable for army service, and will spend most of his time in Russia and France meeting purchasing agents of those governments and supervising deliveries.

Changes in Bearings Co. of America—The following changes have recently been made in the Bearings Co. of America, New York City: J. W. Hertzler, who has been for several years past Western representative of that company, has been appointed assistant manager, and is now located at the factory of the company in Lancaster, Pa. Mr. Hertzler is being succeeded in the Detroit office at 604 Ford Building by W. C. Little, who has represented Brandenburg & Co. and the Buda company in that territory.

Changes Planned in Mid-Continent Tire—Several changes probably will be made soon in the directorate of the Mid-Continent Automobile Tire Co., now operating a plant in Wichita, Kan. R. E. Price of Denver already has retired from the company and his place has been taken by A. O. Rorabaugh of Wichita. Most of the stock is owned in Wichita and it is planned to enlarge the directorate from five to nine and fill it with local business men. The plant will have a capacity of about 400 tires daily.

Albright and Williams Make Changes—W. D. Albright, who for the past two years has been manager for the Portland, Ore., branch of the B. F. Goodrich Co., and C. H. Williams, manager of the Portland branch of the Goodyear Tire & Rubber Co., have both received new appointments. Mr. Albright is now Northwest manager of all lines of the Goodrich company, with supervision over all of Oregon, Wash., northern Idaho, western Montana, British Columbia, Alberta and all of Alaska. Mr. Williams has been named manager of the Goodyear branch in Chicago, and J. A. Leatherman has assumed management of the Portland branch.

Boston Trade Changes—E. A. Francis, formerly assistant manager of the wholesale branch of the Saxon Motor Car Co., Detroit, has been made manager, taking the place of F. S. Sumner, who resigned recently to join the O. L. Halsey Company, Chalmers dealers.

F. C. Stetson has been placed in charge of the new tire department handling Mohawks at the Green & Swett Co. on Boylston Street.

Howard Blossom has been appointed manager of the wholesale department of the Jackson Motor Car Co. of New England, taking the place of A. C. McIntyre.

J. W. Bowman, one of the pioneers in the Hub, has added the Daniels Eight to his Velie line.

Bradford Kinsley has been placed in charge of the commercial department of the Coburn-Draper Co., Maxwell agent.

A. C. White, Jr., has resigned from the New England branch of the White Company and taken on the agency for the Vim line.

New Quarters for N. Y. Chandler—The Brady-Murray Motors Corp., New York City dealer of Chandler cars, has practically completed the removal of its service station and stock room department from the old quarters at 245 West Fifty-fifth Street to the new quarters at 1886 Broadway.

Dallas Items—Special representative Louis Goodlet of the Lewis Spring & Axle Co. was in Dallas recently and practically completed arrangements for the handling of the Hollier Eight.

The Johnson Shock Absorber Co. of Texas has established headquarters at 1305 Young Street, Dallas. A. D. Crum is in charge. The Dallas house will carry a full line of Johnson absorbers.

The A. B. Auto Supply Co. is the latest addition to automobile row in Dallas. C. R. Rodeman, formerly with the Firestone Tire & Rubber Co., is in charge. The company has acquired the business of the Walter Barnes Rubber Co. and will carry a full line of automobile supplies.

The Atlas Tire Co. of Kansas City has established an office in Dallas at 2006 Commerce Street.

New Chase Co. in Chicago—L. P. Rasmussen & Co., 2419-2421 South Park Avenue, Chicago, has taken over the Chase line in the Chicago territory. Heretofore the Chase has been represented in Chicago by the Chase Motor Truck Sales Co., a local company organized by H. T. Bouldon, general sales manager for the Chase Motor Truck Co., Syracuse, N. Y., and was conducted as a factory branch. The new dealer will take over the line at once and the factory salesroom at 2027 South Michigan Avenue will be vacated. L. F. Stevens, who has been acting as Chicago manager, will remain with the Chase organization as division sales manager, with headquarters in Chicago.

Cleveland News Items—The Apperson-Cleveland Co., Cleveland, Ohio, has moved to its new quarters at 2352 Euclid Avenue, where handsome salesrooms and a very complete service station have been prepared.

The Cleveland Automatic Machine Co. has purchased 3500 sq. ft. of land adjoining its present factory at 2269 East Sixty-fifth Street, where an addition will be built.

E. R. Johnstone has taken charge of the service department of the Guarantee Auto Repair Co., and will also be an instructor in the Ohio Automobile School which is owned by this company.

G. A. Guyman, for some years special representative of the G. M. C. truck in Ohio, has become associated with the Packard-Cleveland Co.

C. C. Burneet has taken charge of the used car department of the Hudson-Stuyvesant Motor Co. He was formerly sales manager of the used car department of the Cadillac Motor Co.

Baltimore Trade News—The Ford Motor Car Accessory Co., 1411 North Charles Street, Baltimore, Md., is the latest accessory house to enter the local field. I. R. Rollins is manager, and besides conducting the accessory factory the new concern will buy and sell used Ford cars. A repair department will be conducted with free service for their customers, and special prices will be made to new customers. The firm has also secured the agency of the Boston starter for the State of Maryland.

The Motor Car Co., Maryland and Mt. Royal Avenues, Baltimore, Md., distributor of the Overland and Willys-Knight, has found it necessary to acquire additional space and has leased a large building at 1018 Guilford Avenue, this city. The new building will be used exclusively for a repair and service department and contains 18,000 ft. of floor space, with the acquiring of which the Motor Car Co. has one of the largest plants in the South for the handling of business. Cuba, Porto Rico and South American points are supplied by this firm.

The Tire Mart, F. Morrison Boyd, president, Baltimore, Md., has acquired the agency of the Gordon and Ideal tires, manufactured by Gordon Tire & Rubber Co., Canton, Ohio. D. C. Turnbull has joined the Tire Mart sales force.

The Baltimore Oil Engine Co., Baltimore, Md., has been incorporated under the laws of the State of Delaware and will establish a large plant for the manufacture of internal combustion oil engines under the Wygodsky system. A. W. Gieske of Baltimore is president of the company.

The Rutherford Tire Co., Rutherford, N. J., has leased 1950 Linden Avenue, Baltimore, Md., and will establish a branch.

The Rowan Electric Mfg. Co., Baltimore, Md., has been incorporated with $25,000 capital stock by J. S. Rowan, 208 North Holliday Street, B. H. Cram and A. B. McElderry, to manufacture, buy and deal in an automobile starter, valves, etc.

Missouri News Items—The Diamond Motor Car Co., St. Joseph, Mo., has taken over the $15,000 garage and salesroom of the St. Joseph Automobile Co. at Eleventh Street and Frederick Avenue. The St. Joseph company probably will be disbanded, although no definite announcement has been made. It formerly held the agencies for the Hudson, Maxwell and Marmon cars, the Detroit electric, and the G. M. C. truck in northwest Missouri and northeast Kansas. The Hudson agency has been taken over by the Diamond company and the G. M. C. truck by the Holliday Motor Co. Disposition of the other agencies has not been announced.

L. W. Smith, who was manager of the St. Joseph company, will be associated with the new company.

The Farmer Auto Co., agent in this territory for the Ford line, will move into the quarters made vacant by the moving of the Diamond company.

The Franklin Motor Car Co., Kansas City, will move in the near future from its present location, 3340 Main Street, to new quarters recently leased at 1916-18 Grand Avenue. The company's storage and salesrooms will be practically doubled by the change.

Several changes in locations have been made by Kansas City distributing agencies within the past few weeks. The Bush-Morgan Motor Co., agents for the Paige, has leased the three-story building at 1508-10 Grand Avenue, formerly occupied by the Moriarty Motor Co. That company has moved to the new four-story building constructed for it at Twenty-second Street and Grand Avenue.

Hall Bros. & Reeves, agents for the Bull tractor, have taken the building at 1526 McGee Street. The Chalmers company factory branch has taken new sales quarters at 1506-8 McGee Street, and the factory branch of the Chandler company will move to 1830 Grand Avenue. The R-C-H Co. also has taken new quarters, now being located at 1714 Grand Avenue.

Missouri Haynes Co., Kansas City distributor for the Haynes, Marion and Paterson cars in this territory, will move to larger quarters at the southwest corner of Sixteenth Street and Grand Avenue. The Serlis Motor Car Co. also will occupy the same building.

The Serlis Motor Car Co. is the recently organized distributor for the Briscoe there and has maintained temporary quarters at 1702 Grand Avenue. E. L. Reed, formerly sales manager of the Pathfinder agency in Los Angeles, heads the new concern.

Takes Over Chevrolet Retailing in S. Cal.—An important deal in southern California motor circles was completed yesterday when the Chevrolet Sales Co. officially took over the retail distribution of the Chevrolet in that territory. The new company has strong financial backing and is closely allied with the Chevrolet Motor Co. of California which controls the entire Pacific Slope and the Islands of the Pacific.

R. C. Durant, who is identified with the larger corporation, also becomes a prominent figure in the retail corporation. S. F. Seager, who is well known on the Pacific coast on account of his connection with the Oldsmobile company which controls the Coast territory, is another official prominent in the affairs of the new corporation. Both Durant and Seager will continue in the other corporations while the retailing of cars throughout the territory will be entrusted to a corps of trained men.

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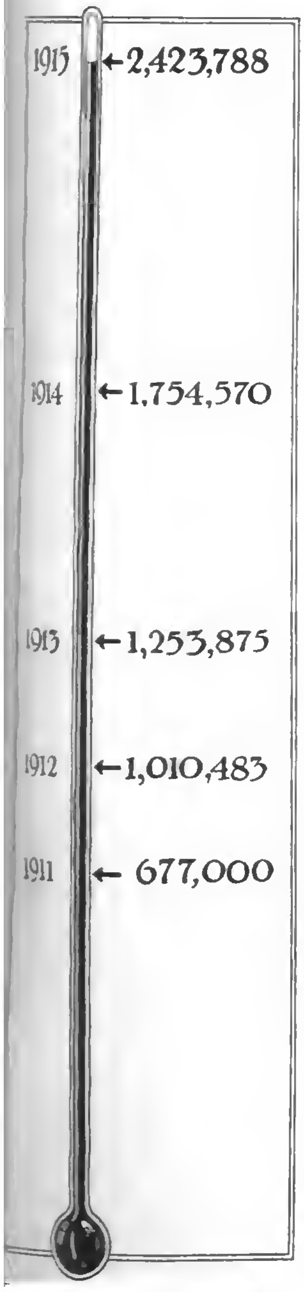
The AUTOMOBILE

United States Has 2,423,788 Cars

1915 Registrations Show Increase of 686,998 Cars and Trucks, or 39.6 Per Cent Over 1914—One Car to 42 People

By Donald McLeod Lay



Illustrating the remarkably [illegible] ratio of increase in automobile and motor truck registrations in the United States [illegible] of the past five years

DURING the calendar year of 1915 there were registered 2,423,788 automobiles and motor trucks in the United States. This total does not include duplicate registrations; at least, all available duplicate registrations have been deducted. The gain in registrations over 1914 was 686,998, which means an increase in the year of 39.6 per cent. Over $4,000,000 was spent in thirty-four States for registration fees alone.

This is a much greater increase than 1914 showed over 1913, when the added registrations for the year totaled 482,915 vehicles. In a word, 1915 showed a 44 per cent greater registration than 1914. Registrations Dec. 31, 1914, were 1,736,790.

Reverting to the grand total of 2,423,788 motor vehicles registered up to Dec. 31, 1915. Taking the latest census department estimate our Government places the population of the United States at 101,208,315 as of Dec. 31, 1915. Taking these two totals as official we have one machine for every forty-two persons in the country.

Considering the gain of 686,998 automobiles and trucks made during 1915, this figure of increase in registration must not be confused with figures of automobile production or manufacture during the calendar year. A conservative estimate has placed the total number of automobiles manufactured at 892,618, this including over 50,000 motor trucks. The number of vehicles registered during the calendar year is naturally much lower owing to the large number exported, also to a considerable number of old cars that have been scrapped or put to other uses and to many cars manufactured during the last three months, many of which are in storage at dealers' warehouses ready for quick delivery when the buying

New York	212,844
Illinois	182,290
Ohio	179,767
California	163,801
Pennsylvania	150,729
Iowa	139,808
Michigan	114,845
Indiana	96,915
Minnesota	91,829
Texas	90,000
Massachusetts	89,133
Wisconsin	81,371
Missouri	76,462
Kansas	74,956
New Jersey	67,556
Nebraska	59,140
Connecticut	38,950
Washington	36,905
South Dakota	29,336
Maryland	27,638
Tennessee	27,266
Colorado	26,611
Oklahoma	25,615
North Dakota	24,678
Georgia	24,059
Oregon	23,758
Virginia	21,357
North Carolina	21,160
Kentucky	19,500
Maine	18,600
Rhode Island	16,362
Montana	14,520
South Carolina	14,500
Alabama	13,798
West Virginia	13,256
Florida	13,123
Mississippi	11,500
Vermont	11,499
Louisiana	10,880
New Hampshire	10,819
Dist. of Col.	10,200
Arkansas	8,021
Utah	7,994
Arizona	7,320
Idaho	7,093
New Mexico	4,947
Delaware	4,924
Wyoming	3,976
Nevada	2,177
Total	2,423,788

Standing of the States in automobile and motor truck registration. All duplicate registrations have been deducted

Distribution of automobiles and motor trucks in the various States, all duplicate registrations being deducted

season opens under the influence of approaching warm weather.

Analyzing the gain of 686,998 registered vehicles during the year, many will be surprised to know that considerably more than half of these registrations were recorded in the last six months. The figures are:

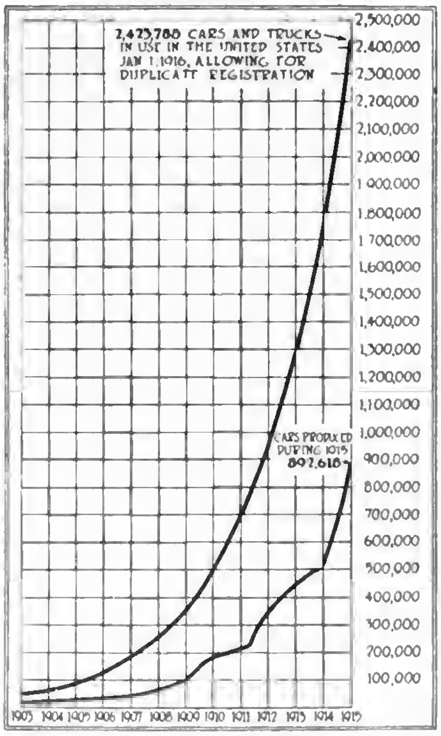
Gain in registrations to July 1............334,113
Gain in last six months....................352,885

Thus it is seen that a practically uniform rate of registration obtains throughout the year, in spite of the heavier selling and re-registration peculiar to spring.

During 1915 several changes occurred in the standing of States having over 100,000 cars and trucks registered. New York continues to lead with 212,844. Illinois keeps second place with 182,290. Ohio, however, has supplanted California in third place with 179,767, as against the Golden State's total of 163,801. Pennsylvania is still fifth with 150,729, followed by Iowa with 139,808; but Massachusetts has yielded seventh place to Michigan, which has jumped up into the 100,000 class with 114,845.

Nine States have between 50,000 and 100,000 cars and trucks, Indiana leading with 96,915, having passed Minnesota, which was one place ahead of it at the end of 1914. Minnesota now has 91,829, while Texas is credited with 90,000. Massachusetts follows with 89,133, and Wisconsin has 81,371; Missouri shows 76,462 registrations and Kansas 74,956; New Jersey has 67,556, and Nebraska registrations total 59,140.

Twenty-five States have registrations varying from 50,000 down to 10,000; Connecticut having 38,950 and the District of Columbia 10,200. In the group with registrations under 10,000 there are eight States, A kansas, Utah, Arizona, Idaho, New Mexico, Delaware, Wy ming, and Nevada. Since registration statistics were fi available the last three States have held this order, th gains being in practically the same proportion each ye Nevada has the fewest cars of any State in the Union, total registration for 1915 being 2177, a gain of 690 o 1914, which is not a bad showing since its population Jan. 1, 1916, according to the estimate just issued by census bureau, is only 104,732.



Registration and production of automobiles and motor trucks in the United States since 1902. Note the uniform upward sweep

Although the majority of the Sta were unable to give statistics cover the number of gasoline cars and tru as compared with electric cars trucks in use, it was possible to obt fairly complete statistics regarding registration of non-residents and registrations due to change of ow ship, etc. These reports show a t of 19,134 cars registered in more t one State, while the number of re-re trations is 55,682. The respective ures for the various States have deducted from the total registratio each instance to secure the actual ber of cars and trucks in use.

Eliminating Duplicate Registration

These statistics have been sec from the State registration officia all cases except the District of Co bia, Mississippi and Texas; all dup tion of registration owing to the car being registered in more than State, cars changing ownership an quired to be re-registered on tha count, etc., is deducted. The sourc information of the three sections tioned are given in the footnote a bottom of page 305.

Taking up the gains made by the various States over their respective totals for 1914 and making allowance for duplicate registrations, Ohio shows the largest increase with 58,502, although it is in third place in the list of total registrations. Ohio has one car to every twenty-eight persons, according to the estimate of the United States census bureau of population up to Jan. 1, 1916.

New York is a close second with 56,671, giving the State a total of 112,844, or one car to every forty-eight of its population.

Illinois, which is second to New York in total registration, as shown in the table on page 303, gained 51,150 cars and trucks during the year, having one to each thirty-three persons.

Pennsylvania is next in order with an increase of 43,588, or one to every fifty-six of its population.

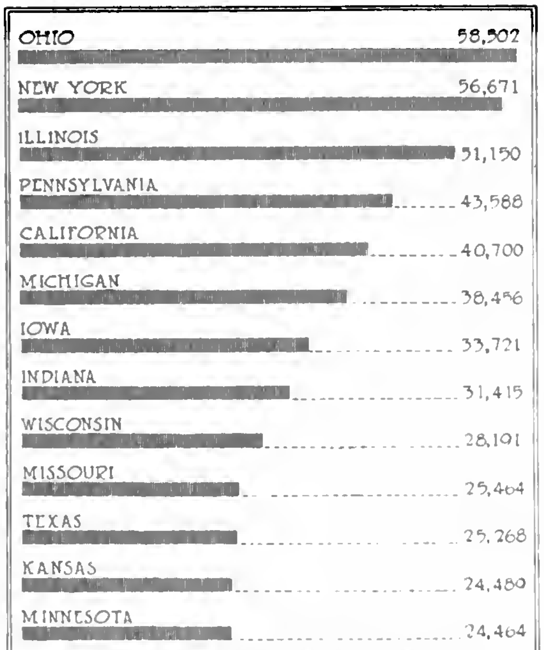
California, which leads Pennsylvania in the total number of vehicles, being in third place, follows the Keystone State in the order of increased registration, having 40,700 to its credit, while its car-to-population ratio is second only to Iowa's, there being one motor vehicle to every eighteen persons.

Michigan ranks sixth, although it follows Iowa in the total number of cars registered, its gain for 1915 being 38,456, while its car-to-population ratio is one to each twenty-six inhabitants.

Iowa follows Michigan in the order of increased registration, showing 33,721, while its car-to-population ratio is the highest of all the States, there being an automobile or truck to every sixteen of its population.

Indiana is the only other State to show an increase of over 30,000 cars, its gain totaling 31,415; the Hoosier State has a motor vehicle to each twenty-nine inhabitants.

A comparison of the tabulations showing total registration

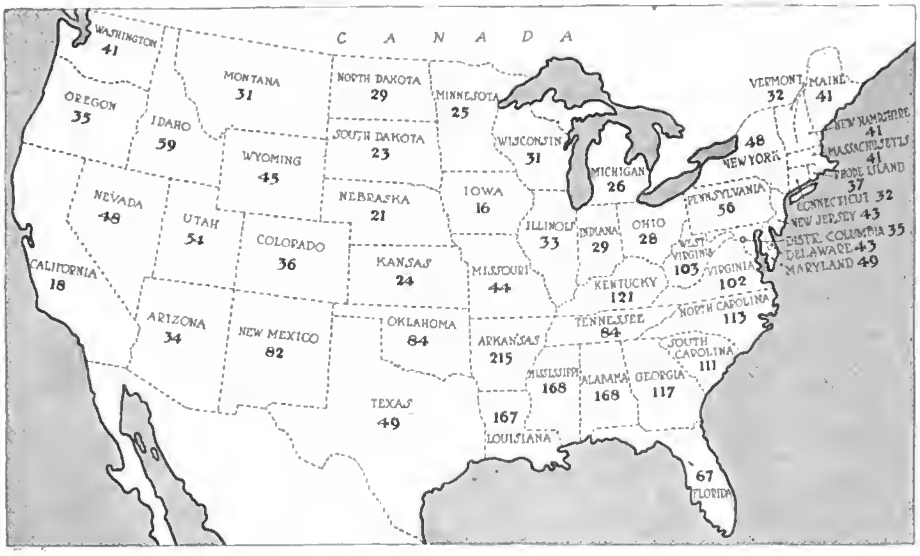


Thirteen States show gains of over 20,000 cars and trucks in 1915

Car and Truck Registration in Each State from Jan. 1, 1915, to Jan. 1, 1916

State or Territory	Total Registration	New Registration	Registration Up to Jan. 1, 1915	Gasoline Passenger Cars in Use	Gasoline Commercial Cars in Use	Electric Passenger Cars in Use	Electric Commercial Cars in Use	Non-Resident Registration*	Re-Registered**	Chauffeurs Registered	Total Fees	Remarks
Alabama	13,798	5,298	8,500	11,615	2,183	***	***	***	***	***		Commercial includes taxicabs and jitneys.
Arizona	7,320	2,280	5,040	***	***	***	***	***	***	***		
Arkansas	8,021	2,379	5,642	***	***	***	***	***	***	***		
California	163,801	40,700	123,101	***	***	***	***	***	***	***		New law.
Colorado	28,254	9,821	18,433	***	***	***	***	***	1,613	3,533	$111,197 00	
Connecticut	38,950	9,645	29,305	34,105	4,847	***	***	***	***	***	536,970 09	
Delaware	4,924	1,874	3,050	***	***	***	***	***	***	***	55,471 00	New law.
Dist. of Col.*†	10,200	2,200	8,000	10,000	2,000	***	***	***	***	***		Perennial reg.
Florida	13,123	1,757	11,366	***	***	***	***	***	***	***		New law.
Georgia	24,059	3,149	20,910	***	***	***	***	***	***	***	126,480 00	
Idaho	7,244	3,972	3,272	7,074	145	25	***	***	151	786	118,188 00	
Illinois	182,290	49,952	132,338	***	***	***	***	***	***	22,905	924,905 74	
Indiana	96,915	31,415	65,500	***	***	***	***	None	***	3,099	571,581.00	
Iowa	145,134	36,727	108,407	***	***	***	***	75	5,251	None	1,510,745.82	
Kansas	74,956	24,489	50,467	***	***	***	***	***	None	None	224,780 00	
Kentucky	19,500	7,754	11,746	***	***	***	***	***	***	1,824	114,184 07	
Louisiana	10,880	7,380	3,500	***	***	***	***	***	***	None	65,000 00	
Maine	21,600	5,900	15,700	20,600	1,000	None	None	2,000	1,000	4,183	268,412 00	
Maryland	27,638	7,425	20,213	27,858	3,189	***	***	***	***	6,000	402,124 49	
Massachusetts	102,633	15,633	87,000	00,673	11,960	***	***	***	13,500	34,736	1,054,704.50	
Michigan	114,845	38,456	76,389	***	***	***	***	***	***	***		New law.
Minnesota	93,000	25,635	67,365	***	***	***	***	500	671	3,000	153,000.00	Triennial reg.
Mississippi§	11,500	7,606	3,894	***	***	***	***	***	***	***		
Missouri	76,462	24,529	51,933	***	***	***	***	***	***	0,380	323,292.50	
Montana	14,520	3,814	10,706	14,060	460	***	***	***	***	625	41,180.00	Year April 1 to April 1.
Nebraska	59,140	9,140	50,000	***	***	***	***	***	***	***		New law.
Nevada	2,177	690	1,487	2,128	47	2	None	***	***	None	7,986.05	
New Hampshire	13,500	2,904	10,596	12,925	500	25	50	1,466	1,215	17,383	257,776.21	
New Jersey	82,556	22,309	60,247	81,848	3,616	***	***	15,000	***	***	1,062,922.96	New law. "Trucks" under 4,000 lb. incl. with gasoline passenger cars.
New Mexico	5,000	1,808	3,192	4,862	128	10	None	2	51	None	29,624 89	
New York	233,325	63,359	169,966	210,037	23,288	***	***	***	20,481	81,266	1,874,075.50	
North Carolina	21,160	6,345	14,815	***	***	***	***	***	***	***	130,000.00	Year July 1 to July 1.
North Dakota	24,908	7,560	17,348	***	***	***	***	10	220	None	79,504 11	
Ohio	181,332	58,828	122,504	***	***	***	***	81	1,484	14,216	983,789 38	
Oklahoma	25,615	18,255	7,360	***	***	***	***	None	None	None	155,000.00	New law. Estimate 5,000 cars not registered.
Oregon	23,758	7,411	16,347	***	****	***	***	***	***	4,131	108,881.50	
Pennsylvania	160,744	47,890	112,854	152,365	8,379	***	***	***	10,015	36,747	1,665,276.50	
Rhode Island	16,362	4,031	12,331	***	***	***	***	***	***	***	208,498 00	
South Carolina†	14,500	§§	15,000	***	***	***	***	***	***	***		Local reg.
South Dakota	29,336	7,916	21,420	***	***	***	***	***	***	None		
Tennessee	27,266	7,598	19,668	***	***	***	***	***	***	***		New law.
Texas††	90,000	25,268	64,732	85,000	5,000	***	***	***	***	***		Loc. and per. reg.
Utah	7,994	1,720	6,274	***	***	***	***	***	***	***		Perennial reg.
Vermont	11,499	3,243	8,256	11,137	355	4	3	***	***	***	218,479 85	
Virginia	21,357	7,205	14,152	***	***	***	***	***	***	***		
Washington	36,905	6,652	30,253	33,042	3,863	***	***	None	***	None	238,717 00	New law.
West Virginia	13,256	5,032	8,224	***	***	***	***	***	***	1,459	131,362 00	
Wisconsin	81,371	26,980	54,382	***	***	***	***	None	***	None	414,765 00	
Wyoming	3,975	1,548	2,428	***	***	***	***	***	None	None	19,880.00	
Total	2,498,604	713,491	1,785,613	819,329	70,960	66	53	19,134	55,682	245,363	$4,18 755 16	

NOTE.—Approximately 3,500 steam cars and 350 steam trucks included in the gasoline vehicle statistics. *Number of cars owned by residents of other States. **Number of cars re-registered owing to change of ownership, etc. ***Not listed separately by registration officials. †Estimated by State registration officials. ††Estimated on basis of population with reference to last registration. §Statistics furnished by Clarion-Ledger, Jackson, Miss. §§Previous estimate considered high by Commissioner. Electric cars and trucks are usually included among gasoline registrations.



Illustrating the population-to-car ratio in the various States. The figures represent the number of people to each automobile or motor truck in the States. The population statistics on which these population-to-car ratios are based are the estimates of the United States census bureau of the population of the various States up to Jan. 1, 1916

and increased registration for 1915 brings out the practically constant ratio of increase in these leading States.

Eight States Gain 10 to 30,000

Eight States show increased registration varying between 10,000 and 30,000. Of these, Wisconsin has the largest gain, registering 28,191 more cars and trucks than in 1914. In this State there is one motor vehicle to every thirty-one persons; Missouri gained 25,464, or more than a number of States ranking higher in the list of total registrations, while its car-to-population ratio is one to forty-four; Texas has an estimated gain of 25,268, there being forty-nine persons to each car and truck in the State; Kansas and Minnesota show the next largest gains, Kansas having 24,489 and Minnesota being credited with 24,464, Kansas having twenty-four persons per car and Minnesota twenty-five; Oklahoma shows 18,255 added registrations, having one car or truck to each eighty-four inhabitants, while the registration officials estimate that there are 5000 cars in the State which their owners have failed to register; Massachusetts and Connecticut show nearly the same gain, Connecticut having 12,732 while its car-to-population ratio is one to thirty-two, and Massachusetts showing 12,301 added registrations, with forty-one persons to each car or truck.

The remaining States show gains varying from Nebraska with 9140 down to Nevada with 690. Thirty-two States show a ratio of not more than fifty persons to each car or truck; seven show between fifty and 100 persons per vehicle, six have between 100 and 150 population per car, and only four run as high as 150 to 215. Arkansas has but one car to each 215 persons, the other three States, Mississippi, Alabama, and Lousiana, having one to 168, 168 and 167 respectively. Probably one reason for this is that the region in which these States lie is largely inhabited by an impecunious negro element, swelling the total population, although unable to purchase automobiles.

245,363 Chauffeurs

Several of the States were able to give the number of chauffeurs registered during 1915, the total being 245,363, or several times the standing army of the United States. It must also be considered that this represents the total in only seventeen States, eleven not requiring chauffeurs to register and twenty-one States being unable to furnish the number. New York, of course, is far in the lead, with 81,266, Pennsylvania being second with 36,747, closely followed by Massachusetts, which has 34,736. Illinois has 22,995 and New Hampshire 17,383, while Ohio is credited with 14,216.

Returns from thirty-four States show receipts from automobile, motor truck and chauffeur registrations of $4,188,755.16. New York leads in fees as well as in registrations, its motorists having paid $1,874,075.50 to the State during 1915. Pennsylvania is second with $1,665,276.50. Iowa has $1,510,745.82 in fees to her credit, while New Jersey automobilists and those visiting the State surrendered $1,062,922.96, and Massachusetts, another great touring State, shows receipts of $1,054,704.50. These are the only States whose fees passed the $1,000,000 mark, although Ohio received $983,789.38 and Illinois $924,905.74.

People are continually pointing to the rapid increase in automobile and motor truck production, demanding what is to become of the enormous motor vehicle production each year. They state that the buying power of the United States has been exhausted or is rapidly nearing its limit so far as motor vehicles are concerned. They warn against continued expansion, holding up the menace of over-production to the industry and prophesying all sorts of disastrous consequences as inevitable if the present rate of progress is sustained. The registration statistics form the foundation for conclusions which indisputably refute all the contentions of these pessimistic prophets. During 1915 the production of automobiles and motor trucks by the manufac-

Dealers, Garages, Supply, Repair and Charging Stations in the United States

States	Dealers	Garages	Repair Shops	Supply Dealers	Charging Stations	Total
Alabama	126	87	39	10	14	196
Arizona	83	70	28	4	6	122
Arkansas	108	72	40	4	7	155
California	943	1,114	405	75	104	1,722
Colorado	263	284	105	8	22	423
Connecticut	287	220	120	33	22	527
Delaware	48	53	15	5	2	77
District of Columbia	53	46	25	13	7	122
Florida	175	179	76	4	16	288
Georgia	211	214	78	14	13	377
Idaho	107	80	31	2	8	143
Illinois	1,557	1,449	558	65	159	2,412
Indiana	850	586	265	20	67	1,256
Iowa	1,463	1,144	512	26	86	1,857
Kansas	840	653	197	14	34	1,141
Kentucky	205	151	52	4	17	261
Louisiana	84	162	19	6	14	120
Maine	115	217	62	5	14	354
Maryland	187	214	96	31	15	366
Massachusetts	582	724	276	66	74	1,258
Michigan	729	652	206	51	53	1,124
Minnesota	1,086	702	262	29	26	1,349
Mississippi	86	63	22	3	7	125
Missouri	734	515	283	37	46	1,116
Montana	196	149	59	5	9	254
Nebraska	725	518	155	13	30	902
Nevada	49	37	12	1	2	70
New Hampshire	159	184	76	3	11	267
New Jersey	494	719	235	35	45	976
New Mexico	69	59	17	1	1	110
New York	1,494	1,841	632	185	118	2,919
North Carolina	172	156	56	6	8	245
North Dakota	411	261	104	3	11	541
Ohio	1,249	1,012	437	63	105	1,812
Oklahoma	268	222	25	13	10	402
Oregon	163	180	33	15	13	270
Pennsylvania	1,256	1,294	542	110	107	2,045
Rhode Island	85	110	70	11	9	209
South Carolina	93	84	30	5	2	145
South Dakota	396	249	89	3	10	484
Tennessee	140	96	52	11	7	206
Texas	514	418	195	25	38	840
Utah	64	41	17	3	6	91
Vermont	121	125	54	4	3	197
Virginia	167	130	61	13	8	245
Washington	260	227	82	25	18	390
West Virginia	139	99	43	2	14	167
Wisconsin	801	656	291	18	17	1,046
Wyoming	51	42	21	..	4	69
Total	20,458	18,560	7,160	1,102	1.439	31,793

Distribution of Car, Truck and Motor Manufacturers in the United States

State	Car Mfrs.	Truck Mfrs.	Motor Mfrs.	Total Mfrs.
California	3	13	..	14
Colorado	1	3	..	3
Connecticut	5	4	2	9
Delaware	1	..	..	1
District of Columbia	..	1	..	1
Georgia	..	1	..	1
Illinois	24	28	6	54
Indiana	31	17	5	50
Iowa	4	3	..	6
Kansas	2	1	..	3
Kentucky	1	3	..	4
Louisiana	1	..	..	1
Maryland	3	3	..	4
Massachusetts	7	10	2	19
Michigan	51	39	12	92
Minnesota	3	13	3	19
Missouri	7	14	..	20
Nebraska	..	1	..	1
New Jersey	3	7	..	9
New York	20	33	7	58
North Carolina	1	1	..	1
Ohio	32	35	8	65
Oregon	2	1	..	2
Pennsylvania	14	21	6	41
Rhode Island	..	1	1	2
Texas	1	2	..	2
Virginia	1	..	..	1
Washington	4	3	..	6
West Virginia	1	..	..	1
Wisconsin	7	9	9	22
Total	230	267	61	512

turers of the United States reached a total of nearly 900,000 vehicles, a goodly percentage of these being exported to Europe, Asia, South America, in all, eighty countries in different sections of the globe, the number of cars and trucks shipped abroad increasing each month as shown by the government export statistics, the increase for the year being 250 per cent while their estimated value is $100,000,000.

Nearly 2,000,000 Gain Since 1911

The tremendous buying power of the country is well illustrated by the phenomenal increase in the number of automobiles and trucks in use in the United States since 1911. For that year a total of 677,000 was recorded, which, during 1912, jumped to 1,010,483, a gain of 333,483. In 1913 the total was 1,253,875, or 243,392 more than were recorded as being in use during the preceding year. As shown by the 1914 and 1915 statistics mentioned above, the increase in the number of vehicles in use from 1911 to the end of 1915 is 1,746,788, or practically the total number of cars and trucks in use in this country a year ago. In other words, the gain in car and truck registrations during 1915 is almost as large as the total number in use at the end of 1911.

Taken in conjunction with the yearly production statistics, the registrations are specially significant. In 1911 American automobile and truck manufacturers produced 209,957 cars and trucks, their annual output increasing rapidly with each succeeding year. In 1912 a total of 378,261 vehicles left their factories, increasing to 450,000 in 1913, and for 1914 the figure of 515,000 given by the National Automobile Chamber of Commerce was held to be so conservative that it was from 5000 to 15,000 below the actual production total for the year. The Chamber estimated that 30,000 of the number given were commercial vehicles. During 1915 the same authority gives a total production of 892,618 cars and trucks, of which 842,249 were passenger cars and 50,369 were commercial vehicles. Over 200,000 freight carloads of automobiles were shipped during that year.

$691,778,950 in Cars and Trucks

The total retail value of the automobiles and trucks built in the United States in 1915 was given as $691,778,950, of which $565,856,450 represented the passenger cars and $125,992,500 the commercial vehicles.

It was pointed out in THE AUTOMOBILE for Aug. 12 that the statistics for the first six months of 1915 showed that the sale of automobiles to farmers and people living in small communities was rapidly increasing. This tendency was continued throughout the year, and it is significant that such agricultural centers as Illinois, Iowa, Indiana, Minnesota and Wisconsin are well up toward the top of the car registration list. Farmers are coming to realize more and more that the automobile possesses greater potential possibilities for the development and broadening of their lives and business opportunities than any other factor. In fact, it is really more valuable to farmers than to any other class of people, as it brings them more closely into touch with the centers of population where they buy and sell than is possible with any other form of conveyance. In addition to this there is the important phase of the situation presented by the facilitation of social activity in rural districts rendered possible by the automobile. Farm life can no longer be described as unavoidably dull and lonesome as practically every aspect of it has been brightened by the influence of the automobile.

The continued rainy and stormy weather in some sections

Increase in Registration

State	Increase in Cars	Per Cent Increase
Ohio	58,502	48
New York	56,671	36
Illinois	51,150	39
Pennsylvania	43,588	41
California	40.700	33
Michigan	38,456	50
Iowa	33.721	32
Indiana	31,415	48
Wisconsin	28,191	53
Missouri	25,464	50
Texas	25,268	39
Kansas	24.489	49
Minnesota	24.464	36
Oklahoma	18,255	250
Connecticut	12.732	49
Massachusetts	12,301	16
South Dakota	9,256	44
Nebraska	9,140	18
New Jersey	8.736	15
Colorado	8.660	48
Kentucky	7.754	66
Mississippi	7.606	195
Tennessee	7.598	39
Maryland	7.425	37
Oregon	7,411	45
Louisiana	7,380	210
Virginia	7.372	53
North Dakota	7.330	42
Washington	6.652	22
North Carolina	6.345	43
West Virginia	6.039	84
Alabama	5.373	64
Maine	4,300	30
Rhode Island	4.031	33
Vermont	3.886	51
Idaho	3.821	117
Montana	3.814	35
Georgia	3,259	16
South Carolina	.....	..
Arizona	2,546	53
Arkansas	2,379	42
Dist. of Col.	2,200	27
New Hampshire	2,081	24
Delaware	2.030	70
New Mexico	1.857	60
Utah	1,855	30
Florida	1,757	15
Wyoming	1,548	64
Nevada	690	46
Total	687,498	
Average increase		39.6

Registration and Population

State	Pop. 1910 Census	Cars and Trucks	Pop. Per Car
Iowa	2,220,681	139,808	16
California	2,893,465	163,801	18
Nebraska	1,264,999	59,140	21
South Dakota	689,277	29,336	23
Kansas	1,818,383	74,956	24
Minnesota	2,263,182	91,829	25
Michigan	3,035,148	114,845	26
Ohio	5,119,491	179,767	28
Indiana	2,807,480	96,915	29
North Dakota	726,142	24,678	29
Montana	452,774	14,520	31
Wisconsin	2,486,941	81,371	31
Connecticut	1,234,031	38,950	32
Vermont	363,075	11,499	32
Illinois	6,110,888	182,290	33
Arizona	251,422	7,320	34
Dist. of Col.	361,330	10,200	35
Oregon	822,615	23,758	35
Colorado	948,930	26,611	36
Rhode Island	608,540	16,362	37
Maine	770,064	18,600	41
Massachusetts	3,690,748	89,133	41
New Hampshire	441,545	10,819	41
Washington	1,502,632	36,905	41
Delaware	212,489	4,924	43
New Jersey	2,914,928	67.556	43
Missouri	3,401,241	76,462	44
Wyoming	176,853	3,976	45
Nevada	104,732	2.177	48
New York	10,179,971	212,844	48
Maryland	1,357,374	27,638	49
Texas	4,386,638	90,000	49
Utah	429,191	7,994	54
Pennsylvania	8,453,004	150,729	56
Idaho	420,291	7,093	59
Florida	882,148	13,123	67
New Mexico	403,600	4,947	82
Oklahoma	2,158,194	25,615	84
Tennessee	2,279,691	27,266	84
Virginia	2,181,516	21,357	102
West Virginia	1,372,756	13,256	103
South Carolina	1,616,610	14,500	111
North Carolina	2,386,916	21,160	113
Georgia	2,836,177	24,059	117
Kentucky	2,372,412	19,500	121
Louisiana	1,815,218	10.880	167
Alabama	2,316,943	13,798	168
Mississippi	1,939,226	11,500	168
Arkansas	1,726,413	8,021	215
Total	101,208,315	2,423,788	....
Average for U. S.			42.00

of the country during the early part of 1915 had a very bad effect on the standing crops, road conditions and numerous other factors which must always be considered as influences on the automobile market. In view of these conditions the marked increase in registrations in these districts is especially significant as indicating their general prosperity and buying power.

A factor of the 1915 car and truck market was the export business with European belligerents. This demand in addition to the large domestic sales rendered necessary the extension of factory facilities by practically every automobile, motor truck and parts manufacturer in the United States. This activity has already been summarized in THE AUTOMOBILE for Dec. 23.

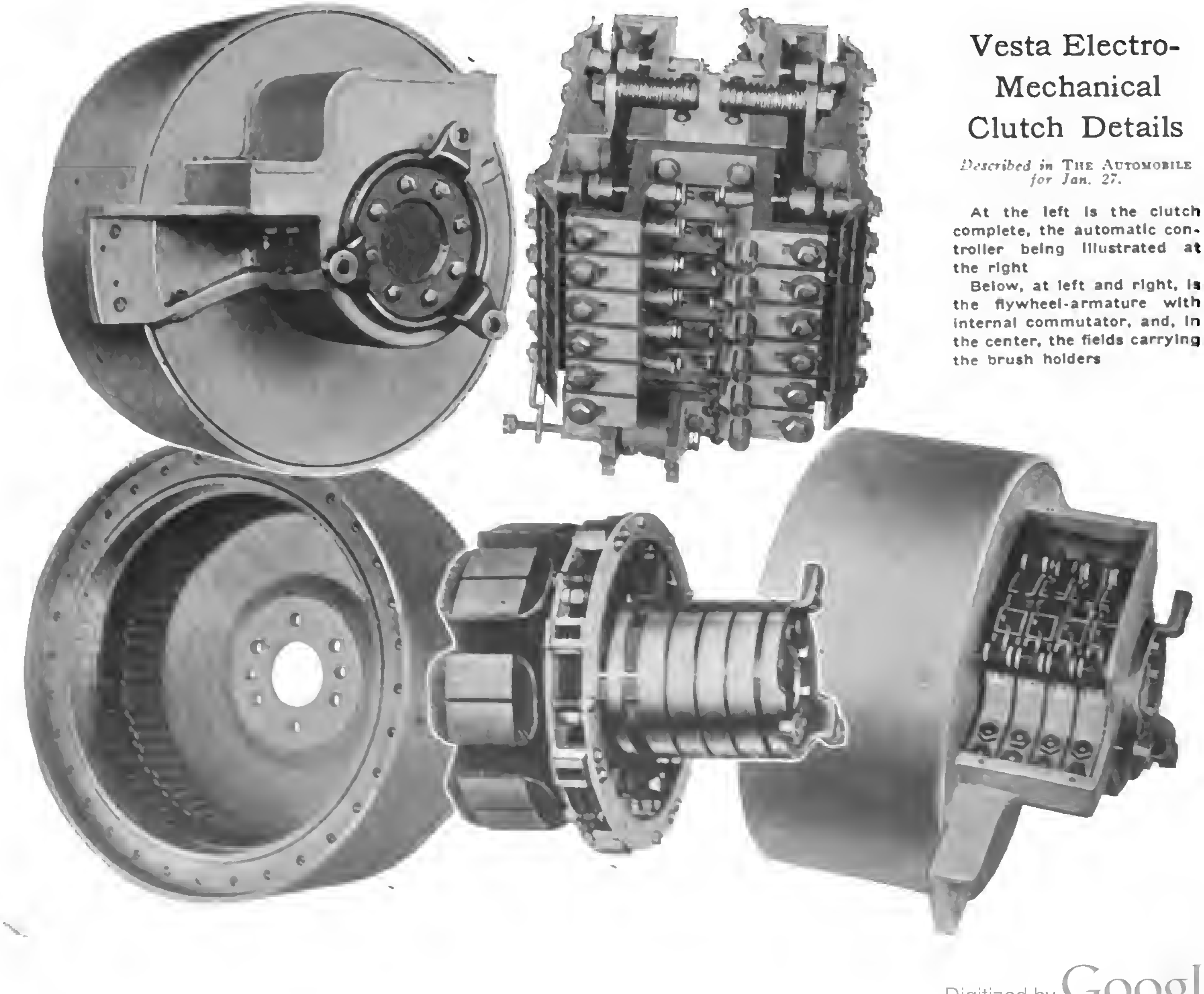
20,458 Dealers in United States

According to statistics compiled by *The Automobile Trade Directory*, there were 20,458 automobile dealers in the United States at the end of 1915, garages numbered 18,560, repair shops 7160, supply dealers 1102 and charging stations 1439. The total is given as 31,793, a number of the dealers keeping garages or repair shops, etc., so that the total does not tally with the sum of dealers, repair shops, supply dealers and charging stations. The distribution of these establishments throughout the various States is shown in the tabulation on page 306. The same authority gives the total number of manufacturers of automobiles, motor trucks and motors as 512. This total does not tally with the 230 manufacturers of automobiles, 267 truck makers and sixty-one motor builders because many of the automobile manufacturers build trucks as well. The distribution by States is given in the table on page 307, twenty-nine States and the District of Columbia being represented.

In the tabulation at the bottom of page 305 are given the total registrations, including non-resident registrations and number of cars re-registered owing to transfer of ownership, etc. In the tabulation on the opening page these duplicate registrations have been deducted, leaving the statistics for each State as accurate as it is possible to make them under the recording system at present in use in most of the States. Very few of the States have registration systems permitting them to give complete information relative to the number of cars of various types, such as gasoline passenger and commercial, electric passenger and commercial, etc. In fact, the majority are able to give but one figure, which is the total number of automobiles and motor trucks in use in the State, irrespective of methods of propulsion.

Nine States Have New Laws

Nine States have new automobile laws passed during 1915, these being California, Delaware, Florida, Michigan, Nebraska, New Jersey, Oklahoma, Tennessee and Washington. Perennial registration still reigns in the District of Columbia and Utah, while Texas has both local and perennial registration. Only one State, South Carolina, now has purely local registration, Louisiana having joined the majority with State registration during 1915. Triennial registration, or registration every three years, is still found in Minnesota. The general tendency in automobile legislation may be characterized as toward sane and reasonable measures, as contrasted with previous years when freak bills were much more numerous.



Vesta Electro-Mechanical Clutch Details

Described in THE AUTOMOBILE *for Jan. 27.*

At the left is the clutch complete, the automatic controller being illustrated at the right

Below, at left and right, is the flywheel-armature with internal commutator, and, in the center, the fields carrying the brush holders

Trend and Possibilities of Automobile Design*

An Analysis of Designs Seen at the Shows—Future of Two Stroke and Crude Oil Motors

By A. Ludlow Clayden and L. V. Spencer

THE effect upon the French trade of dropping their exhibition as an annual affair, in going three years or more without it, was to let French automobile design drop back, allowing England to take the lead. Perhaps it was not an effect, but merely the two things happened simultaneously, but however this may be, there is absolutely no doubt that the quality of French engineering improved a great deal within two years of the resumption of annual shows.

In America we are liable to think that all engineering that matters can be seen in Detroit, that the Detroit engineer has no need to go to New York or to Chicago, because he knows it all beforehand; but *does he?* There are two good reasons for believing that he does not. One is that Detroit, important though it is, is still not absolutely everything in the automobile world, although it forms the larger part; and the second reason, which is far the more important, is that even a Detroit engineer has no opportunity to get a true perspective of progress unless he sees his own car and his competitor's alongside. It is possible to see any number of things one or two at a time and never get a clear view until all of them are seen together. So while it *is* possible to study most of the cars that matter, right here in Detroit, it is impossible properly to appraise them unless they be gathered in groups of hundreds together.

Shows in America

The American show as a spectacle loses greatly on account of the lack of buildings with a single large spread of floor. It is much less impressive at first glance than either the British or French show. Of course, the latter is housed in one of the finest buildings in the whole world, such a building as Chicago and New York ought to possess and no doubt will some day; but it is not fair to blame the building on the exhibition.

Taking, therefore, the stands in detail, the American arrangement is very good indeed. The decoration is much less costly than the uniform schemes used in Paris, and usually the British exhibitor with his individual decoration and equipment spends far more. There is one advantage in the British system, this being that the wealthy manufacturers are able to emphasize their prominence in the industry by using a really fine stand, and the less important firms appear as such. Here the small maker seems to obtain too much prominence. One might sum this up by saying that individual-stand decoration and the division into space sections in accordance with earnings, as used this year, do not seem to be completely effective.

From the merchandising viewpoint the American show leads by an immense distance. It is far easier to obtain information about an exhibit here than in England or France, and though there are plenty of inefficient salesmen to be found on the stands, they are a minority instead of being a 99-per-cent majority. Combine the Parisian grand palace, the individual-stand decorations of London, and use American salesmen, and one would have the ideal show from the spectacular and merchandising viewpoints.

As an engineering display, there is nothing to choose between America and France, but the palm goes to England, *solely for the reason that the Olympia show is the most thoroughly representative.* In London there appear all the British cars, all the French and Italian cars that are of any importance, and quite a number of American cars. At Olympia the cars of all nations are on view.

Leaving all consideration of price on one side, American automobile engineering has reached a high pitch of development as compared with the rest of the world, so in offering criticism it is with the idea that by being dissatisfied with what we have it may be improved still more. A state of perfect contentment with the automobiles of 1916 is greatly to be desired on the part of the user, but it would be most unwise on the part of the engineer. We are not going to be at the end of passenger car chassis development within ten years, nor within fifty.

During the past year we have seen a situation unparalleled in the history of the industry, because we have been trying both to increase the volumetric efficiency of engines while simultaneously trying to cheapen them. This attempt has been successful almost entirely by reason of greatly improved design. Positive figures are lacking, but it is safe to say that never before have so many completely new engines been designed in a single year.

The Ideal Size of Cylinder

It is very tempting to examine the motors of the cars at the 1916 shows and to argue therefrom that the idea of limited individual cylinder capacity has been vindicated. The idea that the eight, the twelve and the six, to say nothing of the four, have each their proper place in the sphere of things, assuming that there is a best individual cylinder size, is well borne out by the shows; but a true critic must not trust his own judgment and must not be tempted to allow appearances to sway his judgment. Thus, trying to eliminate prejudice in favor of a cherished idea, it seems that the cylinder question must wait a year or two before it is settled.

One thing is without doubt, and this is that the much better performance of the average six is due to the coming of the eight and twelve. The six-cylinder engine, as seen on show chassis, is much neater, much more compact and distinctly better finished than was the average six of 1915, and the performance on the road and the speedway of the 1916 sixes shows that this appearance is not misleading. Mr. Howard Coffin said on board the Noronic this last summer that he thought the coming of the V-motor would force American manufacturers to produce some *good* sixes, and certainly they have done it. Are we at the end of development along this line? It is easy to say no and almost equally

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*Extracts from a paper to be presented at the meeting of the Detroit Section, Society of Automobile Engineers, February 16, 1916.

as easy to say yes; but he would be a bold man that would dare to stake his fortune one way or the other.

It was only when the twelve was evolved that the cylinder question could reach its limit. There is nothing to be gained in theory, in going beyond this number, unless we turn to rotating cylinder engines of the Gnome type, so now at last we have all possible sorts of cylinder arrangement before us, from four to twelve. For the first time the cylinder question can be left to the public to work out for themselves, and how they will do it no man knows. The engineer seeks certain qualities of performance and he knows he can get them by different means with different sorts of engine. It is for the individual to choose his means, to choose what qualities he will sacrifice in order to gain other qualities. It has come to a game of give-and-take, with all the cards on the table.

Importance of Condition

Now, while there is nothing more satisfactory than the small-cylinder four in a little car, it is absolutely essential that it be kept in good trim, or the power falls off woefully, and in the same ratio an eight or twelve with minute cylinders will need to have its valves maintained in proper adjustment, to have every detail kept in proper condition.

Much has been written about accessibility and much more been talked during the past year, but however necessary it may be to maintain, from a sales point of view, that eights and twelves are easy to keep in good tune, an engineer cannot blink the fact that an L-head engine of V-formation is horribly inaccessible as compared with a vertical-cylinder engine of the same standard of engineering. The main factor in keeping the little cylinder at good efficiency is maintenance of proper tappet-adjustment. The average owner of an automobile, whether in this country or any other, is not capable of adjusting the ordinary kind of tappet with a set screw and lock nut. The smaller these parts and the smaller the valves, the more difficult does the adjusting process become. On a vertical engine where the valve stems are quite clear, the average man cannot tackle them, on a V-engine his case is infinitely worse. Thus there is reason to believe that the success of the small eight and of the small twelve is largely bound up with the possibility of improving their ease of adjustment.

In an overhead-valve engine with valve adjustment on the rocker fulcrums it is possible to adjust the tappets while the engine is running, and the job can be done quickly and easily by the least skilled, once the method has been explained, and it can be explained easily in writing without demonstration. There are many pros and cons for the valve-in-head construction, but if so facile an adjustment can be provided for this type of engine, why not for the L-head variety? We have held to the old-fashioned methods too long, so valve mechanism, especially as regards adjustability, may be written down as one of the problems of automobile-engine design that remain to be overcome.

Lubrication Could Be Improved

Another part of engine design that is imperfect is lubrication, though this is being improved by slow degrees. Signs are not wanting that a proper proportioning of the oil supply to the pressures prevailing in the engine at the moment is a growing ideal, and its general adoption cannot fail to bring about a considerable oil-economy together with a decrease in the rapidity of carbonization. In this connection it may be questioned whether the most advantageous feature of the aluminum-alloy piston will not ultimately be found to be the ability to make it long without greatly increased weight. This matter of long or short pistons, of the long piston as a preventive of overlubrication of cylinders, versus the short piston with other means for keeping down the oil, must be thrashed out this year. This year we have got to do our utmost to evolve some standard pistons, for the modern methods for making pistons would be facilitated enormously by the creation of a half dozen standard sizes. The problem is difficult, but it is not nearly as difficult as many others the S. A. E. has tackled successfully.

Troubles of Thermo-Syphon Circulation

Turning to the cooling system of the engine, we see syphonic circulation,—or, more correctly, convection cooling—growing in favor, but study of the cars at the shows discloses the fact that the pump has often been discarded without proper appreciation of the conditions under which a convection system of cooling works. In a system of this sort we have always the hot water at the top, and the cold at the bottom, and if the cylinders are situated at a level with the middle of the radiator they will have approximately the same temperature as the middle of the radiator; in other words, the part of the radiator below the level of the cylinder jackets is useful only as a water tank and has little value as a radiator. With convection cooling a high radiator and a low-placed motor are essentials for success unless a great deal more water is carried than is really necessary. Another much-neglected point is the necessity for providing a good head of water at the top of the radiator. As soon as enough water has evaporated to uncover the outlet pipe from the cylinders at the point where it enters the radiator, circulation theoretically ceases. Practically, it does not cease for some time longer, because the water around the valves boils vigorously and the steam thus formed throws the water into the radiator by a splashing action like a kettle boiling over through the spout. Modern ideas of beauty make it difficult to provide a water container at the top of the radiator that is at least 4 or 5 in. deep, and 4 or 5 in. of water are essential if a convection system is to be really satisfactory.

Aluminum and High Temperature

A review of this kind would be incomplete without some mention of the aluminum engine, but so much has been written concerning it that there is no need for lengthy recapitulation. Its future seems to be entirely bound up with the price of aluminum. Let aluminum come down to under 20 cents a pound, and its cost would be little greater than that of cast iron, when the greater ease of machining is considered. There are a few optimistic spirits who think it is only a matter of finding the correct alloys to be able to use an aluminum cylinder and piston without an iron liner, but whether this be so there seems little doubt that the aluminum cylinder is going to make it easier to keep the small multi-cylinder engine in good order. When dealing with high pressures and temperatures, such as prevail in engines with a large power-size ratio, nine-tenths of the trouble is due to heat. Now, the parts from which we want to remove heat with the greatest possible rapidity are the valves and the pistons. The success of the aluminum piston in racing is explained by the fact that its head keeps cooler than that of an iron or steel piston. The walls of the aluminum piston may be actually hotter, but the better conductivity enables the *maximum* temperature at any part of the engine to be kept within bounds. So with the aluminum cylinder, the temperature of the water should be the same as with iron castings, but the difference in temperature of the parts exposed to greatest heat, which are the valve ports, and the parts best cooled, will be smaller. In other words, the aluminum cylinder ought to allow us to use a high efficiency engine with a smaller liability for trouble.

Aluminum may possibly develop some defects after long use as a cylinder material. We may find that it deteriorates with prolonged heating, but experiments have been made for long enough now to make this doubt a very small matter. Cheap aluminum is all we ask to enable us to save weight and increase efficiency without increasing liability to trouble.

There are plenty of other points about engines outside the number of cylinders they may possess. Foremost in impression after looking at a show is the number of detachable cylinder-heads, and this seems a step forward from two viewpoints. First, as befits the engineer, the theoretical may be mentioned, and this is that it is easier to cool the spark plugs properly when they screw straight into the waterjacket than when they are attached to uncooled valve-caps, and the elimination of valve-caps ought to increase slightly the volumetric efficiency of the engine.

Secondly, as befits the commercially minded, the detachable head is a simply prodigious advantage to the owner who wants to grind his valves or scrape his cylinders and pistons. In nearly every case half this advantage is thrown away by making the detachable head in one piece. To lift a single-piece head off a good-sized six needs some effort, and it is a clumsy thing to handle when it is off; whereas, if it is divided into two portions, either is readily handled. Also, the amateur is none too skilled in making gas-tight joints, and the larger the single gasket, the more likely is he to go wrong.

Having due regard to the fact that the forming of carbon deposit is the chief trouble from which the owner suffers, it seems wise to make a feature of the easiest possible means for opening up the combustion space of the cylinder, and this is a point of design that has hardly been touched. Even where a divided detachable-head is used the number of nuts to be unscrewed is excessive, and there surely ought to be some easier way of securely attaching a loose head-piece than by nuts and studs.

Manifestly a dog piece with a single screw, like a tappet retainer, is not practicable, since it calls for too great a rigidity on the headpiece itself, but there are two unexploited alternatives. Could not the nuts and studs be replaced by cams operated by a small lever, or probably still more simple, could not a system be devised whereby the driving in or out of a few small wedges with a hammer would suffice to secure or to release the head? The day has come when the owner's convenience in this sort of way is more worth studying than any other new thing that offers.

Broad Trends in Motor Design

One thing stands out prominently above all others, and this is that all automobile development has been toward smaller cylinders and higher speeds. To this development there must be a limit, as to all other things, and it is difficult to see when we have reached it and when we have passed it. To-day, taking a very broad average of the whole world, it certainly appears that the 3 to 3.25-in. bore and the 4.5 to 6-in. stroke were the economical limits. That a compression of about 75 lb. gage was a happy mean, that a horsepower peak at about 2000 ft. per minute piston speed was the all-round best thing. Leave every factor alone, and one might venture to say that these things positively are correct, but we cannot tell what will happen to bring in another factor.

For example, during the year the number of cars with overhead valves has decreased, but this may easily be misleading when endeavoring to estimate the trend in valve construction. Those that have gone have mostly been old designs, old types that were not so good as the modern. Simultaneously we see several new overhead designs produced that are infinitely superior to the old types. The latter have not yet had time to make their influence felt; it will take a couple of years more for them to establish themselves or to fade away, and so the trend figures again must be examined with care.

Will Concealed Parts Increase?

A point worthy of consideration and of debate is how much further the inclosure of accessories is going to be carried. Block cast, integral cylinders and crankcase as universal practice in automobile engineering seems a certain development, especially if we get the aluminum cylinder as conventional design. The better cooling now generally provided, again to be assisted by aluminum cylinders, will draw us back again toward the integral exhaust manifold, as it has made conventional the integral intake passage. The bell housing is destined to become universal, unless trends are altogether wrong up to date, and control mechanism of all sorts is being steadily unified into some sort of assembly that is complete in itself. One may ask whether we shall borrow further from the Italian school of automobile engineering, and inclose the electrical apparatus, as is done on the Fergus car, or whether the housing for the steering gears will become integral with the crankcase? There is, however, one detail of the engine that may possibly be separated from the unit of which it is now usually a part, and this is the oil pump. As temperatures in the combustion chamber are increased, the necessity for cooling the lubricant increases. Cold oil is vastly more efficient than hot oil, as has been demonstrated beyond question. In the Stutz racing engine the oil pump is a separate assembly and the whole pump is exposed where it obtains the advantage of the air current.

New Transmissions Important

While interest centers mainly upon the engine, it must not be forgotten that there are other parts of the chassis equally worthy of consideration. That the present form of gearbox and clutch will change but little in the next few years is almost certain; it is as certain as anything can be in so rapidly expanding a branch of engineering; but electric transmission is not to be dismissed with a scornful smile.

To-day the gas-electric system is in the same state of infancy that the internal-combustion engine was in 1900. There are a few enthusiasts who believe in it, and they may be just as correct in their belief as was the similar small band who believed in the motor car sixteen years ago. In 1912 there were many good engineers who thought we had developed the automobile nearly to the limit, and how wrong they were time has shown. The electric transmission enables us to get rid of the need for providing the amount of excess power necessary to give the high-gear performance now considered necessary. It allows the minimum speed of the gasoline motor to be several hundred revolutions per minute higher, so easing the carburetion problem, and it allows higher average gearing to be used with a large engine, or a smaller engine with the same gearing we have to-day.

Faults of Brakes and Steering

However, to leave the visionary and return to the very practical, there are two things in which the average car of 1916 is lacking, and two important things—first, the brakes, and, second, the steering. While engineers of all countries have been devoting their time and study to making the automobile go forward, few of them have given much attention to the equally important matter of keeping it under proper control. The car of 1916 is much faster than the car of 1904, yet it is practically no easier to steer or stop.

In designing brakes, the mathematics of the question ought to be considered, and then should be followed by proper tests of brake-surface materials, of details of shoe design, and so on. A brake ought to act smoothly and quietly, and without more than 20 lb. of pressure on the pedal. It ought to remain in perfect condition for at least 10,000 miles of driving, and when adjustment is needed it ought to be made by turning a single thumb-nut. It is possible to make brakes like this, but it is not easy, because so very little is known about the fundamentals of the subject.

Furthermore, it is fundamentally wrong to put all braking restraint on the rear wheels, and since the theory of front wheel-brakes is not too generally understood, it may be permitted to explain this briefly.

When a brake is applied the car as a whole tries to turn around on the axle; so applying a rear-wheel brake puts on a torque which is resisted by the pressure of the front wheels on the ground, they forming the other end of the lever. If the adhesion of the rear wheels is insufficient, so that one of them locks, that wheel is instantly useless for steering, and if the second locks the whole axle cannot be steered.

With front-wheel brakes the tendency of the application is to lift the whole car, so throwing more weight on the front axle and so pressing the wheels harder against the ground, which reduces the liability to lock the wheel, since the adhesion is increased. But—and here comes the whole difficulty—if front-wheel brakes should be applied with sufficient force to lock the wheels, all steering power is lost, and the fact that the two rear wheels are still rolling freely does not help in the least. Thus in theory the ideal arrangement is to link the brakes diagonally; to have a brake on each wheel with the right-hand front interconnected with the left-hand rear and the left front to the right rear wheel. Then apply the brake however fiercely on either axle and there is at least one wheel that is rolling free and able to control the course of the car. Repeated tests both on models and on full-size cars have shown this diagonal system to vindicate the theory completely, the only trouble being in the mechanical layout of the connections for applying brakes in this way. As may be imagined, the linkage is somewhat complicated, and it remains still for some clever engineer to find a way out.

Steering Should Have Castor Action

Steering is faulty on the average car, because it requires too much effort. There is too much power lost in friction; and it also is inefficient because of absence of true castor action. The mathematics of castor steering are not complicated, but they admit plenty of room for discussion. While the front wheel with a central pivot, raked a little fore and aft, is the ideal, there are other ways of obtaining a similar effect; and it only needs to drive a car with perfect steering to appreciate what an enormous amount of additional pleasure it gives.

Few Cars Are Comfortable

Turning to quite the other end of the matter, another point that impressed most strongly at the show was the extremely small number of cars in which the seating was truly comfortable—that is, comfortable for an individual of normal stature. The number of cars in which an average-sized driver can sit at the wheel in an easy attitude when wearing a thick coat is almost to be reckoned on the fingers of two hands. There is a strong tendency to crowd the front seat right up against the cowl board and to stretch out the tonneau till the rear-seat passenger needs a megaphone if he is to be able to speak to anyone in the forward compartment. There has been a great wave of endeavor to make the body better looking from the outside; now it is time to turn to a rearrangement of the interior. That this is commencing is obvious. The cloverleaf body is the logical swing back of the pendulum from the "ballroom" style of tonneau, and it seems likely that the ultimate result will be a happy mean between the two. There were two cloverleaf bodies in New York that were comfortable for four people—and *only* two.

The Question of Wheels

To-day in Europe the wire wheel or the pressed steel wheel is the rule, wood wheels are the other thing, mainly because Europe has not got the right sort of wood. But the introduction of aluminum or celluloid disks to attach to *wire* wheels has led to the adoption of these disks for attachment to pressed-steel wheels also. A wire wheel is hard to clean even though it is mechanically superior to any other kind, and these disks make it into the easiest wheel to clean of any; so it looks just now as though disk wheels would become common in Europe. A disk wheel has many good points in its favor. It is simple to make and can be made very strong, while it can also be cheap to construct. Against it is the popular idea of what a wheel ought to be. Fashion has been conquered so many times that it counts for very little now; so the disk wheel, as a strong, simple and cheap idea, ought to be worth investigating. Probably the wire wheel by virtue of its mechanical excellence is going to be the ruling thing; but whether the disks are the true wheel or merely a wire wheel cover, their advantage when it comes to cleaning is well worthy of consideration.

Springs in Evolution

Another matter of design that seems to be in a doubtful state is that of springs. A year ago we heard all sorts of absurd claims made for the cantilever, rebutted by equally absurd arguments against it. To-day we see all sorts of springs giving just about the same service. The type of spring used on the Marmon and the Moline shows that there is still a possibility of new ideas in spring suspension, so this stands out as one of the things in which uncertainty still obtains. In the Fergus car, shown at New York, we see yet another spring idea that has waited for years to bring forth and is yet the simplest of common sense when you see it. Why not inclose a spring so as to keep it in its original condition of efficiency instead of leaving it open to the attacks of water and grit, which steadily reduce its efficiency, beginning from the first day the car goes on the road? Argued from this viewpoint, you might as well make a transmission with exposed gears as Levassor did for the Panhard company eighteen years ago.

Some Unexploited Possibilities

The subject upon which this paper is based is too large to do more than touch upon at present, but there are a few things beyond the little details already mentioned that are worthy of the engineer's occasional consideration. One possibility almost untouched is the two-stroke engine. The two-stroke seems a rational development, and yet it does not come. To many of us it is an everlasting puzzle to give the reason.

Those idle strokes in a four-stroke engine are poor engineering. It is poor science from the heat-engine theoretical viewpoint. So too is the unscavenged exhaust. The idea of leaving a third of the burnt gas in the cylinder to contaminate the fresh charge is bad from the ideal viewpoint. Yet in twenty years of trial nothing has been done that seems likely to exercise a great effect on automobile engines. There has been no special difficulty in the development of the two-stroke Diesel engine, and the four-stroke Diesel at least does scavenge properly, but the basic principle of the engines that drive the automobiles of 1916 is unimproved from that in use in 1896. If one sits down and ponders this point, the conclusion that we have not done all we might have done is inevitable.

Now, this has little enough to do with the automobiles at the shows, and yet it has everything to do with them, because the reason for mentioning it is that the automobile engines of 1916—the better examples, that is—seem to be very near the limit of efficiency that can be reached by the road we have followed for twenty years. The best engines now made could not be smoother in action, they could not be *much* less trouble to look after, they could not be *much* more durable or *much* more reliable. There are only two criticisms that can be leveled against them, and these are: (1) They could be lighter in proportion to their power; (2) They certainly could have a much higher fuel efficiency.

The second count is divisible into two sections. The present-day engine could utilize a cheaper fuel. If we have reached the limit of smoothness in operation, if we are near the limit in volumetric or in weight efficiency that is commercially possible, are we not also on the edge of what is possible with the carbureter as we know it?

It is easy to argue about reasons for the high price of gasoline, but whether it be due to a real shortage of supply or caused by financial manipulation of the market, the fact remains that we could run our cars much more cheaply if they would burn a heavy grade of kerosene. We have developed the really marvelous automatic carbureters of the day by lavish expenditure, and not a thousandth part of the money has been given to trying to find out how to use heavy oil in small engines. The automobile engine has been developed at such a wonderful pace largely because its fuel was comparatively easy to convert into gas; but we have done next to nothing to develop engines that will use fuels not readily gasified, to develop carbureters or similar devices for making gas from heavy oil. There seems no reason why the problem should be any more difficult of solution than many others automobile engineers have attacked and overcome in the past ten years. Is it not a worthy subject for study and experiment?

Conceive the immense selling argument for a car that would perform as well as those we know to-day and would do it on fuel at a quarter the price, or less, with a practically inexhaustible supply from which to draw. It must be worth while spending millions to achieve the end, and it is impossible to bring forward any fundamental reason why it should not be done.

Maintenance Costs Too High

The greatest point in which the present-day automobile fails in its purpose is that of maintenance cost. It is cheap enough to buy, but it is woefully costly to maintain. In obtaining the high gearability now demanded, the thermal efficiency of the machine as such has been neglected utterly. It was impressive to anyone on the lookout for sales arguments that hardly a stand attendant or salesman had a word to say on the running cost of his car. Nobody seems to be making this a strong point, yet it must be the most important point of all, ultimately.

We are well within sight of the time when the annual model idea will end. It is quite needless, it is wasteful in many ways, and so many manufacturers have broken away from the habit of changing their chassis at a stated time each year that the fiction of yearly series cannot be maintained much longer. Let a manufacturer introduce a new model as often as he likes, by all means; let him produce a new chassis as soon as he finds he can improve substantially upon the old one; but do not force him to make a new car at a fixed date. The novelty idea is almost dead as a sales argument. Cylindricity is ceasing to excite the buyer—this was particularly noticeable at the shows—and some new strong point is needed. Of the choice that offers, low maintenance cost seems to be the greatest, and in working toward this goal engineers will find they have their hands full for a lifetime.

In reducing maintenance cost there are two chief things for which to work, one the reduction of weight, and the other the reduction of frictional loss in transmission. On the weight-reduction scheme we are well started, and shortage of material is going to assist greatly in this direction. On frictional resistance hardly a beginning has been made. Excellent ball bearings and excellent roller bearings are bought and their efficiency thrown away by improper mounting or by careless assembly, and few of use ever pause to consider that a huge amount of power thus runs to waste every day. As a show attraction, it seems there should be a good opportunity to arrange a car in some way that will enable the pressure needed to start it moving to be demonstrated, something after the way in which one car at the 1915 show was exhibited on a scale which showed its actual weight.

The Ideal Car

In conclusion, though progress has been so rapid, we are still a long way from finality. Analyze the requirements of the 1916 buyer. He may not be able to sum up his ideals, but they seem capable of expression in the manner following.

The ideal car should have two pedals and a steering wheel. When power is wanted for starting, for speed, or for hill-climbing, press the power pedal; when it is desired to stop, press the retarding pedal.

At all speeds there should be *no* vibration and *no* sound.

Over all roads the car should roll without shock at any speed.

Its operation and maintenance should require no mechanical knowledge.

It should cost little to buy, and less to run.

If that is truly the ideal, are we not indeed a very long way from satisfying it utterly?

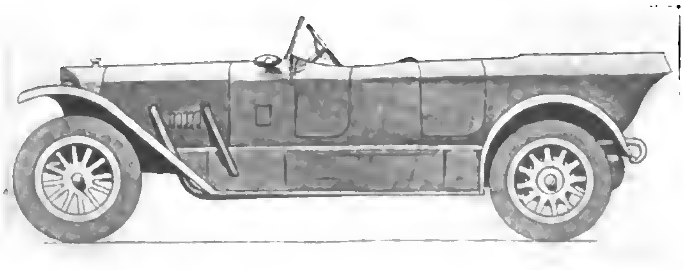
The automobile of the type we know is a wonderfully perfect machine, like the typewriter or the telephone; but like both it is marvelously imperfect, in that it is an immense distance away from what the human mind is capable of desiring it to be.

Government Issues Bulletin on CO Gas

RECENT cases of sickness and death due to carbon monoxide poisoning in mines and in garages has led the Department of the Interior, Bureau of Mines, to publish a pamphlet under the name of Bulletin 74, covering the subject of gasoline locomotives in relation to safety and health.

Important conclusions are reached in this booklet illustrating the relation of proper carbureter adjustment to the amount of carbon monoxide produced, and it has been shown in examining mine engines that the unskilled or careless motorman may use fuel enough to produce noxious gases and obtain about the same power as a skillful motorman obtains from a smaller quantity burned to a much smaller volume of comparatively innocuous gases. To illustrate this fact, a four-cylinder engine 5½ by 5 was made to develop full power at full rated speed and the amount of fuel was increased from 0.74 lb. to 1/18 lb. per brake horsepower hour. The amount of each of the noxious constituents, carbon dioxide and carbon monoxide, of the resulting exhaust gases of each of the several fuel rates, was accurately determined and the CO constituent varied from 2 cu. ft. at 0.74 lb. of fuel per brake horsepower hour to 9.5 cu. ft. at 1.18 lb. of gasoline per brake horsepower hour. The CO_2 constituent ranged from 6.8 cu. ft. at 0.74 lb. of gasoline per brake horsepower hour down to 3.5 cu. ft. at 1/18 lb. of gasoline per brake horsepower hour.

In giving the causes for the formation of carbon monoxide, which is the agent which causes the poisoning as well as suffocation, the bulletin states: "Carbon monoxide is the result of incomplete combustion of fuel. The combustion is affected by the relative quantities of air and gasoline, the completeness of vaporization, and of mixing due to the carbureter and manifold design, the degree to which the exhaust gas is mixed with fresh gas, the degree of compression, the timing of the ignition and speed of the engine, the adjustment of valves, temperature of jackets, lubrication, method of speed control, quality of fuel and probably other variables."



An example of recent German bodywork culled from a Benz advertisement in a German newspaper of a few months back

A Lancia staff officer's car passing troops on one of the mountain roads in Italy

Belgians Build Huge Repair Depot

Factory 2700 by 1800 Ft. Erected and All Belgian Cars Collected For Overhaul and Reconstruction

By W. F. Bradley,

Representative of THE AUTOMOBILE *in Paris*

WITH all but a few square miles of her territory in the hands of the enemy, with all her automobile factories held by the Germans, with her Government established in Allied country, with half her population scattered, it is evident that the task of reorganizing the Belgian army is one that might cause the strongest men to quail. The fact that Belgium has not given up the fight, that she still declines to admit she is beaten, and that she has been and is still preparing to wage war on the invader, is the most heroic feature of the great world conflict.

The automobile section of the Belgian army is the one presenting probably greater difficulties than any other. There are no factories behind the service, and in consequence no more cars can be built and no more spares obtained for the automobiles still in a condition to be repaired. When any other of the warring nations approaches the automobile repair problem they have buildings, machinery, trained staffs and material at their disposal. Belgium has nothing.

Belgians Organize Repair Service

I have just been given an opportunity of seeing how, out of nothing, Belgium has got together an automobile repair service equal to that of any of her Allies or enemies. At a certain French seaport a big plot of ground was turned over to the automobile repair department. On this barren grass land overlooking the sea all the Belgian automobiles which had been abandoned in various parts of the country were brought in on freight trains. When I visited the ground there were two thousand of them, classified according to make, neatly lined up in the muddy field, battered and scarred and scorched and riddled by months of warfare and neglect.

When Belgium was invaded, every kind of automobile was thrown into military service. High-grade Minervas and Pipes and Savas, with bodies by Van den Plas and other artists, were made to carry muddied troopers, wounded men, raw meat, loaves of bread, barbed wire, horseshoes, anything and everything that an army can need in the field. When the cars broke down under the rough work and tremendous strain to which they were subjected, they were abandoned in farmyard or garage, by the roadside or in the ditch. With the reorganization period they were collected, brought to this nameless seaport in France, and entrusted to the repair staff.

Everything on wheels was brought along and made to take its place in the long lines of mechanical derelicts. Under a body which had been splintered by shell, scorched by the sun and rotted by the rain there might be a first class chassis ready for further service after a minimum of labor. Others were down and out. On the edge of the field I noticed an Overland, or what had once been an Overland. For wheels there were a few spokes, one half the rear axle had gone, the frame members were twisted and buckled, two cylinders were missing in the literal, and not the sense usually given to that word; the radiator had ceased to exist—the whole car was junk such as you never saw lying on the junk heap at home.

On that barren plateau overlooking the sea, Belgian soldiers had built huge all wood repair shops. The main building measures 600 by 900 yd., probably the biggest repair department under one roof the world has ever seen. No civilian, whatever his position or influence, was allowed to get within hailing distance of that building unless accompanied by a military officer.

Transport of Derelicts Difficult

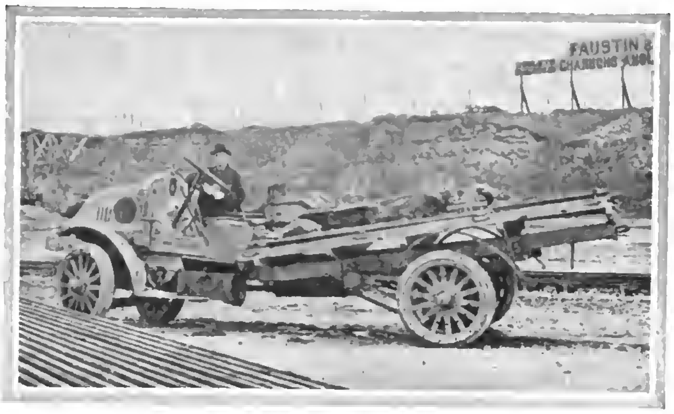
For automobiles to reach those buildings was not an easy task, for no roads existed. At the time of my visit American trucks, most of them 3-ton Kelly-Springfields, were hauling loads of stones from the beach about a mile away, dumping them on the roads which had been mapped out, while gangs of men broke them to suitable size, rolled them in and created a solid road.

Electric power and light had been obtained from the adjoining town. America, France and England had furnished the necessary tools and machinery. Belgium alone provided the labor. While the repair department was housed under one huge roof, the building was divided into bays, each one under a distinct staff and devoted to the repair of one particular type of automobile or truck. Thus, one section dealt with motor bicycles only; another built a standard type of ambulance body and fitted it to a certain make of chassis; another section handled nothing but American trucks; further on only Minerva cars were received and doctored.

American Truck Repairs Easy

The repair of American trucks constituted the least difficult of the many tasks the depot had to undertake, for sufficient spares have been ordered from the American factories and are available by the making out of a requisition form on the stores department. For the benefit of this service, special spare parts lists have been got out for each make of truck; every part has its description in French and carries a number, ordering from the stores being done by number only.

There is not the same simplicity about the repair of Belgian cars, for no factory can be called upon for spares. However, many of the engineers of the leading Belgian factories are available and under their directions most of the commonly required parts for the leading makes of cars are now manufactured.



How a Kelly-Springfield looked after a 60-ton load dropped on it

Engineers Take Charge

The staff is military, but the officers have the assistance of engineers from the home factories. Thus, the highest civilian authority in the shops is an engineer who before the war occupied an important position in the Pipe factory at Brussels. One of the greatest difficulties the Belgian authorities have had to contend with in their reorganization scheme is that of securing adequate skilled labor. Expert mechanics are not going about Europe with their hands in their pockets at the present time. Men not eligible for military service can earn higher wages than at any time in the history of the engineering industry, while those who are under the direction of the army authorities are not allowed to waste their efforts. Belgium has never had the same stringent compulsory military service as France and Germany, very few of her married men even now being obliged to serve in the army. Thus, when the country was invaded, the workers in the engineering trades who escaped to France and to England found plenty of work awaiting them, and are employed at the present time in the factories of these two countries.

The staffs are made up of young mechanics still

Pierce-Arrow traveling repair shop

Getting an Isotta-Fraschini tractor out of a gully on the Italian front

A Lancia standing by an overturned Fiat on the Italian front. The Fiat eventually was raised to the road by a repair crew and, after undergoing a few repairs, was returned to service

eligible for military duty, of engineers and mechanics who volunteered for active service when war broke out and have since been drafted into the army repair department, and of old men for whom the active army has no further service. Even these men, if they are of real value, can only be got by competition with the English and French shops, and as these shops were the first to enlist the skilled refugees it is not an easy matter to get them transferred.

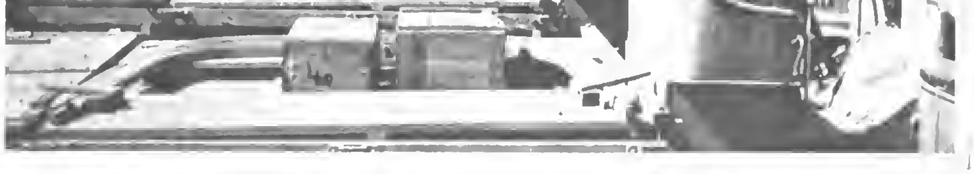
It has been necessary, also, to deal with the younger men of military age, but with no technical experience, who would prefer to be in the workshops rather than in the line regiments. Many of these used whatever influence they possessed to have themselves posted as skilled mechanics, but a few minutes in the shops was sufficient to show that they had everything to learn about mechanics and automobiles. Restrictions have had to be imposed to keep out these young men whose knowledge is based on imagination. A considerable amount of dilution of skilled labor has had to be adopted, a skilled foreman being put in charge of each department, and each skilled mechanic having two or three unskilled or semi-skilled men working under him.

With the completion of her central automobile repair depot the Belgian government will be able to relieve those French and English automobile factories which have for months past been occupied on Belgian repair work. The factories can thus devote all their energies to material for their own armies. The centralization, too, simplifies shipping and control, it being an easier matter to send damaged cars into one central depot within easy reach of the Belgian lines, than to distribute them among a series of automobile factories in various parts of two countries.

Pierce Trucks Make Traveling Shops

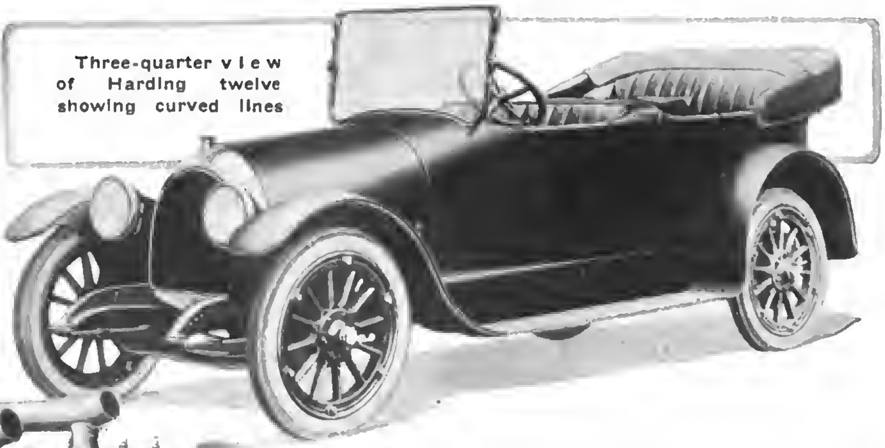
By the British army numbers of the Pierce 4-ton trucks have been fitted as traveling workshops for the convoys to which they are attached. No change is made in the chassis, which is fitted with a platform body with permanent top and a separate cab over the driver's seat. One half of each side and rear hinges down so as to extend the floor space and the other half hinges up. Waterproof curtains are fitted to the extension top and can be lowered so as to prevent rain and sun beating in. Each repair shop is regularly fitted with a Douglas two-cylinder opposed motor direct connected to an electric generator. The machinery consists of an electrically driven screw cutting lathe, a heavy electric grinder, an electric overhead drill, a small foot-power speed drill, a substantial work bench, also flexible connections for portable drills, electric light sockets, etc. The usual plan is to supply one of these repair shops to a fleet of forty to forty-five trucks.

Several are working in this way with the anti-aircraft brigades scattered along the British front in France and Belgium. These brigades comprise heavily armored cars equipped with a new type of machine gun.



A batch of Kelly-Springfields at a depot in France. Note how bodies are knocked down for shipment

Harding Body Design Distinctive



Three-quarter view of Harding twelve showing curved lines

Side view of Harding twelve motor showing removable heads and the light and starting units

THE latest automobile announcement from Cleveland is the Harding twelve, made by the Harding Motor Car Co. This car is rendered distinctive by its foreign body design. Instead of the straight lines of the streamline type, curves have been used, blending into each other from the radiator through the hood, cowl and body to the rear. The car has a wheelbase of 132 in. and the body a comfortable seating capacity for seven.

The Harding motor is of the twin-six type. Cylinders are cast in two blocks of six each, and mounted on separate crank case at an angle of 60 deg. The cylinder heads are removable. The motor is 2¾ by 5, of the L-head type. A single camshaft with twenty-four integral cams is used. Lubrication is by the pressure system.

1916 Empire Four Now Lists at $935

THE Empire Automobile Co., Indianapolis, Ind., has made a few changes in its four-cylinder car. Known as model 45, it differs from the preceding model especially in its wheelbase, which has been lengthened 4 in. to 116 in., and also in its price, which has been increased from $895 to $935. Another change of importance is the adoption of semi-elliptic rear springs in place of three-quarter elliptics. A new brake arrangement has also been incorporated. There are two sets of brakes, internal expanding and external contracting, operating through an equalizer system. The hand brake is attached to the equalizer by flexible steel cable. The foot brake rod is in two pieces, the first section connecting the pedal to a lever on center cross member with another rod from this lever to the equalizer. By this construction the use of countershaft is made unnecessary and brake rod rattle is eliminated.

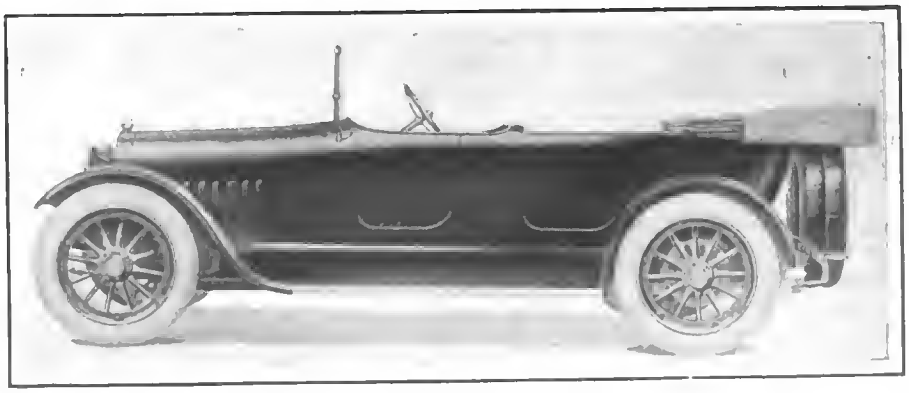
The rear drive is of Hotchkiss type, drive being taken through the springs. The rear axle is Weston-Mott full-floating single bearing type. Drive shafts are chrome nickel steel, 1¾ in. in diameter and propeller shafts 1⅝ in. in diameter. Hyatt high-duty bearings are fitted throughout.

The gasoline tank of the new model has been enlarged to carry 17 gal. as against 14 in the preceding model. The streamline body conforms very closely with the Empire Six. Exceptional leg room in both driving compartment and tonneau is a feature. The front seat is 38 in. wide and rear seat is 47 in. The cushioned seats are upholstered in Spanish leather. The doors are full U-type, 21 in. wide with concealed hinges and handles.

The standard body color is autumn brown with wheels and running gear to match. In addition to this any desired color is furnished upon order.

The equipment is complete in every detail. In addition to the two-unit starting and lighting system, there is a Willard three-cell six-volt storage battery, and a one-man top covered with DuPont Rayntite material. A tire pump is furnished at extra charge.

In addition to the foregoing equipment headlights with powerful searchlights for country driving, tail and tonneau lights, rain vision, ventilating windshield, Stewart speedometer, dash carbureter adjustment, etc., are furnished.



Side view of Empire Model 45 showing streamline body

Weight Eliminated in Peerless Eight

Unit Power Plant with 90-Degree V-Motor Gives Compact Layout—Reducing Lever Arrangement on Clutch Pedal Gives Easy Throw-Out

IN making the radical change of policy noted in the Peerless line for 1916, the engineers of this company claim that they have produced an eight-cylinder car which has performance qualities equal to the six-cylinder 60-hp. car that was a feature of the line for several years. At the same time the mileage per gallon of gasoline has been doubled and the tire cost is claimed to be but one-third of what it was for this former model.

These two results, greater economy and better performance, mean that there must have been developments along the main line of engineering improvement in motor and chassis design, *i.e.*, lightness. With this thought in mind the Peerless car becomes an interesting engineering study, because it shows the results obtained by a concern which has been building cars since 1902, or fourteen years, with a design of car that is markedly different from previous models yet which, after all, is founded on the experience gained in that time.

The group of drawings shown on this and the next two pages illustrates the model 56 Peerless. The power plant, which is a V-design, has two groups of four cylinders mounted at 90 deg. between the axial planes of the two sets of cylinders. The dimensions of the power plant are 3¼ by 5 in. and the rating is 33.8 hp. The Peerless company claims a horsepower output of 80 at 2700 r.p.m.

Staggered Cylinders Used

The two sets of cylinders which are each cast complete are offset to a sufficient degree to permit of a side-by-side connecting rod mounting on the crankshaft. This arrangement is shown clearly in the part longitudinal section of the motor. As will be noted, the lower connecting rod bearings are independent, and can be adjusted separately if desired. The bearing pressures with this arrangement will not be excessively high, as the comparatively small cylinders will not give an abnormal thrust due to explosion pressure. The main bearings are three in number and are quite long. The bearing bridge supports are hung from the upper part of the crankcase and are of web structure, giving light weight with stiffness and providing a cored passage for the lubricating system.

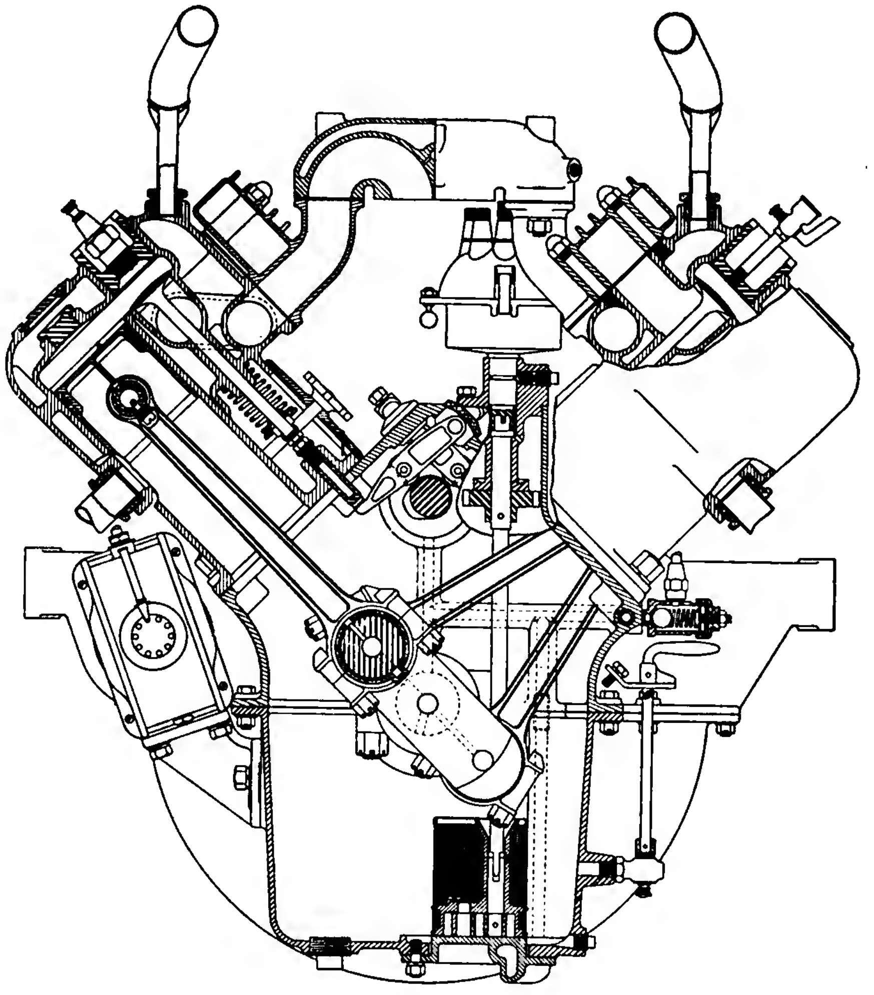
I-beam section connecting rods are used with two-bolt lower ends. The bearings are bronze-backed at the lower end and at the wrist pins the rods operate on phosphor-bronze bushings.

Three bearings are used to support the single camshaft which is located at the upper extremity of the crankcase on the longitudinal center line. There are sixteen cams on the shaft and the valves are operated by finger lifters with roller cam followers. The finger is pinned at one end and has the lifter end at the other extremity, the roller follower being in the center, so that the cam action is approximately multiplied by two, through the finger-lever lifter arrangement. The contour of the cam shows that the valves are given a quick opening, although the cam is not square enough to produce follower hammering. The contour of the cam can be noted in the transverse motor section.

The valves are located in the V, or in inside position, as is natural with the single camshaft arrangement. The individual cylinders are L-head, and the customary arrangement of the standard L-head type has been followed through as far as possible, consistent with eight-cylinder design. Valve stem clearance adjustments are made by lifting a cover plate after removing wheel nuts in the inside of the V.

Oiling System Is Full Pressure

Full force-feed lubrication is employed to carry the oil to all the bearings of the crankshaft and camshaft. Oil is drawn through a cylindrical screen at the lowest point of the crankcase. The oil pump is located in the base of the crankcase and consists of two bronze gears driven from the camshaft. Oil is discharged from the pump into a cored passage which leads to a distributing tube in the upper part of the crankcase, and from the tube independent leads run



Part transverse section through the Peerless eight-cylinder motor for 1916 to each of the bearings, sufficient oil being forced to take care of all the bearing surfaces. The remaining oil passes through the regulating valve which is illustrated in the longitudinal motor section and passes to the timing gear case. Its function here is to lubricate the gears and gear bearings, and, in addition, there is a marked cooling effect on the oil due to its contact with the extended gear case. The passage for the oil to the crankpins is by way of the drilled crankshaft, and after lubricating gears and bearings, the oil returns to the crankcase, where it is strained and recirculated.

A feature of the motor is the ample waterjacket space, and this will be noted over the heads of the cylinders, a point which is sometimes slighted in the endeavor to reduce height and secure compactness. The circulating medium for the water is a double water pump system, which insures equal distribution of the water to both cylinder blocks. Air is drawn through the flat-tube radiator by a six-blade fan and a special provision for free air discharge is made by having ample space between the motor and the sod pan. Cooling ribs are cast on the exterior of the exhaust manifold to cut down the temperature of the metal.

An interesting feature is the mounting of the tire pump which is on a continuation of the fan shaft. The fan shaft is continued back and terminates in a lever-operated clutch which controls the engagement of the single-cylinder, vertical air-cooled pump mounted between the blocks of cylinders in the V. The fan is driven by a train of spur gears which form part of the timing assembly group mounted in the casing at the front end of the motor.

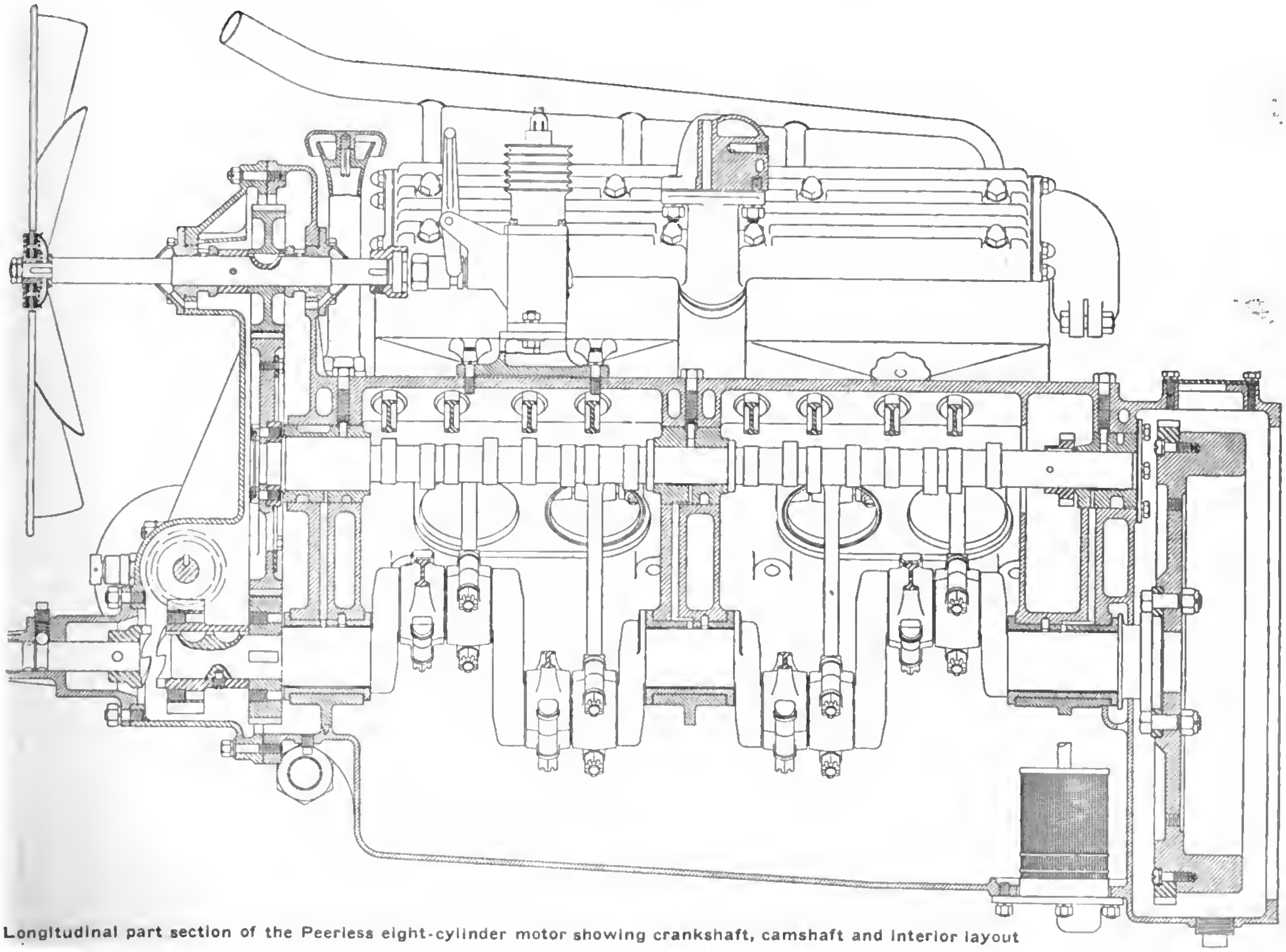
Clutch Has Light Action

In carrying out the general scheme of lightness and compactness, a special study has been made of the clutch and gearset. These parts form, with the motor, a unit powerplant. The clutch part of the unit is a dry multiple disk, faced with fabric on alternate disks. Easy but firm engagement is secured by a double concentric coil spring with a tension control nut for adjustment. The clutch is a small unit and is contained in a housing which is inclosed within the flywheel. When the clutch is disengaged the clutchshaft rests on an aligning ball bearing in the center of the flywheel. Very small pressure is needed to release the clutch, owing to the use of the multiplying levers shown very clearly in the illustration of the pedal assembly.

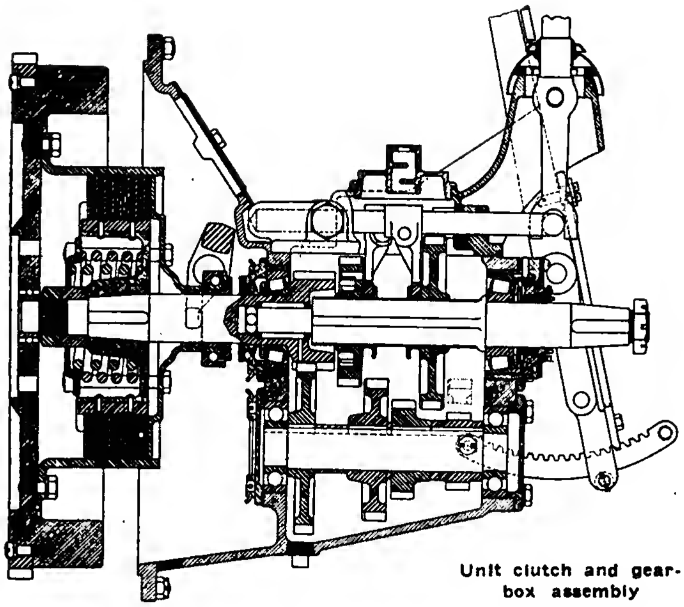
Behind the clutch, in the same housing, is the three-speed gearset which has the main shaft carried on roller bearings and the secondary shaft on annular ball bearings. A feature which is worthy of favorable comment is the mounting of the shifter lever which instead of being in the exact center of the gearbox coverplate, is mounted at the rear end. This brings the shifter lever closer to the driver's seat and aids in making the car comfortable to drive. The shifter lever is connected at the bottom with a ball rocker mechanism through which the shifts are made. The emergency lever is mounted to the side of the shifter lever. Over the center of the gearbox is an oil hole which is fitted with a breather.

Final drive is through a roller-bearing mounted spiral bevel-drive rear axle of floating design. The shaft is tubular and is equipped with two universal joints. The type of drive is the Hotchkiss, as both torque and propulsion thrusts are taken through the rear springs. The brakes are double concentric working upon a single drum.

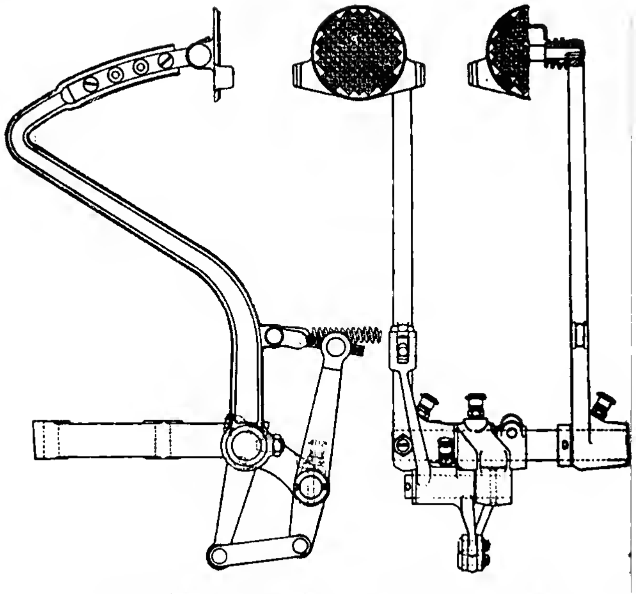
The specifications for the standard car give the wheelbase as 125 in. and the wheel size as 34 by 4 in. The tires fitted, are the oversize 35 by 4½ in. straight side cord type. The standard touring car sells for $1,890.



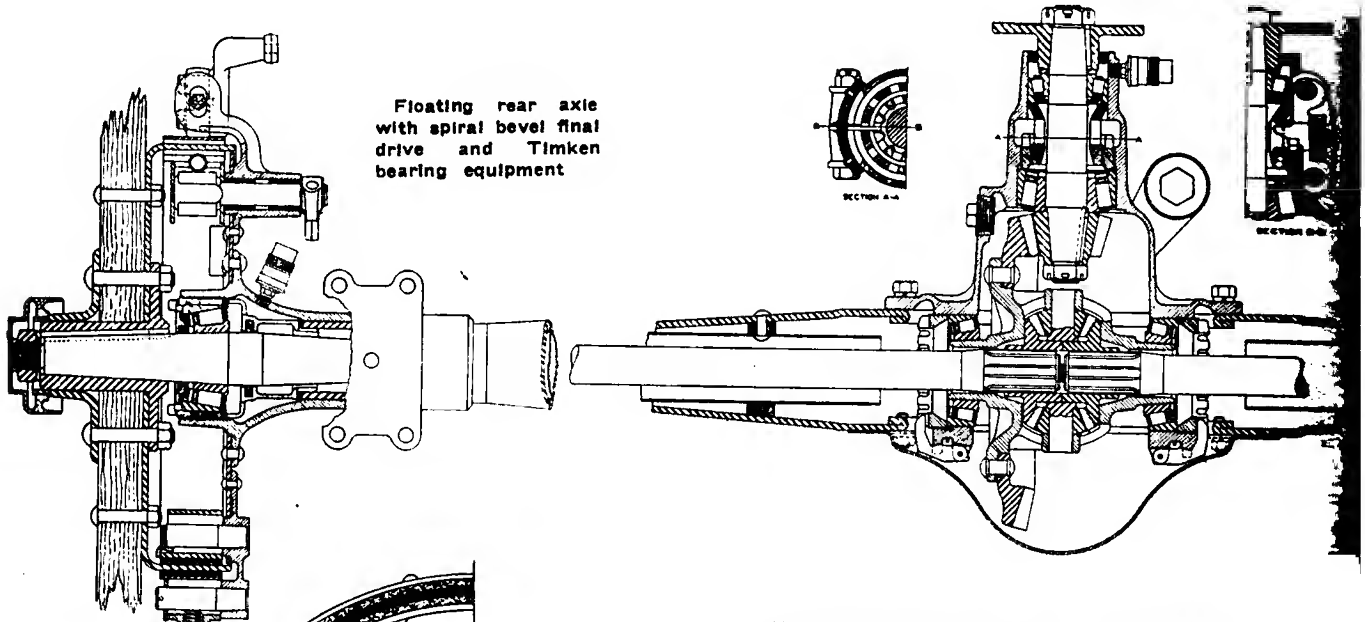
Longitudinal part section of the Peerless eight-cylinder motor showing crankshaft, camshaft and interior layout



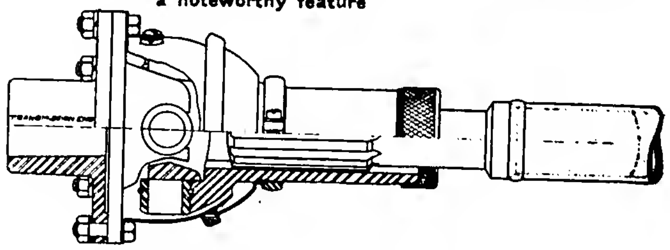
Unit clutch and gearbox assembly



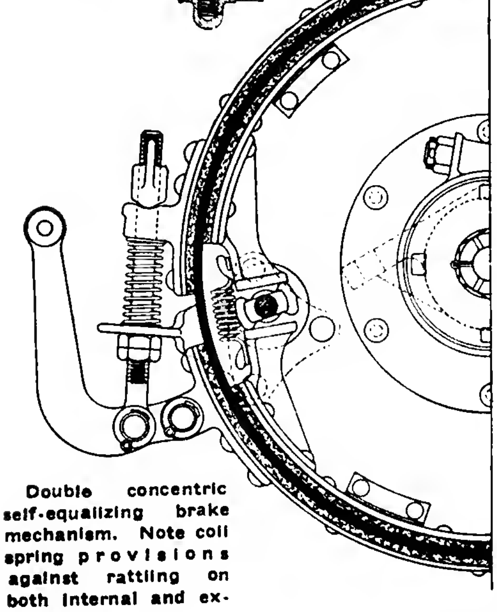
Pedal shaft and pedal construction, showing multiplying levers



Floating rear axle with spiral bevel final drive and Timken bearing equipment



Universal joint construction on the Peerless eight. The neat housing inclosing the joint is a noteworthy feature



Double concentric self-equalizing brake mechanism. Note coil spring provisions against rattling on both internal and external brakes

TRANSMISSION DETAILS OF PEERLESS EIGHT

The FORVM

CONDEMNS BODY DESIGN AND CONSTRUCTION—SUGGESTS OTHER IMPORTANT DIMENSIONS—CONSIDERS SUBJECT OF GREATEST IMPORTANCE

Modern Body "Tin and Imitation Hair"

By Finley R. Porter

I HAVE read the article on the subject of "driver's comfort" in THE AUTOMOBILE for Feb. 3 with interest, and my greatest criticism of it is that the cars are numbered instead of mentioning names.

There has never been any one thing in the automobile business, to my notion, that has caused so much expense, dissatisfaction, and has had more to do with the so-called public demand, than this topic of "driver's comfort." I think too, that the word "comfort" should be displaced by "possible operation," since comfort is not in the question at all. Neither does the ability of the different designers enter into it because they all know better, but the main governing factor is price.

This whole subject is to my mind a clear illustration of the fact that you cannot build an automobile for $1.50. What can be done and is being done, is the assembling of the frames with radiator, wheels and axles together with a little tin, imitation hair and leather commonly termed a body, which one can—by resorting to the numerous contortions mentioned by Mr. Schipper—manage to have it propel itself from one place to another, but so far as calling it an automobile and expecting any degree of comfort, I think it is absurd.

All of the magnetic transmissions, electric gearshifts 4½ to 1 gear ratios, and the general feeling that the public cannot be educated to shift gears are the result of this very thing.

The answer does not lie in adding up the different deformities and dividing them by the number of cars built, since the users range in size from the midget to the giant, and anything attempted as a universal fit is just as ridiculous as it would be for a clothing establishment to try to sell one size suit of clothing to all.

As long as the public are satisfied to expect something like this and pay about $1.50 for a dollar's worth, I think it would be wasted effort even to argue about the matter with the idea of getting the people to try and strike a happy medium.

What I think should be done if anything, is to compile a set of figures for the different measurements that would produce driving comfort and easy operation, that would be in a given proportion to actual measurements from an individual taken as an example. These measurements would of course vary with different individuals, but would remain in a constant proportion, so that any man knowing his own measurements could easily eliminate a great many cars from the list of possible purchases by comparing the actual measurements to the different cars if they were published.

Comfort Partly Imaginary

In the case of a man having his own body built, he most always gets a fit to suit himself, but in a great many instances he doesn't know what is needed, but finally accustoms himself to the body he gets and as a rule firmly believes he is realizing extreme comfort while in a great many instances he is about as far from it as it is possible to get, but the fact cannot be charged up to the designer. There is scarcely any possible way of having adjustments to fit the different individuals because any one measurement is about as vital as another.

Some of Mr. Schipper's deductions such as the added life of the car due to perfect operation are very true, and if the public could only be educated to the point that by paying an additional hundred dollars for their car and having it fit them, a material saving would be had, and they would probably see a great improvement so far as comfort in operation goes. The impossibility however of such procedure seems almost certain, in view of the fact that the tremendous productions coming from some of the factories would cost practically twice as much if the cars were made to somewhere near fit the individuals using them.

Left Drive a Fallacy

The question of getting in and out of the left hand drive cars is one of the many things that make me wonder why they still feel they should have the left hand drives. It is the most impossible of all the changes that have come about in the past few years when considered from the points of advantage claimed for it. It is of course just as easy to make a car drive from the left as the right if the only object is to change the position of the driver, but so far as any real advantages that are being claimed and stuffed down the public's throat, my contention is that there is absolutely nothing to it so far as the operator is concerned.

My belief is that to discuss the subject, the car that is under consideration should be named and attention called to the discrepancies found and ask the manufacturer to defend himself. I imagine this line of procedure would produce replies from the people concerned that would have the little incident of Washington and the hatchet discounted.

Pierce Body Dimensions Carefully Chosen

By D. Fergusson,

Chief Engineer, Pierce-Arrow Motor Car Co.

MR. J. E. SCHIPPER'S article in your issue for Feb. 3 deals with a very important subject and is one, as the author stated, that has been given very little consideration by automobile manufacturers. We ourselves have endeavored to give as comfortable a position as is possible, without curtailing the room behind the driver's seat. We are inclosing a sketch showing the room for the driver and the front passenger in our standard touring car. You will notice these conform fairly closely to Mr. Schipper's ideas, with the exception of the distance from the underside of the steering wheel to the top of the cushion. We feel that Mr.

Schipper is wrong in asking for as much room as he does in this location, as we find that our allowance is ample.

It must be remembered that the cushion is quite soft and that the driver sinks into it an inch or more when in position, thus giving one or more inches over that which we give. For the low position that some few drivers desire, an entirely different arrangement of seat is necessary. We are only giving you our standard touring car dimensions.

Suggests Another Dimension

By W. G. Wall

(Chief Engineer National Motor Vehicle Co.)

IN regard to Mr. Schipper's article about driver's discomfort, would say we realize this is a very important subject and that it has not been given the attention it should. At the same time the public do not seem to understand that there is a limit to these dimensions; for instance: the standard tread of rear wheels limits the width of rear seat cushion unless the seat is made very high, and the length of wheel base limits the distance from the back edge of rear door to the front of cowl, this distance having to be divided up into the hood length, the front room for driver and the width of rear door and of course all manufacturers are anxious to keep the wheel base as short as they can get results; whereas an owner wants a car at as low a price as he can get it, one which is very light, has a short turning radius, and in fact everything pertaining to a short wheelbase, whereas he wants the comfort of a long wheelbase.

I do not quite agree with Mr. Schipper, however, in some of the dimensions which he takes as the most important ones. While some of these are the important ones, he does not give the most important. The most important dimension we consider is the one from the back of front seat to the foot pedals. The distance from the front of the front seat to the foot pedals does not give what is wanted, as the depth of front seat might be anywhere from 18 in. to 24 in. Also the distance of the levers should be given from the back of front seat.

Another dimension we think is important is the distance from the back edge of rear door to the back of the front seat. The door itself may be very wide, but if part of it overlaps the front seat, as a great many do, the entering distance would be very narrow.

There is a great difference, however, in what drivers consider comfort. Some think they should sit up high to be comfortable, and others think to sit low is the most comfortable position. Personally the writer would say that something between these two extremes is preferable.

Also the distance that the seat should be set back varies so much with the height of the driver and the length of his legs that we have found the only feasible way was to make the driver's seat adjustable, and even that only remedies part of the trouble.

We think the points Mr. Schipper brings out are very good and are certainly worth regarding by the manufacturer, but, as before stated, there is absolutely no way of securing all that is desired for different drivers without making several of the parts adjustable, which is not always either practical or possible.

Battery Mountings Should Be Accessible

Rigidity Now Generally Secured, but Ease of Access Means Prolonged Life on Average Car

WITH each succeeding year making the battery more the keynote of happiness as far as car ownership and drivership is concerned, the development of accessibility in locating this important unit is assuming a great importance. It must be conceded that the battery is not an ornament, therefore it must be out of sight. It must also be conceded that it is a utility whose efficiency is maintained by attention and therefore it must be located where it can be reached with the least delay. The two circumstances are not at all incompatible and the page of examples shown here are all good, although it must be admitted that some are better than others from the accessibility standpoint.

The designer must remember in laying out car parts that the car, for most people, is an implement of entertainment. It is occupied largely in a spirit of relaxation. Any work that has to be done on it is considered at least by a large percentage of owners, among whom the tired business man is strongly represented, as a great nuisance. Since the work itself is a nuisance, the lifting of seat cushions which are held within quite narrow limits by the steering column and the performing of other similar tasks will often promote a spirit of procrastination that keeps the hydrometer and the bottle of distilled water on the shelf instead of in the hands of the owner.

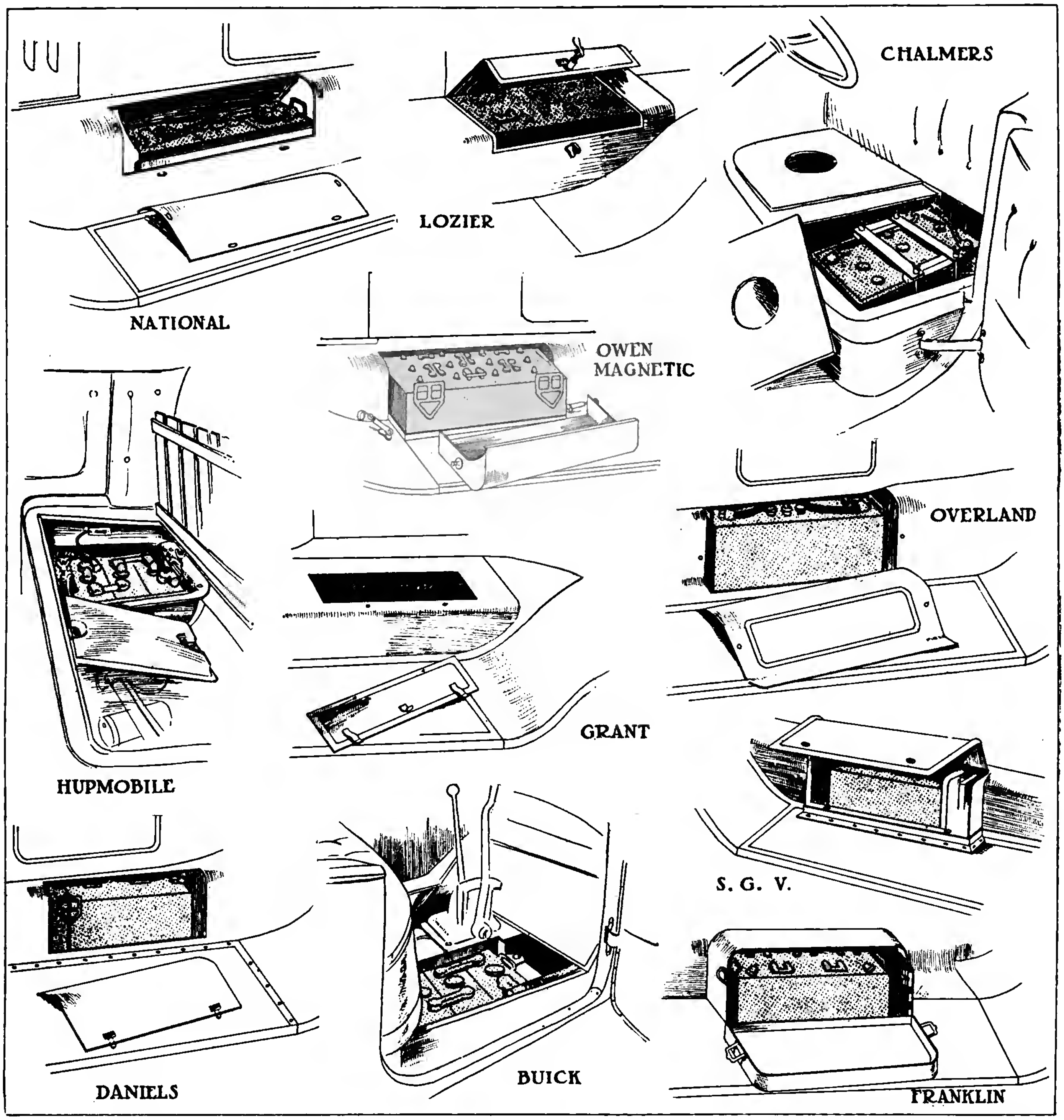
Importance of Detail Care

It has been said that the average American takes his pleasures sadly. If this is a national psychological characteristic, and if the automobile be reckoned among the pleasures, then it behooves the designer to remove as much of the sadness as is possible by turning the searchlight on the little details which help to make the car a comfort. In fact, they cease to be little details if thought is directed to what the results of inaccessibility are. In the case of the battery, the life can be lengthened 100 per cent by careful attention. On the other hand the amount of attention can be reduced immeasurably by having the battery in a place where it is out of reach. The difference in convenience is quite apt to mean the step from satisfaction to the opposite with the electrical service on the car.

Battery makers direct that distilled water should be added to the cells every thirty days. With an inconvenient battery location this will often be stretched to double the time solely on account of the owner's neglect. When the battery plates have gone bad and an adjustment is demanded, the owner will not always be accurate regarding the amount of care that he has spent upon the battery. On the contrary, the fact that he has dug two or three times into the depths of his car and filled the battery will be so impressed upon his mind that he will think he has been over-zealous rather than careless in doing his share toward battery maintenance. If the battery is so located that it can be reached without disturbing any part of the car besides the coverplate, it will be attended to much more frequently.

Mistakes were made quite frequently during the last two years on insufficient rigidity in battery mounting, but that time has about past and the examples of where the battery is apt to shake loose on rough roads are quite scarce. It may be mentioned in passing, though, that there are still a few examples of where the rigidity feature can be given somewhat better attention. The method which has been used with success by many is to employ a metal strap very much like the strap used on magneto mountings. This is fastened by taking up on a nut which pulls the strap tightly over the battery. At the same time the accessibility question as regards removing the battery for repairs is not overlooked. In securing the rigidity it must not be done at the expense of making it a great task to remove the battery from the car.

Miscellaneous 1916 Battery Mountings



Accessibility Made a Study to Promote Care of Battery

THE battery mountings shown above are representative of the practice on 1916 cars. It will be noted that these are a considerable improvement over the methods used in 1912 when it often took as long as 15 min. before the driver could get into such a position that he was even able to see the battery. The filling of the cells with distilled water was often neglected in the older cars simply because it was a difficult task to get to the battery without encountering greasy parts which would destroy any clothing that was not intended to be worn in the workshop.

The installations above show that the subject of accessibility has been made a careful study and the results have been well worth while. The battery is kept out of sight and at the same time it is in such a position that the driver can reach it readily. One of the important considerations in placing the battery is that the wiring is well protected.

The Rostrum

Aluminum Pistons Reduce Inertia Forces

EDITOR THE AUTOMOBILE:—I have a model 79 Overland touring car and am thinking of equipping the motor with aluminum alloy pistons.

1—In general, would you advise this change?

2—Would it materially reduce vibration at the higher car speed, say 25 to 45 m.p.h.?

3—What clearance should the pistons have?

4—Should oilways be provided?

5—Do the wristpins need any particular attention due to the higher thermal capacity of the alloy piston?

6—Will carbon form on alloy pistons as readily as on cast-iron pistons?

7—What compression should the above motor have when in first-class condition?

Massina, N. Y. L. O. V.

—In general aluminum pistons materially reduce the vibration in a four-cylinder motor, especially at the high engine speed.

2—It would be within the speed range you mention that the effect would be noticed.

3—Clearances should be approximately twice those of the present iron piston.

4—Yes.

5—It is possible that the wristpin should be fitted a little more tightly when cold.

6—Provided there is not excessive lubrication the carbon deposits should be less.

7—The model 79 Overland motor when in good condition should show 65 lb. compression on gage.

Tests Must Be Made in Laboratory

Editor THE AUTOMOBILE:—Is there an accurate instrument made for testing water in a radiator to which denatured alcohol has been added to ascertain at what temperature it will freeze? If so, please describe it and how it works.

Washington, D. C. H. M. B.

—This is a straight laboratory test. The devices used are simply a container for the mixture and a thermometer. The temperature is reduced by means of a refrigerating machine until the mixture begins to freeze, when the reading on the thermometer is taken. Hydrometer readings when the mixture is correct give a key to evaporation losses.

Four-Wheel Drive Not for Passenger Cars

Editor THE AUTOMOBILE:—Why do not passenger automobiles use the four-wheel drive and what are its disadvantages?

2—Would it be practical to use a fan on a snow sledge for the main drive? Would there be any loss through slippage?

3—How many miles does an aeroplane go on a gallon of gasoline? B. J.

Wolverton, Minn.

—The purpose of the four-wheel drive is to secure traction at both the front and rear ends of the car. Naturally it is going to call for somewhat more complicated mechanism than the two-wheel drive, where traction is only secured at the rear. Since in the passenger automobile it is desired to keep the vehicle as light as possible, the four-wheel drive would hardly be used; while for heavy trucking work, especially in difficult country, it might be very desirable.

2—It would only be possible to use a fan on a snow sledge for the main drive if the sledge were extremely light and worked over the surface of the snow and not through it. The loss in any case through slippage is enormous, as it is in any form of aerial propeller work.

3—This varies through such an enormous degree with the different types of machine that it is impossible to give you any answer. There are some machines which do not travel over two or three miles to the gallon and others which travel fifteen or twenty. The distance traveled also will vary with the wind, whether the machine is climbing or descending, and a great variety of other disturbing elements.

Fastest Mile Ever Made on Motorcycle

Editor THE AUTOMOBILE:—Reading over your magazine inquiry of C. E. G., Charlottesville, Va., in the Rostrum, dated Dec. 16, 1915, about the fastest mile ever traveled on a motorcycle, I believe the famous Curtiss mile, to my knowledge, is the fastest mile ever made on a motorcycle.

This was an eight-cylinder, 40 hp. Curtiss motorcycle, driven a mile in 26 2/5 sec., by G. H. Curtiss at Ormond Beach, Jan. 23, 1907. FRANK H. LUMPE.

Del Monte, Cal.

Cadillac Eight-Cylinder Firing Order

Editor THE AUTOMOBILE:—How does a Cadillac eight fire?

2—What is meant by 3.750 to 1 and 4.00 to 1 ratio?

3—Can an Overland 80 model go 18 to 20 m.p.h. on first speed?

4—What is the speed of an Overland 80 engine?

5—What is the speed of a Hupp 32 engine?

Camden, W. Va. J. C. C.

—The order of firing of the Cadillac eight is as follows: First No. 1 cylinder on the right, then No. 4 on the left, No. 3 right, No. 2 left, No. 4 right, No. 1 left, No. 2 right, No. 3 left.

2—These ratios indicate that the crankshaft rotates respectively 3¾ and 4 revolutions to 1 revolution of the rear wheels.

3—Yes.

4-5—These speeds depend altogether on the condition of the motor, and vary to such a degree that THE AUTOMOBILE cannot give such figures. The maximum speeds, however, are probably close to 2500 r.p.m.

No Official Ford Consumption Record

Editor THE AUTOMOBILE:—What is the best official record of m.p.g. of gasoline for a Ford car?

2—With what carbureter was this made?

3—Was the claim of 44 miles per gallon of gasoline for a Ford, made by the manufacturer in Detroit recently of an auxiliary air button, substantiated?

4—Why cannot a good modern automatic carbureter give as many miles per gallon without the use of any separate auxiliary air device?

5—With the proper heating of the mixture will a Ford motor run properly and satisfactorily on kerosene, having at first been started on gasoline?

6—It is claimed that the motor will overheat and that the running on a kerosene mixture is otherwise detrimental to the motor. Is this true?

7—Does heating of the gasoline before it enters the carbureter facilitate better combustion—this in addition to taking in heated air? C. C. W.

Huntington, N. Y.

—THE AUTOMOBILE has no knowledge of any official records of gasoline consumption with a Ford car.

2—The standard Ford cars are equipped with Holley and Kingston carbureters, and an average of 20 miles per gallon should be obtained if the carbureter is properly adjusted. It is not uncommon to secure from 25 to 30 miles per gallon on fine adjustments.

3—There is no record of any sanctioned trial by recognized officials on a test of this kind.

4—No doubt the same results could be obtained with any dash control carbureter.

5—Yes, provided proper vaporization is maintained.

6—No.

7—The heated air method is probably more satisfactory without the heated gasoline except after it reaches the carbureter. Care must be taken in pre-heating the fuel not to rarefy the charge.

Cadillac Horsepower Curves Are Similar

Editor THE AUTOMOBILE:—Kindly give me the power curves of the 1915 and 1916 Cadillac eights? H. W. F.

Burlington, Vt.

—The horsepower curves for the 1915 and 1916 Cadillac eights are similar. The curve is shown in Fig. 1. It was incorrectly given in THE AUTOMOBILE of Feb. 10.

Heat Required as an Aid to Carburetion

Editor THE AUTOMOBILE:—Would like to obtain information regarding the adjusting of a Schebler model L carbureter.

2—Would this make of carbureter, being water-jacketed, work better than one which was not a water-jacketed carbureter? R. C. G.

Monroe City, Ind.

—With the present grade of gasoline the more heat that can be applied to the fuel the better results are obtained. It is recommended that you use an exhaust sleeve or drum around the exhaust manifold and flexible tubing running to the air bend of the carbureter. Heat applied at this point gives the best result.

2—Where the carbureter has a hot water jacket it is advisable to tap the exhaust and run a pipe from the exhaust to the jacket of the carbureter. In this way the exhaust heat will warm the carbureter jacket, or, if it is convenient, the hot water can be piped to the carbureter jacket. It is easier, however, to utilize the exhaust heat. With the present grade of fuel it is very necessary to heat the carbureter in the region of the primary nozzle, and it is especially essential that the low speed air be warmed.

Reduction Equals Ratio of Gear Teeth

Editor THE AUTOMOBILE:—Kindly enlighten me how to figure gear ratio of a drive pinion of an auto with twelve teeth and a ring gear with forty-three. As I understand, the answer is 3.58.

Also show me how to figure the gear ratio of a transmission that has twenty-six teeth on the countershaft and twenty-one on the sliding shaft or drive shaft; on the intermediate gear on the low there are twenty teeth on the countershaft and twenty-seven teeth on the sliding gear.

Also inform me how to figure cubic inch displacement of a motor 3⅝ by 4½. I have seen these examples worked in algebra and that is something I know nothing about. Is there any other way to figure it? T. A. E.

San Francisco, Cal.

—The method of figuring the ratio of a train of two or more gears is to take each number of gears that mesh and divide the number of teeth in the driven gear into the number of teeth in the driving gear.

The gear reduction of the whole train is the product of all the ratios of the intermediate gears.

Piston displacement can be easily calculated by arithmetic without the use of algebra. Simply multiply the diameter of the cylinder by itself, then multiply by 0.7854 and multiply again by the length of the stroke. This will give the piston displacement for one cylinder. For the whole engine simply multiply by the number of cylinders.

In the motor you give, the piston displacement would be calculated by the following example: 3⅝ x 3⅝ x 0.7854 x 4½ x the number of cylinders, which you do not mention.

If it is a four-cylinder engine the displacement is 185.8.

Tractive Power Formula Explained

Editor THE AUTOMOBILE:—In the issue of Dec. 16 there appeared this formula for determining tractive power:

$$VC = \frac{8.4 \times n \times b^2 \times S \times R}{D \times W} \times em \times et$$

Where *em* is the efficiency of the motor as compared with the S.A.E. rating as unity, I would like to have this term explained. H. S. J.

Mill Valley, Cal.

The formula given above may be divided into three parts, the fraction, the term *em* and the term *et*. In the fraction it is first presumed that all motors will develop a torque in pounds at 1-in. radius equivalent to that of their N.A.C.C. horsepower rating, assuming that the mean effective cylinder pressure is 90 lb. per square inch, and the piston speed at 1000 ft. per minute. The term *em* gives the correction for any particular car. The average value of *et* × *em* for a large number of cases tried figured out to be 0.95. A more complete discussion of the question may be had by referring to the S.A.E. Bulletin for July, 1915.

Bad Mixture Causes Motor Cough

Editor THE AUTOMOBILE:—I have noticed sort of a coughing sound coming from the exhaust of a Ford motor. It sometimes seems to be between explosions. It is sometimes irregular and sometimes regular. What is the cause of this?

2—What will cause a light irregular knocking or tapping

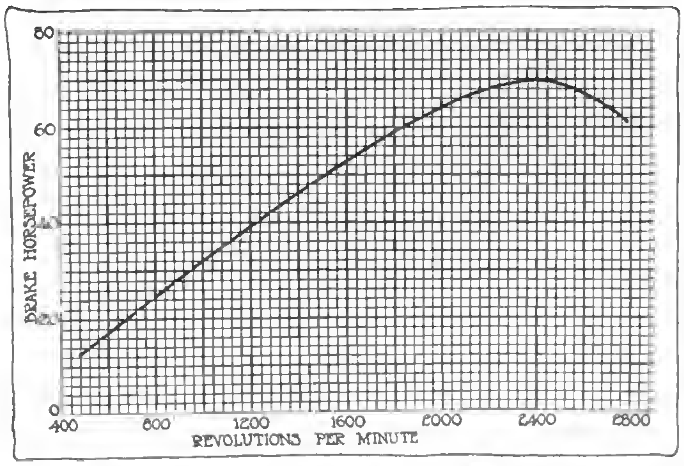


Fig. 1—Horsepower curve for 1915 and 1916 Cadillac eight motors

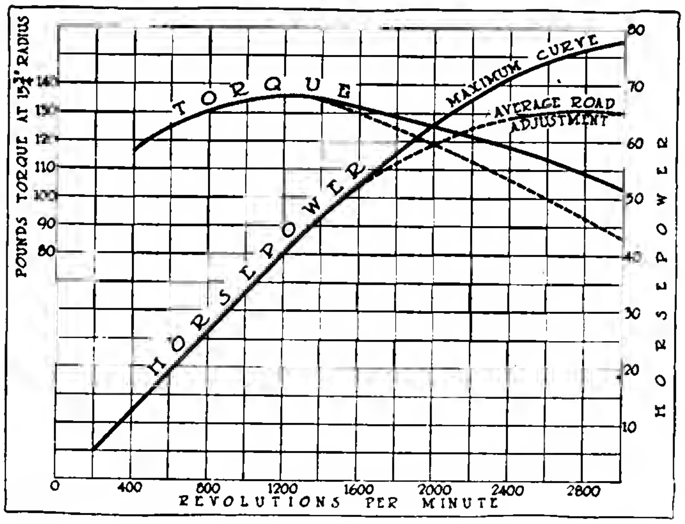


Fig. 2—Horsepower and torque curves of twelve-cylinder National

sound in a Ford engine? The noise is only evident when the engine is well warmed up with the spark in correct position and free from carbon. It is not very noticeable on hard pulls. H. & S.

Brownell, Kan.

—The coughing sound is due to an improper mixture, either too much or too little gasoline being supplied.

2—It is difficult to give the cause of a knock from the information you supply. The trouble, however, may be the result of a valve slap caused by too great clearance between the pushrod and valve stem. It can be remedied by replacing these parts. The cause also may be a loose wristpin.

Horsepower Curve of Twelve Motor

Editor THE AUTOMOBILE:—Will you kindly send me the horsepower curve for one of the following twelve-cylinder engines: Weidely, Enger or National?

Sandusky, O. L. D. D.

—The horsepower curves of the Weidely and Enger twelve-cylinder motors are not available. That of the National twelve-cylinder is given in Fig. 2.

Valve Clearance Set on Closed Valves

Editor THE AUTOMOBILE:—In setting the clearance of valve lifters on a 14-38 Packard can the valves of more than one cylinder be set at one time or do you set them one, two, three and so on?

2—How many explosions take place in one revolution of the crankshaft in a twin six Packard? How many in a 14-38 Packard, and please explain:

3—Do you favor putting denatured alcohol in the petcocks when the motor is hot in order to clean out carbon?

4—What is meant by the tread of a chassis?

5—I find on a cold day after standing a while it is hard for me to shift gears. I use oil in the transmission and differential. What is the cause?

6—Is it harmful to pour a little steamer oil in the radiator to lubricate the water pump?

7—How much alcohol would you put in a radiator holding 6 gal. to keep from freezing?

8—How would you proceed to treat a car that is frozen?

Brooklyn, N. Y. W. C.

—The valve clearances can be set on all the valves that are closed.

2—The explosions per revolution in a four-cycle engine are always half the number of cylinders, therefore, in a Packard twin six there are six explosions per revolution and in a six-cylinder Packard there are three explosions per revolution.

3—Putting denatured alcohol or kerosene in the petcocks of the motor when hot will delay the accumulation of carbon materially.

4—The tread of a chassis is the distance between the points of contact of the rear wheels and the ground measured transversely.

5—This is no doubt due to the stiffening of the oil in the gearbox due to cold weather.

6—Yes.

7—It depends upon the temperature outside. You would put more alcohol in if the weather were 10 deg. below zero than you would if the weather were 20 deg. above zero. To keep the mixture from freezing down to zero degrees Fahrenheit, the mixture should consist of 40 per cent denatured alcohol and 60 per cent water.

8—Simply allow it to thaw out, and if it is not damaged due to the freezing all that will be necessary is an extra allowance of oil in starting. If the motor is damaged due to freezing there is no estimating what it may be necessary to do. Sometimes an entire new radiator and motor is required.

Ford Motor Possible for Marine Use

Editor THE AUTOMOBILE:—I am thinking of using a second-hand automobile motor for a motor boat. What kind of a motor would you suggest? How about a Ford?

2—Also, I wish to make some valve seat reamers and would kindly ask that you give me the diameter and angle of seats. Also, the diameter of valve stems of the following makes: Buick, Overland, Reo, Paige, Cadillac, Chalmers, Packard, Ford, Maxwell and Hudson? I imagine that I will be able to use the same reamer for several different makes, using, of course, different stems.

Would appreciate specifications as mentioned above, or any other make of car. The names of cars are those which we work on most. A. M.

Lawrence, Mass.

—The Ford motor can be used very satisfactorily in a motor boat provided that the boat is of light weight and of such a design that a light duty motor will be satisfactory. In a 20-ft. runabout probably a propeller of 18-in. diameter with two blades will be the most satisfactory to use. On this wheel the pits would be about 22 in.

2—The valve diameters and angle of seats and also the diameter of valve stems of the cars you mention are as follows:

Car	Diameter of Seat at Top	Angle of Seat	Diameter of Stem
Overland 83	1 7/8	45 deg.	0.373 + 0.0005
Overland 86	1 1/2	45 deg.	0.372 + 0.0003
Overland 75	1 9/16	30 deg.	0.373 + 0.0005
Maxwell	1 1/2	30 deg.	0.373 — 0.374
Hudson 6-40	1 1/2	45 deg.	0.375
Buick D-44, D-45	*1 1/4	45 deg.	0.3085 — 0.3100
Buick D-54, D-55	*1 1/2	45 deg.	0.3695 — 0.3710
Reo 1912-13 intake	†1 3/4	30 deg.	0.375
Reo 1912-13 exhaust	†1 3/4	45 deg.	0.375
Reo 1914-15-16 inlet	†1 3/4	30 deg.	0.375
Reo 1914-15-16 exhaust	†1 3/4	45 deg.	0.375
Reo 1915-16 six inlet	†1 3/4	30 deg.	0.375
Reo 1915-16 six exhaust	†1 3/4	50 deg.	0.375
Packard Twin Six	1 1/2	45 deg.	0.250
Paige (Continental)	1 11/16	45 deg.	0.3717 — 0.3723
Paige (Rutenber)	1 7/16	45 deg.	0.3095 — 0.311
Ford	....	45 deg.	0.3125
Cadillac	1 3/4	45 deg.	0.370 — 0.371

*At throat. †Widest opening.

Maxwell Motor Same for 1916

Editor THE AUTOMOBILE:—A and B have made a wager and I am stakeholder. A has a 1915 Maxwell, and B has a 1916 Maxwell. A claims that the motor in his car is more powerful, more convenient and has a higher mileage record per gallon of gasoline. Is the 1916 model better than the 1915 model, speaking of the motor?

Battle Creek, Mich. J. J. H.

—The motors of the 1915 and 1916 Maxwell cars are exactly similar.

The History of the American Automobile Industry—17

Development of the Explosion Type Motor—Lebon d'Humbersin Engine of 1801 Was the Father of the Modern Internal Combustion Motor — American Inventors Take Up the Problem

By David Beecroft

IN this third installment of the development of the internal combustion engine the early efforts in America are outlined, four names standing out prominently in this respect. These are: Isnard 1824, Morey 1826, Ericsson 1833, and Brown 1826. From these dates it will be seen that American enterprise did not begin until a quarter of a century after the real start of the internal combustion engine had been developed abroad. It is an interesting retrospect to recall that while the practical advent of the internal combustion automobile in America dates from 1901, the first essentials of this engine were worked out by a Frenchman, Lebon d'Humbersin, in 1801, exactly 100 years earlier. The Lebon d'Humbersin three-cylinder type of motor is illustrated this week.

Early English Patent Laws

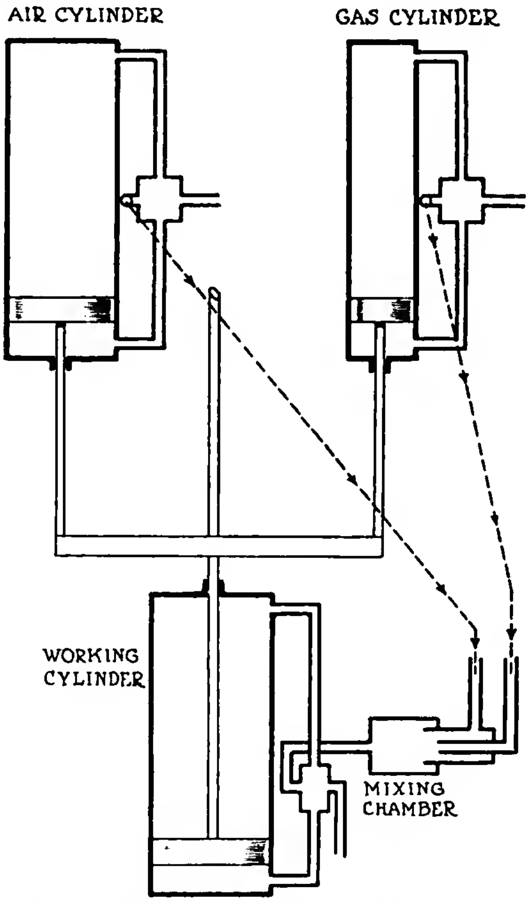
Of course our readers understand that the earlier English patent laws permitted great latitude of description to inventors and that many devices mentioned in a patent may never have been more than ideas. Also that the invention was largely judged from the description rather than confined to the claims, as in United States patents.

Valance Pneumatic Tube System

John Valance, also in England, patented in 1824 a method of travel much faster than any other then known means, viz., the pneumatic tube system. He proposed and described cast-iron tubes 6 ft. in diameter by 12 ft. long, connected by flannel packed joints and having a track inside. He also explained that the power could be furnished by several of the large blowing pumps used for mine ventilation and that doubling the number of pumps would double the speed while such a large car area as proposed would furnish ample thrust even at very low air pressure.

Two More Steam Types

In 1833 Maceroni & Squire, England, built one of the most simple and compact vehicles yet seen, and followed this with another in 1834, one of which afterward went to Paris and the other to Brussels, where they attracted considerable attention. Maceroni continued building steam carriages until as late as 1841.



LEBON D'HUMBERSIN EXPLOSION MOTOR OF 1801

Practically the first explosion type motor was the Lebon d'Humbersin of 1801, which deserves to be classed as the father of the present type of internal combustion motor. This engine was a very close anticipation of the Brayton engine, an American design which figured prominently in the recent Selden patent litigation, and which engine came about 1875, or approximately seventy-five years after the d'Humbersin. The d'Humbersin engine had three cylinders, the two upper ones in the illustration serving for storing air and gas. From these two cylinders the respective air and gas were brought into a mixing chamber and thence into a combustion chamber, where they burned and expanded and were then carried to the working cylinder. This engine, while right in general theory, undoubtedly gave much trouble because of the difficulty of handling and the losses involved in attempting to carry the red hot gases from the combustion chamber through the valves and pipes to the double-acting working piston.

Lebon d'Humbersin's activities in engine development were followed by Sir George Cayley in 1807, who developed a hot-air engine and who in 1837 patented the application of this engine to an automobile. His patents show an engine with two or more cylinders, water-cooling and self-starting so long as the fire was burning.

While these inventors are all foreigners, the same period found American mechanics taking up the problem, as shown by patents to M. Isnard of New York, in December, 1824, and to S. Morey in April, 1826, descriptions of which were lost in a patent office fire. About this latter date John Ericsson, American, began working and in 1833 brought out his hot-air engine, which attracted much attention for the next score of years. This differed somewhat from the Cayley device of 30 years before in that it employed outside heating and, like the Stirling, was dependent upon the durability of the surfaces exposed to the fire. He employed a regenerator or economizer, as it was then called, but instead of passing the air back and forth through this economizer, it had a partition along its central line so that the incoming cool air passed one side of the partition and the outgoing exhaust passed the other side. The heat from the exhaust was carried by the metal through the partition and given up to the incoming cool air on the other side. Like the Cayley device, an air pump was used to force atmospheric air through the economizer and into the head of the working cylinder, which head, being heated, expanded the air in addition to the heat received from the economizer, and drove the working piston, after which the hot air was exhausted as in any steam engine, passing through the economizer on its way out. By the use of the ordinary steam admission valve, the entrance to the working cylinder could be controlled and the air from the air pump cut off at part stroke and used expansively.

Ericsson Used Internal Heating

Probably his most ambitious attempt was a four-cylinder engine installed in an ocean-going steamship at New York, which made several trips with this power. As first made these cylinders were 14 ft. diameter by 8 ft. stroke. Ericsson used external heating and such large volumes of air were impossible to heat quickly. The cylinders were afterward reduced in size and finally the engine was replaced by a steam equipment. Some forms of Ericsson's engines, particularly small ones, with some improvements, were on the market for many years under his name, whereas the Stirling has in recent years been best known as the Rider.

Brown's Combustion Engine

In the same year (1823) that Gurney, England, began his steam carriage work, the internal combustion engine was worked on by Samuel Brown, also an Englishman, whose patents are dated 1823 and 1826. By some, Brown's engine is thought to be an improvement on Cecil's, but it seems rather to have been suggested by Watt's condensing steam engine. He seems to have used atmospheric pressure as his source of power with the air engine exhausting into a vacuum formed by producing a flame in a closed chamber, allowing most of the products to escape and condensing the remainder by a jet of water. Crude as this idea seems to have been, it is said to have been actually used to pump water, drive a boat on the Thames and propel a road vehicle at a reasonably rapid rate of speed.

With this activity in both gas and steam engines it is but natural that compressed air should come in for some attention, and we find a number of inventors working along this line, one of them being William Mann, England, who began work in 1827 and secured a patent in 1829. He advocated using compressed air, which should be compressed by several stages, now recognized as the proper procedure. He also advocated compressions of thirty-two to sixty-four atmospheres (450 to 1000 lb.) and power stations at frequent intervals along the roads. A central station in the colliery districts with the distributing mains along the principal roads, was also advocated by him. At that period tanks of compressed coal gas for lighting purposes were sold much as acetylene is sold at present, and it is likely that his carriage employed these tanks, but filled with compressed air, for the propulsion of his vehicle, built in 1830. About this time a Yankee, Lemuel W. Wright, proposed in connection with compressed air carriages that the air should be heated before using, or used with steam, in order to secure a greater economy. This practice is now quite common where compressed air is used to any considerable extent. At a somewhat later period it was thought to add economy to add compressed and heated air to the steam from boilers and this was quite commonly done.

Compressed Air and Rails

In 1840 A. & T. du Motay, France, applied compressed air to vehicle propulsion, but although designed for road use, the only vehicle constructed ran upon rails. It would carry three passengers, stored the air at about 250 lb. pressure, worked at 50 lb. and its inventors contemplated pressures as high as 900 lb. and heating it before using. They also provided an emergency supply for hill climbing or as a reserve in case the other became exhausted unexpectedly—a provision now commonly fitted in most gasoline tanks.

Another Compressed Air Type

Fifteen years later, 1855, another compressed air carriage was seen upon Paris streets, invented by Mr. Julienne. It weighed about a ton when loaded and carried its air supply at about 400 lb. pressure.

A Twenty-Passenger Vehicle

About 1848 Baron von Rathon ran a 3-ton compressed air vehicle on English roads at 8 to 12 miles per hour, carrying as many as twenty passengers. The air reservoirs were of 75 cu. ft. capacity and filled with air at 750 to 900 lb. pressure. The inventor continued work along this line for 20 or more years. Many other experiments were made with compressed air, but almost wholly without bearing on the solution of the automobile problem, so no further mention need now be made of the compressed air progress.

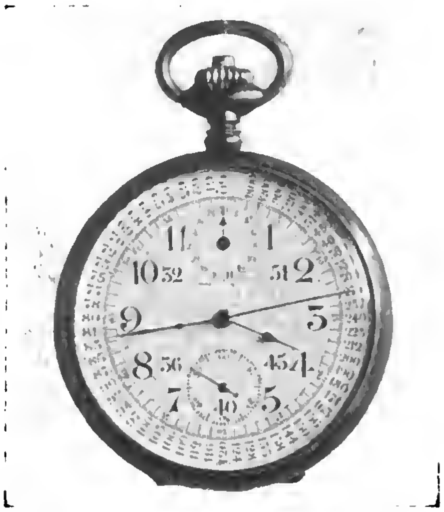
In 1833 L. W. Wright described a non-compression explosion engine working on both sides of the piston, the cylinder being water-jacketed.

ACCESSORIES

Silberberg Master Cronograph

ENGINEERS and manufacturers interested in time and motion studies will find the Master Cronograph of assistance in this work, the instrument having been designed for the purpose. The Cronograph, illustrated herewith, contains a seventeen-jewel timepiece which is extremely accurate, and in addition contains divisions in seconds and fifths for the time study feature. The figures on the outside of the dial designate operations per hour for any operation within 1 min. and the figures on the inside, 51, 45, 40, etc., denote operations per hour for any operation running over 1 min. For instance, if the large black hand were stopped on 13 sec., denoting the completion of an operation, the reading under this hand would show 275, being the number of operations which could be completed in 1 hr. on a basis of one operation taking 13 sec.

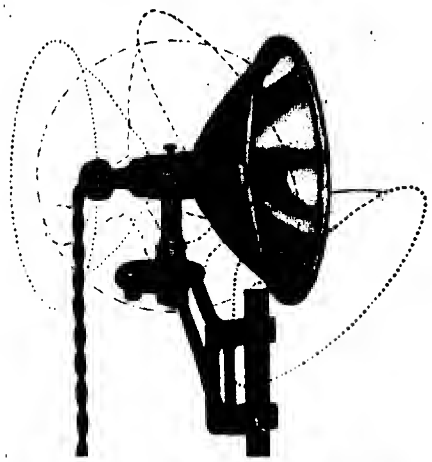
The instrument operates entirely from the crown on the start, stop and fly-back system, the timepiece feature being the same as any modern watch. The works are impervious to magnetism, heat and cold, and are of Swiss manufacture. The case is gun metal.—M. J. Silberberg & Associates, Chicago, Ill.



Silberberg Master Cronograph for use of engineers and manufacturers in motion study work

Kaufman Spot Light

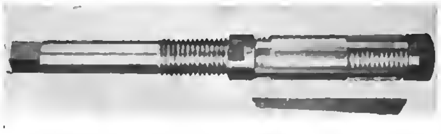
The Kaufman light is provided with a 6-in. reflector and is designed for mounting on the side of the windshield. It is provided with a universal joint which allows moving in any direction and there is a clamp for fastening it in any position desired. It sells for $7.50.—Kaufmann-Williams Lamp Co., Santa Ana, Cal.



Kaufmann light for windshield mounting

Carter Spark Detector

This device is designed for locating a defective spark plug. The plugs are removed from the motor one at a time while the motor continues to operate on the remaining cylinders. The detector is placed against the metal of the plug below the porcelain and the indicator immediately shows whether the plug is operating correctly or not. Price, $1.50.—Carter Spark Plug Detector Co., Detroit, Mich.



Carter detector to locate defective plugs

Malleable Aluminum Alloy

An aluminum alloy which can be die-cast and also sand-cast from which the castings are unusually smooth and free from pin-holes and other surface defects is being put on the market. According to the manufacturers, it is about 25 per cent stronger than ordinary No. 12 aluminum and will stand considerable twisting and bending. The usual drag on tools when it is being machined is noticeably absent and in filing the file is not filled and clogged. A volatile salt in its composition, it is said, gives it these characteristics. It is produced either in castings or pigs, the cost being slightly greater than that of ordinary aluminum alloys.—Pioneer Brass Works, Indianapolis, Ind.

Non-skid truck tire made by the Modern Railway Appliance Co.

Non-Skid Truck Tire

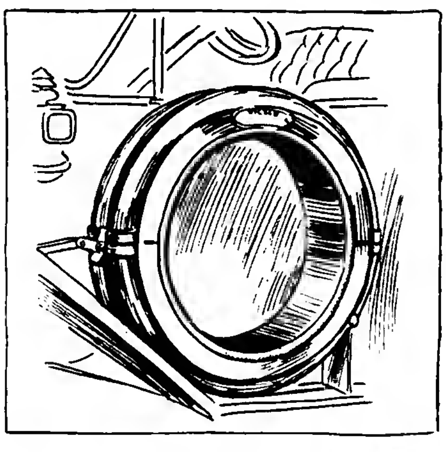
Better traction is said to be obtained by the use of cylindrical rubber blocks held in place by steel forgings. The latter have the same resiliency as the former since they are cushioned with rubber. After the rubber becomes worn, the bolts holding the blocks are loosened and the rubber blocks are turned, giving a new wearing surface. In this way the blocks can be used several times. A 30,000-mile guarantee is given.—Modern Railway Appliance Co., Albany, N. Y.

Victor Tire Holder

This Ford tire holder is made in three sheet steel sections and completely incloses the tires; the holder takes two. The Duplex is another model which is like the Victor except that it incloses only the lower half of the tires. The Simplex is like the Duplex, except that it holds only one tire. The price of the Victor for 30 by 3½ is $10; this does not take demountable rims; the demountable rim type costs $12. The Duplex 31 or 32 by 3½ costs $4.50 and 36, 37, 38 or 40 by 5½, $7. Prices of the Simplex range from $3 to $5.—International Stamping Co., Chicago, Ill.

Wood's Polishing Cream

This cream is designed to preserve the finish and appearance of a car, preventing paint and enamel from checking or cracking. The cream is clean to use and has no bad odor or injurious effect on the hands. A bright, dry, high gloss that does not gum or gather dust can be obtained in from 20 to 30 min. The cream



Victor tire holder, full inclosed type

is put up in 12-oz. bottles in cartons with suitable cloths for application and polishing packed in the top of each carton. A single bottle, if properly used, will keep the finish of a car in the best of condition for a year. The cream is guaranteed on a refund basis. It sells for $1 per bottle by mail to any point in the United States east of Denver, Col.—Wood's Auto Polishing Co., Galesburg, Ill.

Rideover Spring Lubricators

After slightly separating the spring leaves thin strips of Rideover graphite compound are slipped between them, it being unnecessary to disassemble the springs to put them in. When between the leaves the graphite spreads, lubricating the entire contact surface, the compound being designed to stay in place for a long time insuring constant lubrication. The strips are easily handled and sell for $1 per box of sixty.—Avery Portable Light Co., Milwaukee, Wis.

Paco Accelerator for Fords

The throttle of the Ford is actuated by a small pedal which, however, is not attached either to the footboards or to the cylinder head, so that these can be removed without interference. The action of the accelerator is separate from that of the hand throttle. The pedal is so balanced that the weight of the foot is supported, avoiding fatigue when using the accelerator for long periods. The pedal projects through a small opening in the dashboard and connects with the throttle through a steel cable. Price, $1. —Peoria Accessory Co., Peoria, Ill.

Pioneer Searchlight

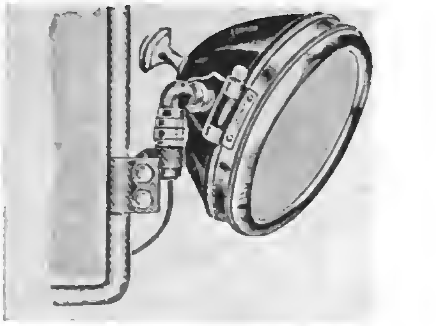
This light clamps to the windshield and may be set at any angle forward or backward, up or down, its motion being practically unrestricted. It is made in three models, the 4½-in. lamp throwing its light 200 ft. and the 7½-in. light 250 ft. The lamps sell for $5.50 and $7.50, respectively, while the 7½ size equipped with a rear view mirror lists at $10.—Pioneer Lamp Co., Chicago, Ill.

Instanto Spark Plug Tester

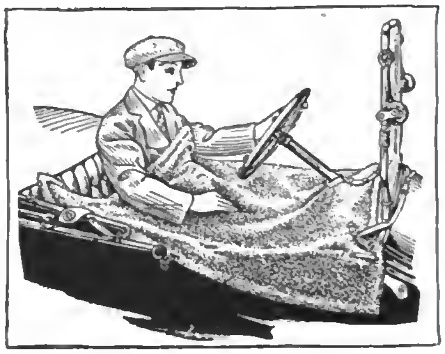
By the use of the Instanto device, a spark plug may be tested without removing it from the motor. The tester, as shown in the illustration, is held so that one point touches the terminal cap, the other contacting with the shell of the plug. If the latter is working correctly a spark appears regularly at the gap between the two points in the tester.—W. Jackson & Co., Chicago, Ill.

Frunt-Seet Robe

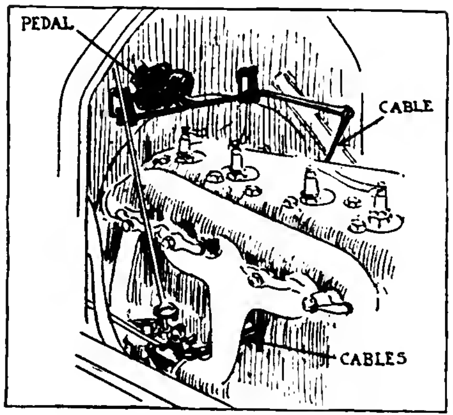
The robe fastens to the side of the body and to the dash and thus keeps the driver warm. A special flap allows it to fit around the steering post. It is made in sizes to fit all cars and comes in black, or green plush, cloth-lined, and is reversible to fit right or left drive. Price, $6.50; rubber, cloth-lined, $5; rubber, khaki-lined, $4.50. Special sizes for Fords finished as above, $5, $4.25 and $3.75 respectively.



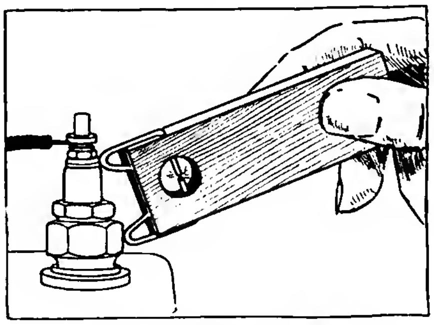
Pioneer searchlight moves in all directions



Frunt-Seet robe for driver's protection



Paco foot accelerator for Fords



Instanto spark plug tester

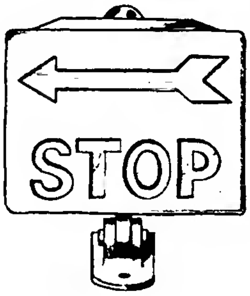
Special suits for motorists, known as Coverall, are made. They are to protect the clothing and are in one piece. Olive and tan khaki are the colors offered, price, $2.25, $2.75 and $3.25, according to goods.—Automobile Apparel Co., Port Chester, N. Y.

Robbins & Meyers Radiator Ornament

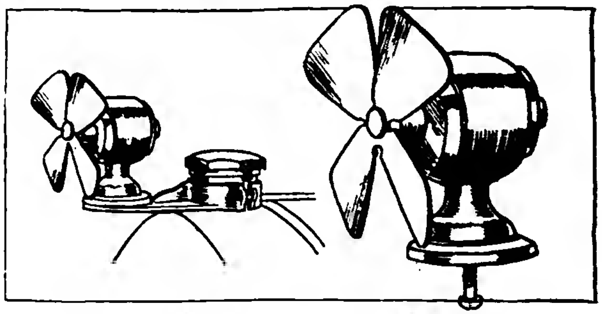
This ornament may be attached to the filler cap of any car and consists of a four-bladed fan which is operated by the air currents caused by the motion of the car. It spins swiftly at the lowest car speeds and the speed of rotation increases rapidly on acceleration. When revolving in the sunshine the highly polished blades produce the effect of a radiant disk. A baked gloss-black enamel finish is applied to the body of the fan and the blades are furnished in nickel or polished-brass finish. The fan weighs about 1 lb. and the diameter of the blades is 4 in. A screw threaded in the base of the fan secures it to the radiator filler cap upon drilling a ¼-in. hole through the latter. If the radiator cap is not shaped conveniently for this mounting a special bracket mounting clamping around the radiator filler tube may be used. With screw in base the fan sells for $1.50.—Robbins & Meyers Co., Springfield, Ohio.

Ona-Moto-Lite Signal

A new device for signaling has been put out under the name of the Ona-Moto-Lite. It works on an arrow indicating principle, giving direction of turning and stop signals. There are no lenses used, the transparent surfaces being red and green glass. The arrow for the left turn is a brilliant green 4½ in. long. The word Stop is a bright red. One of the features is an electric pilot switch which may be placed on the cowl board or other convenient place to show the driver that the signal is operating. It is finished in hard baked glossy black enamel and is placed on the left rear fender or back of the car. The price of the device is $5.—Ona-Moto-Lite Co., Cleveland, Ohio.



Ona-Moto-Lite signal



Robbins & Meyers radiator ornament

The AUTOMOBILE

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2,423,788 Cars and Trucks

ALTHOUGH the increase in the number of automobiles registered in 1915 is 44 per cent higher than the increase shown in 1914 over 1913, there yet remains very large possibilities for increase before the much-discussed saturation point of the country is reached. The error is frequently made of using the total of cars manufactured as the criterion instead of the total registrations in the country. A considerable percentage of automobiles manufactured are exported. This approximated 50,000 for the past year. It will in all probability increase rapidly when normal conditions are restored, when ocean shipping rates are back to normal. America is bound to benefit after the war, in that many of the European countries will not be ready to carry on their export trade as they have done in the past.

The saturation point of the country is yet far off. Take one State, for example. Minnesota has 156,000 farmers. The average farm is 177 acres. The average value per farm is almost $10,000. These farmers have enjoyed two of the most successful years in their career. Of the 156,000 farmers, only 46,000 own automobiles to date. Conservative financial men of that territory say that 100,000 are financially able to own cars. With the present bumper crops and high prices, this number can be increased. To Minnesota add a dozen of the other great agricultural states of the Mississippi Valley. You soon have a total of well over 1,000,000 farmers, located in the most fertile area in the country. These farmers can absorb the entire supply of cars. But when you subtract export figures, and those annually destroyed in wear and tear, you find that the saturation point is not coming so rapidly as many would have you believe. While the saturation point for high-priced cars was looked for a few years ago, it is satisfactory to know that each year sees the boundary of high-price selling zones constantly extended, and at present high-priced cars are being sold in cities and towns where manufacturers thought sales impossible a few years ago. Some of these sales are due to large crops, some to higher livestock prices, others to higher prices for minerals, and others to improved stock prices and general industrial improvements. From year to year varying conditions are going to occur and so with normal advancement the saturation point is being pushed back a little each year and the field of automobile consumption correspondingly extended.

Tractors for Farmers

ONE form of transportation assists another. The more systems of travel, the more travelers and the better the service. The development of trolley systems did not injure railroads, and the automobile has not injured the trolley. Population increases, demands of travel increase, and transportation facilities must increase.

One form of motor power assists another. The automobile is going to hasten the introduction of the agricultural tractor. The automobile has already impressed on hundreds of thousands of farms the utility of the internal combustion motor. The agricultural tractor of to-day is but another adaptation of the automobile motor.

At the start the motor truck was largely an offshoot of the automobile. Later new makers tried to blaze a new highway of truck engineering, but so far as the engine is concerned, the lessons learned in automobile development have applied to trucks. In many other respects the direction of progress in trucks has followed that in automobiles. So may we expect that agricultural tractor development will follow that of automobiles and motor trucks. The reduction of weight is as applicable in one as in the other. The higher motor speeds and lighter motor parts apply equally to automobile, motor truck and agricultural tractor. The inclosing of the driving elements started in the automobile has been taken up in the truck and later will, with equal certainty, be incorporated into the agricultural tractor. The trend of progress in all these is largely alike. Already truck manufacturers are showing commendable judgment in quickly building on the development of the automobile engineer. Those agricultural tractor makers taking advantage of this will succeed, granting that the other aspects of their business are equally capably cared for. Those tractor makers who push aside what the truck and automobile makers have done for them will fail.

Value of Automobile Output Increased 350.3 Per Cent Between 1909 and 1914

Government Statistics Show Value of Output in 1914 Was 181.7 Per Cent Greater Than 5 Years Before—Number of Establishments Increased 0.07 Per Cent

WASHINGTON, D. C., Feb. 17—According to a statement issued by the director of the Bureau of the Census, Department of Commerce, this city, there were in 1914 just 338 establishments manufacturing complete automobiles, their output being 573,114 cars, valued at $465,042,474.

Output Gains 350.3 Per Cent

Comparing the foregoing figures with the 1909 report, the latest issued by the bureau, it is found that though the number of establishments in 1914 has increased only 0.07 per cent during the five years, the number of establishments in 1909 being 315, output, however, showed a large increase—350.3 per cent—the 1909 output being 127,287 cars. The value of the 1914 output was 181.7 per cent greater than that of 1909, which was $165,099,404.

In regard to the 1914 establishments it is stated that thirty-eight of the 338 mentioned were engaged primarily in the manufacture of bodies and parts, agricultural implements, and other products, and reported the manufacture of complete automobiles as a subsidiary product. In addition there were twelve establishments which manufactured twenty cars, either for experimental purposes or for their own use, upon which no market value could be placed.

The fact that the increase in value of the output during the five years was much smaller, relatively, than the increase in number of machines made is accounted for not only by a general reduction in prices, but also by the production of a larger proportion of machines of low-priced makes in the later year as compared with the earlier.

Of the total number of automobiles manufactured during 1914, those operated by gasoline or steam numbered 568,399, and those operated by electricity, 4715, as compared with 123,452 operated by gasoline or steam, and 3835 by electric power, manufactured in 1909. The increase during the five years in the number of gasoline automobile and steam machines manufactured was thus 360.4 per cent, and in the number of electrics, 22.9 per cent.

454,876 Touring Cars

Touring cars were, of course, the principal type manufactured during the two census years. In 1914 the output of this class of vehicle was 454,876, valued at $351,585,518, as compared with 76,189, valued at $113,510,575 in 1909. Of the total production for 1914, the number designed for pleasure or family use was 544,255, compared with 119,190 in 1909. For business purposes and for use as public cabs, omnibuses, ambulances, patrol wagons, fire engines, etc., 24,144 machines were manufactured in 1914, as compared with 4262 in 1909. The output of delivery wagons and trucks was 22,753 in 1914, as compared with 2771 in 1909.

The report also classifies the gasoline and steam automobiles manufactured in 1914 according to their horsepower. The production of vehicles of less than 10 hp. amounted to only 391; of from 10 to 19 hp., to 45,116; of from 20 to 29 hp., to 346,399; of from 30 to 49 hp., to 163,468, and of 50 hp. or more, to 13,025.

These figures do not represent the number of establishments nor the value of products of the entire automobile industry, but only the figures for establishments making complete automobiles.

Comparative statistics of the two years follow:

	1914	1909	Per Cent Increase
Establishments	338	315	.07
Output	573,114	127,287	350.3
Value	$465,042,474	$165,099,404	181.7
No. of Vehicles Made:			
Gasoline and steam*	568,399	123,452	360.4
Family and pleasure	544,255	119,190	356.6
Touring Cars..	454,876	76,189	497.
Value	$351,585,518	$113,510,575	209.
Delivery wagons and trucks	22,753	2,771	721.1
All other	1,391	1,491	6.7†
Electric	4,715	3,835	22.9

*Returns were received from only two establishments making steam automobiles in 1914. The statistics for these companies are consolidated with those manufacturing gasoline automobiles in order to avoid the disclosure of their operations.

†Decrease.

Belden Is Packard Body Engineer

DETROIT, MICH., Feb. 15—E. H. Belden, who has been with the Packard Motor Car Co., for several months, engaged in special research work, has been promoted to body engineer. He is an old-timer in the automobile engineering field.

Goddard Is Dodge Assistant Engineer

DETROIT, MICH., Feb. 15—Chief Engineer Russell Huff of Dodge Bros., has appointed G. E. Goddard assistant chief engineer.

Mr. Goddard recently left the Packard Motor Car Co., where he was body engineer and where, during the six years he was with the engineering department, he worked at various times in most of the different divisions of the department. His stay with Packard was not a continual one. After the first three years he went with the Studebaker Corp., remaining there two years and then returned to the Packard company. Previous to these connections he was for three years chief engineer of the Mora company, Rochester, N. Y.

Crawford and Gunn on Premier Engineering Board

DETROIT, MICH., Feb. 15—The Premier Motor Corp., Indianapolis, Ind., has secured the services of E. G. Gunn, chief engineer of the Northway Motor & Mfg. Co., this city, and C. S. Crawford, chief engineer of the Cole Motor Car Co., Indianapolis. These two men, together with J. L. Yarcan, builder of the Curtiss V-type aviation engine, are to compose the engineering board of the Premier concern.

C. W. Nash, president of the General Motors Co., who is now managing the Northway company, following the resignation of general manager A. F. Knoblock, has made no engineering appointment to fill Mr. Gunn's place.

Page Buggy to Make Front-Wheel-Drive Truck

MARSHALL, MICH., Feb. 9—The Page Buggy Co., which some time ago started to make automobile trailers, will probably also soon start to make a front-wheel-drive truck. It is said that a company having a capital stock of $100,000, the officers and stockholders of which will be largely those of the Page company, is now being formed.

Only Two Scripps-Booth Models

DETROIT, MICH., Feb. 16—The Scripps-Booth Co. has raised the price of its four-cylinder roadster from $775 to $825.

The company also announces that the speedster model shown at the New York and Chicago shows and called the Vitesse is not to be marketed, nor is any form of eight-cylinder roadster to be made. Besides the four, the line will include only one other model, this being an eight-cylinder, four-passenger car selling at $1,175.

44,365 Fords Made in January

DETROIT, MICH., Feb. 12—There were 44,365 cars made by the Ford Motor Co. during the twenty-five working days of January. This is at the rate of better than 1774 cars a day. It is the second largest one month's output of the company, April, 1915, holding the record with 46,510 cars made.

British Imports $37,821,680

Exports for 1915 Still Total Over $12,000,000 or 64% of 1914 Figure

LONDON, ENGLAND, Jan. 26—Automobile import and export statistics just published by the British government are interesting on account of the comparisons they allow between the war and the pre-war periods. For the twelve months ending December, 1915, England has imported a greater number and a greater value of automobiles than in any period of her history. The actual number of complete cars and chassis brought into the country was 20,546, but of these 754 were re-exported, leaving a net import of 19,792. For 1913 the net imports (making the deduction for re-exports) was 12,993; the figure was practically the same for 1912. The value of these imports for the year 1915 is $37,821,680, or $42,065,920 if the re-exported cars are considered. Taking the gross import figures, which includes cars remaining permanently in this country and those re-exported to the colonies or other foreign countries, the increase for the twelve months is 26.29 per cent.

British exports show a loss for the twelve months of 35.69 per cent., the figures dropping from $19,741,715 in 1914 to $12,695,955 in 1915. It is necessary to go back to 1910 to find such a low figure.

The British statistics do not deal with the motor trucks which were thus bought direct by the army authorities in America and elsewhere, and imported by them. They do include those trucks imported by dealers and afterward sold to the government.

The re-export figures are decidedly low, the number of cars and chassis coming into Great Britain for transit to other countries being 754 against 1785 in 1913. This business has dropped back to the position it occupied in 1908. This is explained by the fact that most of the re-exported cars came from France and other Continental countries, and were sent through England in order to get better shipping rates, or because Colonial agencies were held by English firms. This business has been entirely stopped since the outbreak of the war, by reason of all Continental automobile factories being engaged on munitions.

The value of imported parts shows less change than the value of complete cars. This is explained by the fact that while few parts have come from the Continent of Europe, there has been an increase of cheap American cars, such as the Ford, which are brought in a knock-down condition and classed as automobile parts. Since 1913 the authorities differentiate between car parts and tires. Thus in 1913 the value of imported tires was $11,620,775, while in 1915 it had dropped to $7,120,845. If re-exports are included in these figures, the drop is considerably less, for England sent more foreign tires out of the country in 1915 than in 1913. This is doubtless explained by the fact that England received American and French tires and then shipped them to Russia and other countries engaged in the war.

BRITISH AUTOMOBILE IMPORTS

Year	Cars and chassis	Value	Value of parts	Value of cars and parts
1908	6,530	$11,013,110	$7,752,590	$18,769,700
1909	7,747	11,446,570	8,167,335	19,613,905
1910	9,915	13,861,275	9,202,005	23,063,280
1911	11,909	14,902,840	11,661,025	26,563,865
1912	13,164	15,977.580	15,926,135	31,903,715
1913	12,993	15,683,555	17,104,965	32,788,520
1914	12,408	14,714,065	13,167,780	27,881,845
1915	19,792	20,209,690	17,611,990	37,821,680

Re-exports have been deducted from above figures.

BRITISH AUTOMOBILE EXPORTS

Year	Cars and chassis	Value	Value of parts	Value of cars and parts
1908	2,441	$4,383,100	$1,909,695	$6,292,795
1909	2,801	6,188,935	2,629,090	7,818,025
1910	4,119	7,952,110	5,075,525	13,026,635
1911	5,271	10,505,540	5,425,650	15,931,190
1912	6,457	12,304,695	6,107,645	18,412,340
1913	8,829	14,308,260	7,485,815	21,794,075
1914	7,490	13,259,610	6,482,105	19,741,715
1915	3,764	6,582,040	6,118,915	12,695,955

Lee Tire Sales Increase 100 Per Cent

NEW YORK CITY, Feb. 10—Lee Rubber & Tire Co. sales for the month of January of its puncture proof tire increased 100 per cent over the corresponding month in 1915. Sales of the regular pneumatic increased 70 per cent. The output is now 1200 tires a day.

The Lee company reports to the New York Stock Exchange, for the ten months ended Oct. 31, 1915, as follows:

Net Sales	$2,794,025
Cost of sales, including depreciation $51,052	1,991,691
Gross profit	802,333
Profit on materials sold	1,100
Total profits	803,433
Selling, administration and general expenses	364,017
Balance	439,416
Other income	18,498
Total income	457,914
Charges	14,439
Surplus	443,475

Hall Motors, Ltd., to Build Canadian Motor Trucks

TORONTO, ONT., Feb. 11—Hall Motors, Limited, will manufacture purely Canadian trucks. A plant has been secured at Markham, which will be fully equipped with every modern facility. During the current year it is estimated that the output will be between 400 and 500 trucks. E. A. Hall, carbureter and motor expert, under whose management the plant will be conducted, states that quality will be the watch-word of the new industry. Production will begin in March.

Continental 100% Dividend

Capital Increase to $5,900,000—46,000 Motors Produced in 1915—125,000 in 1916

DETROIT, MICH., Feb. 15—At a special meeting of the directors of the Continental Motor Mfg. Co., they recommended that the stockholders approve at a meeting to be held to-morrow, that a stock dividend of 100 per cent be declared; that the capital stock of the company be increased from $2,900,000 to $5,900,000, and that the par value of the shares, which is now $100, be lowered to $10. It is more than likely that these suggestions will be approved.

Under the new plan of reducing the par value of the share, the holder of one share of present common stock will receive ten shares of the new stock and in addition ten shares as his stock dividend.

This is the second 100 per cent stock dividend the Continental company will have declared within the last four months.

Production during 1915 was more than 46,000 motors. For 1916 the company expects to make 125,000 or more, half here and the other half in the plant in Muskegon. Within the next three weeks the average daily output is expected to reach 300 motors at both plants. The total number of men on the pay roll will be about 6000.

Genemotor Price Raised $10

NEW YORK CITY, Feb. 14—In line with the present high cost of materials and the corresponding prediction of higher prices, the General Electric Co. has followed the lead of a few of the automobile makers by advancing its retail price of the Genemotor lighting and starting systems $10 to $85. This change applies to the 1916 shaft drive type.

Coincident with the change in price it is announced that the General Electric Co. has taken out a license to produce the Genemotor under the Coleman starter patents, Nos. 745,157 and 842,827. These patents were declared valid in the Court of Appeals last December after two years of litigation in the local courts.

Surre Continental Rubber Second V.-P.

ERIE, PA., Feb. 11—W. J. Surre, manager of the tire sales department of the Continental Rubber Works, this city, has been elected second vice-president.

Coburn Is Maxwell Advertising Manager

DETROIT, MICH., Feb. 16—Andrew E. Coburn, former advertising manager of the Cleveland Twist Drill Co., has been appointed advertising manager of the Maxwell Motor Co., this city.

Perlman Rim Patents Declared Valid and Infringed in Court of Appeals

Decision of Lower Court Upheld in Suit of Demountable Rim Inventor Against the Standard Welding Co.—History of the Development of Perlman's Invention

NEW YORK CITY, Feb. 15—The United States Circuit Court of Appeals, Second Circuit, has handed down a decision affirming the decision of Justice Hunt, C. J., in the United States District Court, declaring the Perlman demountable rim patent valid and infringed by the Standard Welding Co. of Cleveland, Ohio. An injunction and accounting order against this company was issued last August by the lower court.

The Perlman demountable rim patent case is of more than ordinary interest because it affects the use of demountable rims on nearly all the automobiles made and now in service in this country.

The Perlman demountable rim patents were applied for in 1906, and the patent was finally granted after many years of delay in the Patent Office, on Feb. 4, 1913. Perlman, however, was not behind these delays, for both he and his attorneys were insistent upon a prompt issue of the patent, because tire and rim makers and automobile manufacturers knew of his invention and had boldly appropriated it, pending the issue of his patent.

700,000 Cars Will Use Them

Good judges of the volume of the output of the automobile industry estimate that of the 1,000,000 cars produced during the current year about 700,000 will use demountable rims, and yet the royalty for the use of these rims, as asked for by Mr. Perlman, will be so moderate that it will not add at all to the retail selling price of automobiles. This statement should quiet any apprehension that might be felt regarding any added cost owing to this decision.

The testimony in the lower court showed that in 1903 Perlman completed, and in 1904, in a successful way operated his invention on a Royal car, and that for years, beginning away back in 1900, Perlman was industriously at work upon the repairing of tires, always with a view of inventing means to avoid the relays incident to repairing tires on the road.

Completion of the Device

Later on, in October, 1904, he put his wheels on a Welch car, and then Perlman realized that his methods of mounting the demountable rim and the short stem lug used for securing the tire on the rim, were perfect and complete. Later on in the same month he drove this Welch car to the first Vanderbilt cup race on Long Island.

It is well known that a few foreign and American patents were issued for demountable rims held tight upon their wheel bodies by conical and taper fit or bolts pulling the rim down against the wheel body. Perlman's idea was just the reverse; he, while holding the rim rigidly in place on the wheel, separated them by wedges.

Perlman filed his first patent application May 21, 1906, and on June 29 of the same year he filed a continuation and substitute for it, with some additional details. The idea being to patent, as he then said, "A wheel whose demountable rim is bodily detachable from its fixed rim and felly, means being provided for firmly and rigidly retaining the demountable rim on the fixed rim and felly while is use, such means at the same time being adapted to be manipulated for enabling ready, rapid and easy removal of the demountable rim when desired."

Demountable Rims Abroad

Demountable rims were used abroad on racing cars late in 1906 in the Grand Prix Race, but the difficulty with the styles then used lay in demounting the tire rim from the wheel, the two beveled and inclined faces of the rom and wheel were forced tightly together, and use and rust added to this perplexity.

But these other and older kinds of foreign racing demountable rims were of little use, as shown by Joe Tracey and Camille Jenatzy and others who used them in the 1906 Vanderbilt road races, owing to the fact that the rims became so attached to the wheel bodies that it required much more labor to remove them than to take the tire from the rim in the old way in the days of the common, clincher-type fixed tire rim. The device of Perlman was a practical solution of the problem of replacing a deflated automobile tire in a quick and easy way.

The Idea Develops

Perlman's conception of the demountable rim was really a road inspiration. For years he had been working on pneumatic tires, always with a view to their ready replacement and repair on the road, and his first efforts were confined to the production of tools for replacing and repairing tires, but these ideas he found were merely petty time savers, and the tire repair was still always a road job. One day he was out riding with a friend. They had, of course, the usual punctures which were common in those days, and after they had made a roadside repair of the inner tube, Perlman started to pump up the tire, using the primitive hand pump of the period. While engaged in this work and perspiring under the task he suddenly realized for the first time that all his previous ideas were wrong; what was wanted was a removable rim idea, so that the tire could be put on the rim in the garage or barn, inflated there, and carried on the car as a separate unit just as is done today, and then his only problem was to conceive mechanical ways and means for carrying out the idea practically. This he accomplished after exhaustive, costly, laborious, experimental work, finally adopting the wedge and screw, and the air space between the two rims which prevented the rims from rusting together.

Elements of the Invention

Perlman had already solved the problem by his invention of the separating wedge, the bolt and the nut and the use of the short stem lug and the air space between the rims. Simple enough after it was conceived, and anybody can do it now, but nobody ever did it before Perlman did it, although the history of the demountable rim shows that for more than a decade prior to the Perlman invention, many men had sought to discover an efficient means which could positively and effectively retain the demountable rim in place and present displacement thereof, and at the same time permit quick and easy removal of the rim.

Cornell to Address Indiana S. A. E.

CLEVELAND, OHIO, Feb. 11—F. A. Cornell of the Perfection Spring Service Co., this city, will present a paper at the monthly meeting of the Indiana Section of Automobile Engineers Feb. 25, the subject being "Anticipating Complaints."

Harroun Secures Quarters

DETROIT, MICH., Feb. 15—Ray Harroun, the former chief engineer of the Maxwell Motor Co., who is to build aeroplane motors and a special racing car, has leased part of the Dodge Power Building, Jefferson and Brush Streets, where he will start manufacturing and maintain his offices.

Thirty-Five Per Cent Co. Petitions

NEW YORK CITY, Feb. 16—The Thirty-Five Per Cent Automobile Supply Co., 148 Duane Street, has filed schedules showing liabilities of $83,766 and assets of $40,509.

Ford Plant for Calgary

CALGARY, ALTA., Feb. 11—The Ford Motor Co. will build an assembling plant at Calgary, Alta., next spring. The building will be four stories high, with provision made for increasing the size later. They will employ 150 men.

Columbia Motors Co. Organized

Bayerline-Daly Concern To Build 2500 Sixes at $900 in 1916

DETROIT, MICH., Feb. 16—The new automobile company, which former president J. G. Bayerline and former sales manager W. L. Daly of the King Motor Car Co. launched a few weeks ago, will be known as the Columbia Motors Co. In addition to Bayerline, who is general manager, and Daly, who is vice-president and in charge of sales, other members of the new organization are: A. T. O'Connor, secretary, who was formerly with the Olds, Packard and Abbott companies; F. A. Bollinger, factory manager, who was formerly in the same capacity with the King company; Ray Long, engineer, formerly assistant engineer of the Saxon Motor Co.; John Molerhardt, superintendent, who was also formerly with King. W. E. Metzger, well known in automobile circles, is one of the directors.

It is stated that all of the capital stock has been subscribed and an option on a plant in Detroit has been secured. The first demonstrators of the new car, which is a six, to sell at about $900, will be out about March 1, and dealers' cars are expected to be out by June 1. The output for the first year will be 2500 cars.

Only 19 Automobiles Imported During November, 1915

WASHINGTON, D. C., Feb. 11—Supplementing the November export report in THE AUTOMOBILE for Feb. 3, is the announcement that imports for that month amounted to $33,780, and numbered nineteen cars, compared with $81,647 and sixty-two for the corresponding month in 1914. For the eleven months ending November, automobile imports amounted to $312,256, and numbered 204, as compared with $454,733 and 280 cars in the corresponding period in 1914.

Burke Rejoins Gray & Davis

BOSTON, MASS., Feb. 14—W. W. Burke has rejoined Gray & Davis, Inc. He will assume his former duties in connection with the sales department.

24,000 War Trucks Shipped

U. S. Government Could Get 6200 Trucks in About 30 Days

WASHINGTON, D. C., Feb. 12—It has been ascertained by the War Dept. that in the period between August, 1914, and December, 1915, about 24,000 commercial trucks, valued at $64,250,000 were exported for use by foreign armies.

It is stated by army officers that army quartermasters now are giving much attention to the equipment of army field and divisional trains. The view is expressed that the field trains that accompany troops should be animal-drawn, but that for divisional trains, supply, ammunition and sanitary trains motor trucks should be used.

With that end in view, a canvass has been made as to the resources of the country in that particular. The reports to the quartermaster general by manufacturers of trucks show that in thirty days 6200 trucks could be furnished.

Imports of Automobiles, Trucks, Parts and Tires for November and 11 Previous Months

	November				Eleven Months Ending November			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	Value
Automobiles								
Automobiles	62	$81,647	19	$33,780	280	$454,733	204	$312,256
Imported from—								
France	4	$16,289	6	$6,788	64	$134,493	59	$116,682
Germany	1	1,571	....	....	12	21,979	....	....
Italy	39	38,812	....	....	106	115,718	23	29,549
United Kingdom	9	18,837	7	20,960	55	137,306	34	77,399
Other countries	9	6,138	9	6,032	43	45,237	88	88,626
Parts of (except tires)	....	$62,809	....	$40,054	....	$846,997	....	$530,319
India Rubber, Etc.								
Unmanufactured—								
Balata ....lbs..free..	336,306	$110,821	268,182	$95,721	1,815,156	$805,502	2,045,386	$770,947
Guavule gum ....lbs..free..	230,700	68,255	....	....	1,533,371	573,656	4,902,291	1,356,537
Gutta-joolatong ....lbs..free..	....	....	1,342,375	50,172	17,471,331	806,189	18,723,068	875,448
Gutta-percha ....lbs..free..	78,161	12,890	170,426	21,148	1,876,677	327,564	2,016,483	237,819
India rubber ....lbs..free..	12,253,509	5,517,024	19,272,465	9,319,160	131,481,364	65,333,751	197,192,381	98,089,361
Imported from—								
Belgium	....	....	....	....	9,018,596	$5,028,504	....	....
France	....	....	50,560	$22,444	2,107,247	899,281	270,592	$123,186
Germany	....	....	....	....	4,631,589	2,336,218	6,987	843
Portugal	132,627	$38,152	244,156	80,009	1,225,206	366,313	4,065,932	1,451,843
United Kingdom	6,295,418	3,130,256	5,878,663	3,229,791	50,700,629	28,921,299	80,120,179	43,147,626
Central Am. States and British Honduras.	39,349	13,091	71,940	29,404	465,362	212,998	1,135,860	504,709
Mexico	464,204	148,100	132,853	50,431	1,249,848	488,163	1,624,394	612,712
Brazil	2,965,549	1,142,733	5,009,041	1,887,162	38,344,443	14,939,991	46,665,741	19,352,763
Other South America	875,295	363,798	746,796	282,691	2,793,258	1,123,619	5,641,403	2,391,386
East Indies	1,481,067	680,894	7,115,436	3,724,395	19,264,890	10,082,953	52,597,336	27,673,973
Other countries	....	....	23,020	12,833	1,680,296	934,412	5,063,957	2,830,320
EXPORTS PREVIOUSLY UNREPORTED								
Gasoline Engines for Automobiles	203	$66,940	4,158	$577,048	3,047	$1,059,466	16,466	$2,196,582
Shipments to Non-contiguous Territories of United States								
To Alaska								
Automobiles	....	....	....	....	54	$69,703	79	$103,019
Parts of (except engines and tires)	....	$1,021	....	$672	....	9,121	....	15,236
To Hawaii								
Automobiles	70	$91,024	199	$243,378	825	$860,553	1,196	$1,300,841
Parts of (except engines and tires)	....	7,149	....	21,882	....	86,684	....	129,122
To Porto Rico								
Automobiles	44	$30,362	63	$46,421	328	$298,994	672	$539,387
Parts of (except engines and tires)	....	4,935	....	6,987	....	63,293	....	92,503
To Philippine Islands								
Automobiles	32	$29,954	49	$59,790	392	$401,495	641	$774,602
Parts of (except engines and tires)	....	1,023	....	5,108	....	44,916	....	51,257

Kansas City's Trade Territory Has a Total Wealth of $772,380,183

1916 Is Looked Upon as Its $500,000,000 Year—Production of Crops, Livestock, Zinc Lead and Oil Estimated as Reaching That Total

KANSAS CITY, MO., Feb. 12—It isn't possible to lump Kansas City and its trade territory into a single word this year. At other times the one thing, "crops," might have sufficed to cover all the resources of this big district, including, as it does, western Missouri, Kansas, northwestern Arkansas, Oklahoma and parts of Texas and Nebraska. But this year its description must be more diversified.

The Kansas City trade territory looks upon this as its half-billion year. The production of farm crops, livestock, zinc and lead, and oil—the chief factors—in the adjacent States reached approximately that sum for the year 1915. Of course, all of it does not represent profit and it is not money that will be expended entirely outside of living and other actual expenses. It does not include the value of the manufactured and jobbing products of such cities as Kansas City, St. Joseph, Springfield, Topeka, Wichita, Hutchinson, Oklahoma City, McAlester and others in the Southwest that count Kansas City as their gateway and have resources not dependent upon any of these things.

Farmers, Oil Men and Miners

The sum does represent, however, the returns to the three large classes of producers in this territory—the farmer, the oil man, and the miner. This much money came into their hands as the result of the business of 1915—it is the value of the raw products originating in those States covered by the Kansas City distributing agencies. Some of this money will be used for paying off mortgages, some to buy flour, meat and groceries, and some to pay labor bills, but that amount went into the Kansas City territory last year and is available for one purpose or another.

Nearly an $800,000,000 Field

Itemizing the various components, eight separate items must be listed to make up the wealth of this territory. They reach the sum of $772,380,183 and were compiled from reports of State and federal officials, showing totals for Jan. 1. The tabulation gives details.

The visitor to the annual automobile show that closed to-day in the Case Building—the largest, by the way, ever held in Kansas City—became impressed quickly with the numerous factors tending to make up the immense buying capacity of this territory. At one booth would be a Missouri zinc miner who is selling his ore this year at $110 a ton whereas a year ago he was getting not to exceed $50, at another would be an Oklahoma oil man who had watched the price of his product jump from 40 cents a barrel to $1.30 within the last six months, and at a third would be a Kansas farmer who had paid off the mortgages on his farm out of the tremendous wheat yield of a year ago and now counted the surplus from his last crops as so much free money to go into the banks or be spent for automobiles, talking machines, etc.

Wealth of Kansas City's Territory

Wheat	$142,330,000
Corn	194,740,000
Oats	35,408,000
Hay	43,672,000
Other crops	75,000,000
Livestock (marketed)	198,191,533
Oil and Gas	55,000,000
Lead and Zinc	28,038,650

But that is not all. There is yet the Missouri farmer to be reckoned with who increased the value of his farm output in 1915 to approximately $219,000,000, the Kansas livestock grower who added $49,000,000 to the value of his livestock last year and, likewise, those men from the country districts who have been shipping every week $1,000,000 worth of horses and mules into the Kansas City market for re-shipment to the warring nations of Europe. Like other sections of the United States, this territory has a greater spending capacity than at any other year in its history. As a witness, the cashier of the Kansas City federal reserve bank is introduced. He said:

"The financial resources of this territory are from 15 to 18 per cent above what they were this time a year ago. Then we thought we were the most prosperous section of the country. Certainly we are to-day."

$41,000,000 for Cars, etc.

Figures for the motor car purchases from the Kansas City distributing and retail agencies in 1915 show a total of $41,000,000 for cars and accessories. They are supplied by E. E. Peake, secretary of the Kansas City Automobile Dealers' Assn., and carry with them a prediction that the 1916 sales will closely approach $50,000,000 of which a fifth will be for tires and accessories.

The number of cars owned in the Kansas City trade territory has shown a steady growth under the stimulus of better cars and more vigorous campaigning by the agencies. Missouri has jumped from 16,387 cars in 1911 to 76,462 for the calendar year of 1915 according to the report of the Secretary of State.

The Kansas growth has been practically the same until now it has reached 74,956 registered cars. Two-thirds of these are owned on the farms and in towns having a population of less than 2500 according to an estimate made by the state secretary.

Oklahoma began registering cars last June and on Feb. 2 had 25,029 passenger cars and trucks registered, owned largely in the smaller cities and country districts.

Huge Crop Resources

To explain the resources of this distributing territory it is necessary to go into detailed figures. The field crops of Kansas as a whole for 1915 were valued at almost exactly $250,000,000, a loss over the 1914 totals of $28,500,000. Wet weather during the summer months cut the wheat yield to practically half of that of the 1914 bumper crop of 181,000,000 bushels. But the farmer, the man who grew the wheat and the man who purchases motor cars to drive back and forth from town, sold his 95,000,000 bushels in 1915 at higher prices. The year before, pressed with debts hanging over from previous lean years, he had to sell at threshing time for prices ranging from 60 to 70 cents. He paid off those debts and when the 1915 harvest came around he decided to hold his crops until late for larger prices. He got them, ranging from 90 cents to $1.10 per bushel, by not selling until November, December and January. Now Kansas is selling wheat in quantities never before recorded in the winter months. And the debts he must pay with that money are few. He will spend it largely for luxuries.

Crop Conditions Similar

Crop conditions in the three States, Missouri, Kansas and Oklahoma were very similar. Wheat production was less than the year before in each. Missouri fell 25 per cent behind, Kansas 50 per cent and Oklahoma 25 per cent.

Corn production was greater, totalling for the three States $263,000,000, an increase of $56,000,000 over the preceding year, thus wiping out a lot of the wheat decrease, which totalled $78,000,000 for the three States.

Hay, dairy, poultry and horticultural products showed an increase in all the States, so much so that the totals make 1915 the second largest crop year in the Kansas City territory this century. The 1914 crops were the only ones larger.

Kansas, Oklahoma, and Missouri at this time have the heaviest bank deposits in their history. Kansas banks have deposits of $224,110,565, an increase of $23,000,000 in a year; Oklahoma has $134,476,292, or about $19,000,000 ahead of 1914 and in Missouri the same ratio is maintained, although exact figures are lacking. As an indication of the same growth Kansas City is pointing proudly to its bank clearings and deposits. The deposits on Dec. 31, 1915, in Kansas City banks alone totalled $180,000,000, a gain of $34,000,000 in a year, and the bank clearings for the year reached the total of $3,835,000,000, a gain of $250,000,000 over 1914.

$600 to $900 Cars Favorites

The Kansas farmer is the heavy buyer of motor cars and the average car sold there is the all-purpose car averaging from $600 to $900. The car used in that State must be one that the farmer can drive to town and utilize in bringing back supplies and provisions; in other words, one that isn't so costly that it demands care and washing. Figures taken from the State assessor's lists but not including all the machines owned in Kansas shows Fords to constitute a third of those in Kansas. Buick and Overland come second and third. The list by makes furnished from the assessor's report is:

Auburn	652
Buick	5,998
Cadillac	855
Chalmers	732
Dodge	551
E. M. F.	699
Ford	25,254
Hudson	879
Hupmobile	755
Jackson	512
Maxwell	3,026
Mitchell	707
Oakland	720
Overland	5,515
Regal	523
Reo	2,389
Saxon	378
Studebaker	3,427
Velie	406

Kansas, also, has not yet started actually to build good roads. Any number of counties have enthusiastic plans for highway improvements but few indeed are those that have borne fruit. This is another factor in the sale of cars in that State. Higher-priced motor cars are not purchased when they have to be driven through mud and slush. Road sentiment has crystallized largely throughout the past year, more so than during other years, and it is reasonable to believe many roads that are now impassable in winter will be macadamed or improved before another twelve-month period has passed.

The sale of cars is nearly equally divided between city and country. Kansas City has 9309, St. Louis has 16,000. The western half of the State, Kansas City territory, contains within it Springfield, Joplin, Carthage, Sedalia, St. Joseph, Webb City, and several other cities in excess of 10,000 population. St. Joseph is as large as any city in Kansas and, of course, there are none to compare in size with Kansas City.

High Prices No Drawback

Electrics are sold freely in all of the cities of Missouri mentioned and in each of them gasoline cars selling up to $2,500 and $3,000 and even higher may be found. The hills of Kansas City are no bar to electrics and one big bakery here recently installed a fleet of twenty-two electric trucks. Joplin has recently opened a public charging station and under the stimulus of the war-time zinc prices the Joplin-Webb City-Carthage buyers no doubt will invest more in electrics and the larger and more costly gasoline passenger cars.

Good progress has been made in the last year in increased distribution of electric cars in the Kansas City territory. Kansas City alone has to-day between 800 and 850 electric passenger cars. The city of St. Louis has approximately 750, but must not be classed in the Kansas territory. For the past six months the sale of electric passenger cars has increased very perceptibly and has been stimulated by the high price of crude oil in the Oklahoma territory and zinc war prices in western Missouri. In the Oklahoma oil territory electrics are becoming relatively common. Manager Clark of the Detroit Electric in Kansas City states that there were sixteen recent sales made in Tulsa, Okla., which is the center of the oil section, three in Bartlesville, which is also in the oil district, and three in Muskogee, another oil center.

During the past few months there has been a wider distribution of electrics and as a result of this the business has more than doubled as compared with a year ago. It is now becoming more general to establish some kind of dealer in all towns of 10,000 population or over and to carry demonstrators in them.

Electric Business Doubles

The influence of general improved conditions in the Kansas territory is reflected in the greater sale of electrics. Joplin, Mo., of zinc fame, has eight electrics. In several towns in Kansas the electric is making headway. Topeka, the capital, is not a leading city, but has four. In Hutchinson there are three. Wichita has proved a particularly good second-hand market, one distributor having sold eleven in the past fall.

In Kansas City there are three electric garages, one operated by the Detroit Electric Car Co., a second by Baker R. and L., and a third by a party not selling cars. Of these 800 electric cars in Kansas City all except 250 are kept in the private garages of the owners. The introduction of a new type of rotary converter for charging purposes, which is very simple to operate, is advanced as one reason for a wider use of electrics in Kansas City.

Such oil centers in Oklahoma as Tulsa, Bartlesville and Muskogee are buying more high-priced cars and electrics than ever before. Oil has made many millionaires within the last six months and development is going on so rapidly that extensive new wells undoubtedly will be brought in. This has come about as a result of the price increase since Aug. 1. At that time crude oil at the wells was selling for 40 cents a barrel and production dropped to a low minimum. Then it began climbing and in twenty days had jumped 25 cents a barrel. At that time it was estimated that a 15-cent increase meant that $50,000 more per day was being brought into the Oklahoma fields. Late in January the last advance brought the price up to $1.30 a barrel, an increase from the low mark of last July that means at least $300,000 more per day going into the Oklahoma fields than was at this time a year ago. That money will go largely into the purchase of motor cars.

Zinc and Lead Output

The zinc and lead mines are not confined entirely to Missouri. A fringe of Kansas counties near Joplin and Webb City has several good producing mines and the mineral belt extends into northern Oklahoma. Production in the Missouri-Kansas-Oklahoma fields went up tremendously last year, totalling $26,000,000, more than double that of the previous year, and estimates based on the present prices and production fix this year's total at $38,000,000.

20,000 See Kansas City's First Tractor Show

KANSAS CITY, MO., Feb. 12—The close of the first tractor show here to-day brought statements from the officers of the Kansas City Tractor Club that paid admissions for the week totalled 20,000, a large majority of whom were farmers who came to Kansas City not from curiosity but from a desire to purchase tractors. Sales were heavy, one firm having contracted more than one hundred machines, another seventy-five, and others from twenty-five to fifty.

A Business Crowd

The attendance was unusual. It was a business crowd. Sightseers composed a very small part of it. The show's location in a tent near the Union Station, the cold weather, and the damp ground made it unattractive to the merely curious. Those who went through the gate were there because they had some good reason —farmers and ranchers desirous of investigation, automobile and implement dealers who wished to take on agencies, and tractor owners who came to see the improvements that had been made since they purchased.

Many of the country motor dealers who were in Kansas City on account of the motor show, held in another place, visited the tractor show and some were appointed agents in their respective territories. Tractor manufacturers who also sold motor cars and accessories appointed a large number of their representatives out of the motor dealers. Old line implement houses that have tractors as a part of their farm machinery did not reach this trade heavily. They seemed content to place their agencies with the implement and hardware men in the various county seats. Motor dealers, however, displayed much enthusiasm at the tractor show and many left Kansas City with agency contracts signed up for both pleasure cars and tractors.

Army Tests Artillery Tractors

LAWTON, OKLA., Feb. 12—The use of tractors for hauling heavy field artillery is being tested by a board of army officers at Fort Sill, near here. The board is composed of Colonel Adams, Captain Bryden, Lieutenant McGlachlin. The tests will continue several days and only preliminary results have been announced. These are to the effect that the tractors show a big advantage over horses in the crossing of railroad bridges with the cannon. This is impossible with horses.

The trucks used at Fort Sill, however, have not yet been pronounced a success but the army officers are agreed that the tractors meet all the requirements for motive power for the maneuvering of big guns.

Plan Empire Fair for 1917

LONDON, ENGLAND, Feb. 3—Plans are being made for a British Empire Fair to be held next year. An exhibition building which, it is said, will be the largest of the kind in the world, will be erected at Willesden Green, in the spring of 1917. A new building will be erected and will be designed to provide accommodation for exhibits from almost every known industry. It will continue three weeks.

Richey with J. Walter Thompson

ANDERSON, IND., Feb. 14—S. Hunter Richey, formerly manager of the local branch of the Russell M. Seeds Co. advertising agency, has resigned, and joined the staff of the J. Walter Thompson Co., New York City.

Bates Tractor Business Gains 400%

LANSING, MICH., Feb. 9—According to M. F. Bates, secretary of the Bates Tractor Co., business in January was 400 per cent ahead of that of the first month in 1915.

K. C. Show Attendance 125,000

This Territory Will Handle Large Volume of Cars This Year—Dealers Optimistic

KANSAS CITY, MO., Feb. 12—The motor show closed here to-night with a final attendance that brought the total for the week to practically 125,000, not including the pass admissions to exhibitors, dealers and press representatives. All exhibitors will be rebated for their space and the surplus left in the treasury of the Kansas City Automobile Dealers' Assn. will be spent on good roads promotion in the territory adjacent to this city.

Both attendance and sales were largely in excess of that of any previous show here and almost without exception the exhibitors spoke of expected sales increases for this year of from 20 to 30 per cent.

Business Is Promising

The results of the show go to prove that this territory will handle a tremendous volume of cars this year. The Buick allotment, largely contracted already, is 5000 cars; Overland will handle 6500 machines in the territory that took 3900 last year; Reo and Grant, handled by the same company over a large section, have contracted about 5000, and Oakland expects to increase largely over 1915. Truck exhibitors likewise were extremely optimistic of the show results, saying almost without exception that the actual sales during show week and the prospects obtained exceeded former weeks.

The older pleasure car agents in this territory contracted few new dealers during the show. Their organization has been pretty well worked up through other years but a tendency was shown to cut down the districts alloted to each dealer, making the district smaller so each dealer would go through it more thoroughly. Many of the manufacturers that had not been well represented in Kansas City have appointed new distributors here or taken over the agency as factory branches and these companies, of course, appointed a large number of new dealers. One firm announced it had practically tripled its representation during the six days of the exhibition.

St. Louis Chevrolet Receives $4,000,000 Body Order

ST. LOUIS, MO., Feb. 11—Russell E. Gardner, president of the Chevrolet Motor Co., this city, received yesterday a contract from the Chevrolet Motor Co. of New York for the manufacture and delivery of 200,000 bodies to be built in one year and costing approximately $4,000,000.

The order will necessitate the erection of several additional buildings and the purchase of much equipment. The plant at Second and Rutger Streets, which now produces twenty-five Chevrolets a day, will be increased so that in thirty days the production will be seventy-five cars a day.

Novel Service Plan Inaugurated by Studebaker

DETROIT, MICH., Feb. 11—Studebaker owners in Detroit who spend their evenings at theaters, clubs, hotels, or lodges need not worry any more about the cars they leave standing outside. A novel extension of the service plan of the Studebaker Detroit retail branch provides for nightly inspection of every Studebaker car in the downtown district.

Twice every night a Studebaker service wagon, fitted out with all sorts of equipment, makes the rounds of Studebaker cars, while the owners are indoors. Those to which any form of service is administered are tagged a card specifying just what was done. Service given is without charge to the owner. The service car operates on a regular schedule and it takes about 2 hr. to make the trip.

If the motor is hard to start, as on a cold night, it is warmed up. If the tires are low, they are either inflated, or in case of a puncture, a new inner tube is put in and the owner is notified to call for his old tube. If lights are weak, the bulbs are replaced, or if necessary, the batteries are changed and the owner is instructed to call for his own next day.

If the motor is missing, new spark plugs are put in and the engine is tuned up generally. If snow or rain started to fall after the owner left his car and the top is down, the service crew raise it. If the gasoline supply is too low, 1 gal. is put in the tank.

Dallas Automobile Dealers to Form Common Defense

DALLAS, TEX., Feb. 11.—Dallas automobile dealers representing factories as distributors over the State of Texas are expecting to meet and form a common defense against the views of Attorney General B. F. Looney on their system of arranging selling contracts in which he charges they violate the Texas Anti-Trust Law.

This belief was freely expressed in Dallas to-day following the filing of another suit against the Hupmobile company at Austin late Tuesday afternoon, and the filing of similar suits two weeks ago against the Houston Motor Car Co. of Houston and the Munger Automobile Co.

Automobile men in Dallas to-day declared emphatically that the automobile industry of Texas centered at Dallas, and, representing the investment of millions of dollars, would be destroyed unless the views of the Attorney General are not changed and he does not pursue some other course. It is also predicted unless something is done that many of the big companies would leave the State instead of building their factories and assembling plants in Texas. At the present time local dealers declare that business is blocked and no contracts are being made. Dallas dealers declare they have agents who work in a prescribed territory, and that contracts can hardly be made otherwise.

Late Wednesday afternoon advices were received in Dallas that the Attorney General had also filed suit against the Studebaker Corp. and the Willys-Overland Automobile Co. This action came a big surprise in Dallas. Both companies had planned to establish branch factories in Dallas. This may alter their plans, as under the present work of the Attorney General automobile men declare that the automobile industry in Texas is doomed. The action of the Attorney General has come to Dallas dealers like a thunderbolt.

U. S. Government Truck Bids Open March 6

WASHINGTON, D. C., Feb. 12—The Secretary of the Treasury, through the general supply committee, has sent out an invitation to gasoline and electric motor truck makers and dealers to submit bids, on March 6, for furnishing the executive departments and independent government establishments in Washington with a quantity of trucks during the next fiscal year, beginning July 1. The gasoline trucks will have a capacity of 1000 lb., 1500 lb., 2000 lb., 3000 lb., 2 tons and 3 tons. The electrics will have the same capacity. Rigid specifications have been drawn for the above mentioned trucks, and bidders will be required to strictly abide by them.

Kleiber Truck to Double Plant

SAN FRANCISCO, Feb. 10—The motor truck industry in California is steadily improving and as a result the business of the Kleiber Truck Co. of San Francisco, builders of the Kleiber truck, has increased to such proportions that the local concern has been forced to seek larger quarters. The factory has purchased a piece of land at Eleventh and Folsom Streets covering an area of 205 ft. on Folsom and 275 ft. on Eleventh Street and will immediately start the erection of a one-story fireproof structure that will enable it to more than double its present output.

The Kleiber company is a local stock corporation headed by N. Kleiber with A. Hammersmith as general manager.

Toledo Show Sales Large

Dealers Estimate Demand of 22,100 Cars Up to July

TOLEDO, OHIO, Feb. 12—The eighth annual Toledo automobile show which closed to-night, was, moderately speaking, at least 100 per cent better from every point of view than any of its predecessors.

Sales as reported by the exhibitors were from 75 to 300 per cent better than in 1915. Retail sales especially were far ahead of what had been done at last year's show and this is directly due to the very large number of farmers and others from the rural districts who came from all over the State and from other States.

It is conservative to estimate that the number of cars which the dealers expect to dispose of by the end of the 1916 selling season, which means next July, is 22,100. This to make it clearer, refers to the total sales of 1916 cars, from the beginning of the season or the middle of 1915.

Out of the 22,100 cars which are expected to be sold 17,100 are credited to eight concerns or distributors, which leaves a total of 7000 to be sold by the other thirty or thirty-five dealers with headquarters here. All told about seventy different makes of passenger and commercial cars are handled in the city.

Agents' Territory Varies

The size of the territory of the local agents varies a great deal. The Blevins Auto Sales Co., for instance, which handles the Studebaker, has nearly all of Ohio, all of West Virginia and Kentucky, part of Michigan, Virginia and Indiana. It is the biggest of all Studebaker distributors and expects to dispose of 5000 cars this season. The Dodge agent, H. W. Lancashire, has only five counties within which to sell the 500 cars he has thus far contracted for. The Maxwell and Jeffery distributor, the Landman-Griffith Co., has twenty-two counties of Ohio and expects to dispose of 2000 or more cars. The Roberts-Toledo Co., Ford agent, has contracted for 4000 cars and has seven counties to sell them.

It is hardly necessary to give some reasons why the local agents expect to sell on an average more then 100 per cent more cars during the season. In their territory just like in that handled by the Cleveland dealers, or the Detroit agents, or those from Minneapolis, or Buffalo, every line of business, every industrial concern, every bank, every farmer, has been doing greater business, has been making more money. There is no such thing as pointing out merely to one or two or half a dozen particular products, whether of the farm or from the factory, which have or are causing this increased automobile business. As H. W. Blevins, the Studebaker distributor, says, it is a general condition all through the country, embracing every business, every industry, and this cannot justly be said to apply for instance to the steel mills, or to the sugar industry, or the munitions industries. It all is interwoven. One has caused the other to grow and thus it concerns all the industrial activities of the country.

Packard to Pay for Employees' Citizenship Papers

DETROIT, MICH., Feb. 11—The Packard Motor Car Co. will pay the fees required of any of its alien employees who may desire to take out first papers toward American citizenship. This follows the announcement made Jan. 31 to the effect that only American citizens, or those of foreign birth who have relinquished their foreign citizenship and who have filed their applications for citizenship, will be given promotions to positions of importance, and that loyalty to the United States is a prerequisite to employment.

The company offers practical help in training foreign-born employees to become citizens. One class in English for foreigners is being conducted several nights a week at the factory, and two more classes are in preparation. Two welfare department men are studying the best methods of teaching English, to be able to qualify as instructors.

Vim Motor Truck Adopts Packard Scheme

PHILADELPHIA, PA., Feb. 12—The Vim Motor Truck Co., this city, has given notice that the Packard anti-hyphen scheme would be put into effect immediately in its plant. It has given notice that it will not advance men who fail to take out naturalization papers and file them with a view of becoming citizens of this country.

Tractor Show for Des Moines

DES MOINES, IOWA, Feb. 12—The Committee on Agriculture of the Des Moines Chamber of Commerce is arranging for the first annual Iowa tractor show to be held here this fall. A 1200-acre tract of land west of the city will be leased for the tractor demonstrations. Des Moines is to be on the midwest circuit of tractor shows. E. T. Meredith, publisher of *Successful Farming*, is chairman of the committee in charge of the arrangements.

Freight Car Shortage Becomes Serious Problem in Detroit and Toledo

Flats and Other Types of Car Are Adapted to Take Automobiles—Dealers Urged to Unload Promptly—January Shipments Break Records

DETROIT, Feb. 12—In spite of a serious handicap due to the shortage of automobile freight cars, Detroit automobile manufacturers managed to ship approximately 58,800 motor cars of the passenger type during January. This figure was obtained by a careful canvass of the concerns here and is a close approximation to the actual number. Yet this rather large shipment would have been much greater had the makers been able to secure all the railroad cars they wanted in which to convey the vehicles to their destinations. Although in many cases the number of automobiles that left the city was greater than ever before in the history of the concerns in question, there are other big producers whose shipments were curtailed as much as 40 per cent by the lack of railroad cars. One big maker, for instance, shipped a little over 3500 automobiles, and would have been able to ship 5000 could the freight cars have been secured.

Yet with this shipping situation and the materials markets troubling them, the car makers nevertheless enjoyed the largest January in the history of the business here, taking the industry collectively. It is an unusual thing for dealers to be crying for cars at this time of the year, and never before have they been so insistent for them when the winter months were on. In fact, so anxious have some of them become for cars that they have actually driven them over the snow-covered roads to their own towns rather than wait for freight shipping.

Number of Carloads

The traffic department of the National Automobile Chamber of Commerce has reported total carload shipments for the whole United States for January to be 18,054. Although in some cases less than five automobiles make up a carload, and in others the number is greater, it seems logical to say that each freight car would average five machines. On that basis, the number of freight carloads leaving Detroit in January was 11,760. This figures to pretty near 65 per cent of the total number.

However, there can be no disguising of the fact that freight conditions are bad. In most cases the automobile freight car is a special type, and while it is of use to other lines of industry as well as to the automobile maker, the latter is not in so good a position, for it is hard for him to utilize the other types of cars. But necessity has forced the traffic departments of the big companies to take whatever railroad equipment they can secure quickly.

Utilizing What They Can Get

As a result it is not uncommon to see big shipments of motor vehicles on flat cars, and in some cases they are even utilizing gondola and other types of coal cars. These they box over and really make very presentable box cars out of them. Some of the makers who have made use of flats are the Studebaker Corp., Maxwell, Paige, the Overland in Toledo and the Velie at Moline, Ill. Wherever possible these flat cars have so far been used only for the shipping of export cars to the coast. That is, the export machines are very tightly boxed and no harm can come to them through open shipment in similar fashion to harvesting machinery, etc. Where the run is comparatively short, Studebaker has been using flats in conjunction with heavy tarpaulins which they use very carefully to cover the cars against any weather conditions. The use of gondola cars is perhaps the most unusual adaptation of whatever can be secured in the way of railroad rolling stock.

According to the traffic bureau statistics, there are in use by the American railroads at the present time 68,235 automobile freight cars, and there is prospect of 10,000 more being added to this equipment in the very near future. This will give an enormous equipment designed for the special service of the automobile industry, which to-day has developed to the point where it is one of the chief sources of freight revenue of the railroads, but even with the added number it is doubtful if the supply will keep pace with motor car production. The railroads seem to be doing all they can to help the movement of motor cars, but they did not anticipate the demand and, although they have hastened to build more equipment, the difficulty of getting material has held up the placing of the additional freight cars in service. As a notable example of what the railroads are doing, it might be mentioned that the Santa Fe and other Western roads are sending trains of empties back to the automobile centers instead of holding them at their destinations for loads to take back.

In line with the endeavors of the railroads, the car makers are instructing their dealers that under no circumstances must they use the freight cars for storage of their machines, but they must unload them immediately on arrival. In the past this has been one cause of delay in getting the cars back, but it is believed that this situation has greatly improved, for the dealers recognize the need of coöperation for the good of all concerned.

A considerable factor in the present dearth of freight cars is the tie-up in the East, according to one of the traffic men here. His concern has sixty-nine carloads tied up in Norfolk, Va., waiting to be loaded on steamers, and doubtless there are many other such instances. There is no place to store the automobiles pending their being put on the ships, and consequently they are letting them lie in the freight cars. This is quite prevalent at all the export points, and is being practised by many of the makers. Due to this and other causes of congestion in the East, the Lake Shore, for instance, has been holding up shipments for eastern points as far back on its lines as Toledo. Then, too, other industries are demanding a great many cars, war shipments are very large, and the whole combination of circumstances at the present time is making it a puzzle to move the output. One day last week, as an instance, there were only fifteen automobile freight cars received in the whole city of Detroit. That, however, was an exceptionally bad day.

Shipping Costs More

A sidelight on the very serious shipping situation is the added cost to the car makers of each car shipped due to the troubles they have to go through in utilizing other than automobile box cars. Whenever flats have to be pressed into service, there is an additional item of expense where tarpaulins are used, for these have to be sent back to the factory. If it is necessary to box in a gondola car, there is a large cost item to be considered. Loading crews must be larger, and this adds to the cost. Taking everything into consideration, one big shipper of cars said that it costs from $2 to $3 more per automobile to ship them than it did when conditions were better and it was easier to get the right sort of freight equipment.

It is indeed deplorable that at a time when it seems impossible to meet the demand for cars, the makers should be handicapped by the shipping trouble. It has meant, and will continue to mean, curtailment of the production of cars to adjust the output to transportation facilities.

Evans Poyer Works Mgr.

MENOMINEE, MICH., Feb. 8—G. M. Evans, formerly with Dodge Bros., Detroit, has been appointed works manager of the D. F. Poyer Co., manufacturers of the Menominee trucks.

Buyer of Chalmers Car on Installment Plan May Have Immediate Delivery

Agricultural Credit Co. Purchases $5,000,000 of Installment Notes—6 Per Cent Interest—Fire and Theft Insurance for a Year Included in Sale of Car

DETROIT, Feb. 11—The Chalmers Motor Co. has made arrangements with the Agricultural Credit Co., Chicago, for the financing for dealers on the time sales of the Model 6-30 Chalmers car. This is the model which was brought out late last year and which sells for $1,050. By the plan which has been worked out the customer is required to pay $450 cash on receipt of the car and $32.50 to cover the cost of insurance for one year and interest. The balance he pays in eight monthly payments of $75. The item of $32.50 covers interest on the notes at 6 per cent and the actual cost of the insurance for a year against fire and theft on 80 per cent of the list price of the car.

The Agricultural Credit Co. buys the notes from the dealer or distributor less a very small brokerage. This concern is a large banking house which has carried on a farmer's credit plan for a number of years, enabling the farmer to finance his farm until revenues from crops came in, and its action in extending its field to cover automobiles is another instance of the recognition which high banking circles are taking of the motor vehicle industry. The directorate and official roster of the Agricultural Credit Co. contain the names of some of the foremost bankers of this country, and recently the directors authorized the purchase of $5,000,000 of installment notes taken on time sales of cars.

Pontiac Drop Forge Purchased by Jackson Capitalists

PONTIAC, MICH., Feb. 9—The Pontiac Drop Forge Co. has been purchased by Jackson capitalists, among them being Paul Leidy, secretary of the Jackson Board of Commerce, and Leigh Lynch, well known in Jackson automobile quarters. The capital stock of the company has been increased to $150,000. It is said that the production facilities will be greatly increased.

Monroe-Chevrolet Merger Denied

FLINT, MICH., Feb. 9—The Monroe Motor Co. will not be absorbed by the Chevrolet Motor Co. as has been rumored for some time. In fact, arrangements have been completed for the production of 10,000 Monroe cars this year and a new light five-passenger model will soon be announced. Its chassis and motor will be similar to those of the present model.

There have been negotiations between the Monroe and the Chevrolet companies concerning a possible consolidation of the two companies, but President R. F. Monroe states that this is a matter of the past and that the Monroe company will from now on become more active than ever before. That part of the plant which last year had been leased by the Chevrolet company is now again occupied by the Monroe company.

Pending the completion of the new Chevrolet axle plant the Monroe company will continue to make axles for the Chevrolet. It was also arranged that the bodies for the new Chevrolet Four-Ninety runabout will be made by the Monroe Body Co. in Pontiac. The Monroe company, which now employs 130 men, expects to have 700 on its payroll by June 1. Mr. Monroe has disposed of his stock in the Chevrolet company to Mr. Durant.

Supreme Court May Consider Price Maintenance Decision

WASHINGTON, D. C., Feb. 12—Accessory manufacturers and dealers will be interested to learn that for the third time the Supreme Court of the United States has been asked to consider the power of manufacturers of patented articles to control the price or conditions on which the public may obtain their product.

Attorneys for a prominent New York department store have filed with the court application for a review of the decision of the New York Federal Court of Appeals holding against its right to sell to the public at cut rates certain talking machines and records.

The problem of the right of patentees to control the resale of their goods to the public has proved one of the most perplexing questions the court has had to deal with in 10 years. First, in 1912, Justices Lurton, McKenna, Holmes, and Van Devanter, then a majority of the court, decided that a mimeograph manufacturer could control the kind of supplies to be used by the public on his machine. Chief Justice White, Hughes and Lamar dissented. Justice Day was absent and there was one vacancy.

About 2 years later Chief Justice White and Justices Day, Hughes, Lamar and Pitney decided a medicine manufacturer could not control the resale price at which the public bought its patented articles. Justices Lurton, McKenna, Holmes and Van Devanter then dissented. Justice McReynolds, who succeeded Justice Lurton, has not participated in any cases of this kind.

The New York store now claims that the principles of the medicine manufacturer case should be applied to "licenses to use" upon the payment of "royalties" because the "licenses" were only a cloak for a sale.

The court's decision will be awaited with interest by the automobile accessory trade.

World's Salesmanship Congress in Detroit July 9-13

DETROIT, MICH., Feb. 14—The World's Salesmanship Congress will be held here July 9 to 13. This was finally decided at the general committee's meeting today.

Bill to Bar Trucks Weighing Over 8 Tons from Maryland

ANNAPOLIS, Md., Feb. 12.—Under the provisions of a bill introduced in the General Assembly here no commercial motor vehicle with capacity of more than 8 tons will be permitted to operate in the State. The bill also proposes to greatly increase the license fees paid by all commercial vehicles. At present all the commercial vehicles in the State pay the flat rate of $3.00 a year. This bill which has been introduced provides that cars of this kind with capacity of not more than 1 ton pay $15 a year; those of more than 1 and less than 2 tons, $20; $25 for those between 2 and 3 tons; $30 between 3 and 4 tons; $35 between 4 and 5 tons; $40 between 5 and 6 tons; $45 between 6 and 7 tons, and $50 between 7 and 8 tons.

Olds Will Not Drop Four

LANSING, MICH., Feb. 9—According to general sales manager J. V. Hall, of the Olds Motor Works, the manufacturing of the Oldsmobile four will continue as long as there is a public demand for these cars and notwithstanding the great demand for the Oldsmobile eight. The statement was brought about on account of rumors that the four will be discontinued.

Elliott Is Mais Manager

INDIANAPOLIS, IND., Feb. 14—E. M. Elliott has been appointed general manager of the Mais Motor Truck Co. division of the Premier Motor Corp., Indianapolis. Plans have been completed to increase the production of the Mais company, and to add to the line of trucks hitherto manufactured.

Assembly Plant for Regina

REGINA, SASK., Feb. 11—The newly amalgamated Willys-Overland Automobile Co. and the Russell Motor Co. have made Regina headquarters for western Canada, and will erect an assembling plant.

To Finance Studebaker Sales

Commercial Investment Trust to Help Dealers on Deferred Payments—⅓ Down

Detroit, Mich., Feb. 11—Arrangements have just been completed by the Commercial Investment Trust, with offices in New York and St. Louis, whereby Studebaker dealers have been placed in an advantageous position to finance the sale of Studebaker cars on deferred payments. On either of the Studebaker models the dealer is able to offer to sell the car to the customer for one-third down and the balance in eight equal monthly payments. The buyer of the car pays the regular list price.

It often develops that an automobile buyer is anxious to get his car immediately but cannot pay the full amount at the time. Because of anticipated income, he can pay part and wishes credit for the balance. The plan of the Commercial Investment Trust enables the dealer to handle such sales without tying up his own capital, and is a particular advantage for the dealer working on limited capital. The notes which the dealer gets from his customers are converted into cash by the Commercial Investment Trust, which collects the notes.

The arrangement with the Commercial Investment Trust is not intended to interfere with local banking arrangements which Studebaker dealers have, but is a provision for more extensive banking facilities, at the option of the dealer.

The Studebaker Corp. states that it has no financial interest whatever in the Commercial Investment Trust, having simply been instrumental in effecting the plan for the benefit of its dealers. The Commercial Investment Trust and the Studebaker dealers handle their banking arrangements independently.

Gasoline Up in West

New York City, Feb. 11—Gasoline prices in this city, which reached the 23-cent-a-gallon mark, wholesale, last week, show no indications as yet of a further rise.

In Oklahoma and Colorado, this fuel has been advanced 1 cent to 22. Prices in Montana have been advanced ½ cent. South Carolina prices have risen 1 cent; now ranging from 24½ to 26½ cents.

In Portland, Ore., gasoline, tank wagon basis, is now selling at an advance of 1 cent to 17½. In Los Angeles the price prevails at 17 cents, just 1 cent higher. Louisville, Ky., gasoline is selling, tank wagon basis, at 21 cents at an advance of 1 cent.

The price of gasoline has been advanced 1 cent a gal., tank wagon basis, to a minimum of 22½ cents and a maximum of 25½ in Arizona, to a minimum of 22 cents and a maximum of 24 cents in Florida, and to a minimum of 22½ and a maximum of 25 in Georgia.

15 Per Cent Dividend Declared by Streator Trustees

Streator, Ill., Feb. 14—Creditors of the defunct Streator Motor Car Co. were notified this week by E. U. Henry, referee in bankruptcy, that the trustees have collected $38,633.61, sufficient to declare a dividend of 15 per cent. A meeting was held on Feb. 16 to ratify this dividend and also to discuss the disposition of the remaining real estate belonging to the bankruptcy estate. This real estate has been appraised at $75,000 but the trustees have been unable to receive any substantial bid for it. It is desired to wind up the concern, as all the assets have been realized upon with the exception of the real estate mentioned.

Market Prices Steady

New York City, Feb. 15—With the exception of a further rise of 2 cents a pound to 56 cents for aluminum and a 10-cent rise in lead, market prices last week were fairly steady with few changes. Rubber was a little higher, though it has not as yet reached the high mark of several months ago. Para rubber is now quoting at 78, while the Ceylon, first latex pale crêpe grade, is quoting at 90. The demand for rubber has increased from the manufacturers. Most of the sales, however, were made on spot.

Though no change has been made in copper prices, the market in that metal is active with the movement of quotations continuing decidedly upward. It has been estimated that domestic consumption is now at the rate of about 150,000,000 lb. a month.

Crude oils have been very steady during the past two weeks, Pennsylvania holding at $2.35 a bbl. and Kansas crude at $1.30. Gasoline still quotes at 23 cents a gal.

Mason Tire & Rubber Co. to Make Capital $1,000,000

Kent, Ohio, Feb. 11—The Mason Tire & Rubber Co. has awarded contracts for nearly $80,000 worth of buildings and equipment. The directors have determined to raise the capitalization if the stockholders approve it.

At a meeting of the board of directors in the company's offices a resolution was passed authorizing an increase in capitalization to $1,000,000, and calling for a general stockholders' meeting within a few weeks to ratify and approve the action.

Studebaker Declares Extra Dividend of 1 Per Cent

South Bend, Ind., Feb. 14—The Studebaker Corp. directors declared the regularly quarterly dividend of 1¾ per cent of preferred stock and a quarterly dividend of 1½ per cent with an additional extra dividend of 1 per cent on common stock. These dividends are payable on March 1, 1916, to stockholders of record at the close of business Feb. 19, 1916.

Johns-Manville Elects Directors

New York City, Feb. 14—At the annual meeting of the H. W. Johns-Manville Co., L. R. Hoff, W. R. Seigle, T. T. Lyman, H. R. Trainer, Harry Gillett, F. B. Smith, J. E. Meek, H. R. Wardell and J. W. Perry were elected members of the board of directors.

M. & A. M. Adds Seven Members

New York City, Feb. 11—At a meeting of the board of directors of the Motor and Accessory Manufacturers, held in the association's offices to-day, the following concerns were elected to membership:

Blanchard Bros. & Lane, manufacturers of patent and enamelled leather, Newark, N. J.; Flint Varnish & Color Wks., manufacturers of varnish, paints, and enamels, Flint, Mich.; Harrison Mfg. Co., Inc., manufacturer of radiators, Lockport, N. Y.; Price Electric Devices Corp., manufacturer of lighting and ignition generators, starting motors and

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.54	.54	.56	.56	.56	.56	+ .02
Antimony	.44	.44	.44	.44	.44	.44	...
Beams and Channels, 100 lb.	2.17	2.17	2.17	2.17	2.17	2.17	...
Bessemer Steel, ton	34.00	34.00	34.00	34.00	34.00	34.00	...
Copper, Elec., lb	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl	9.35	9.45	9.02	9.62	9.57	9.35	...
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Manhaden, Brown	.51	.53	.53	.53	.53	.53	+ .02
Gasoline, Auto, bbl	.23	.23	.23	.23	.23	.23	...
Lard Oil, prime	.94	.95	.95	.95	.95	.95	+ .01
Lead, 100 lb	6.15	6.15	6.20	6.20	6.20	6.25	+ .10
Linseed Oil	.74	.74	.74	.74	.74	.74	...
Open-Hearth Steel, ton	35.00	35.00	35.00	35.00	35.00	35.00	...
Petroleum, bbl., Kansas, crude	1.30	1.30	1.30	1.30	1.30	1.30	...
Petroleum, bbl., Pennsylvania, crude	2.35	2.35	2.35	2.35	2.35	2.35	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.75	.75	.78	.77	.77	.78	+ .03
Rubber, Ceylon, First Latex, Pale Crepe	.84	.85	.90	.87	.87	.90	+ .06
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	41.38	41.00	41.38	41.20	41.20	41.50	+ .12
Tire Scrap	.06	.06	.06	.06¼	.06¼	.06¼	+ .00¼

battery charging outfits; automatic cut-out switches, Waynesboro, Va.; Syracuse Malleable Iron Wks., manufacturers of malleable iron castings, Syracuse, N. Y., and the Walker-Weiss Axle Co., manufacturers of automobile axles, Flint, Mich.

The Driggs-Seabury Ordnance Co., manufacturer of automobile parts, Sharon, Pa., was reinstated to membership.

Detroit-Wyandotte Elects Officers

WYANDOTTE, MICH., Feb. 11—At the annual meeting of the Detroit-Wyandotte Truck Co., which makes the Horner, the following officers were elected: G. A. Horner, president and general manager; Frank Marx, vice-president and treasurer; R. A. Parker, secretary. These officers and Otto Schmidt and M. C. Wick form the board of directors. Because the plant is to be enlarged and production facilities increased, no dividend was authorized.

Dividends Declared

Pratt & Whitney; quarterly, 1½ per cent on preferred, payable Feb. 15 to holders of record Feb. 9.

Maxwell Motor Co.; quarterly of 1¾ per cent upon first preferred, payable April 1 to stockholders of record on March 10.

Recent Capital Increases

TOLEDO, OHIO, Feb. 11—The Pilloid Motor Co. has increased its capital from $50,000 to $100,000.

CLEVELAND, OHIO, Feb. 11—The Ohio Rubber Co. has increased its capital from $250,000 to $300,000.

Security Prices Higher

General Motors Features Automobile Issues with 30-Point Gain—Chevrolet Is Up 4

NEW YORK CITY, Feb. 15—A better tone developed last week in the automobile and accessory issues. A majority of the issues showed substantial gains for the week with General Motors common the feature. This stock has been going steadily down from its high mark of over 500, its bottom price being under 425. Saturday it reached 475, going up 5 points over night and 30 points for the week. Chevrolet went up 4 points to 130. Overland common rose 1 point to 221 after a 19-point rise the previous week.

Deposits of Maxwell Motor warrants for conversion into first preferred stock are being received by the company steadily, and it is expected that a large proportion will have been exchanged by March 10, which is the stock of record date for the April 1 dividend on the first preferred. Holders of warrants must exchange before March 10 to receive this dividend. These warrants were issued in January, in payment of 14½ per cent back dividends on the first preferred stock.

Sales of the International Motor Co. in January increased 36 per cent over those of a year ago. Domestic sales for 1915 increased 20 per cent over 1914.

Activity in the rubber issues was more marked last week. Ajax went up 2¼ points; Goodrich common rose 1½ points, while its preferred went up 1 point; Goodyear common rose 3 points; and U. S. Rubber common and preferred went up 1½ and 1 points respectively. Kelly-Springfield's new common went up 1 point. Ajax reached a new high record of 72 7/8 in the outside market Monday on large sales. An officer of the company announces the completion of arrangements covering its requirements for the year, the largest stocks of crude rubber ever warehoused by that company, all purchased at prices which now protect the company's profits.

Detroit Exchange issues were exceptionally strong last week. Continental, General Motors and Studebaker featured with large gains. Continental, especially, has been a matter of much comment on the Detroit Stock Exchange. Thursday morning, Feb. 10, the stock was quoted at 292. Friday morning it rose to 327½ and at the close of the exchange there were bids at 350 and a few offerings at 360. Less than one month ago the quotation was 247 bid and 255 asked, or a gain of over 100 points.

General Motors Sales $74,000,000 in Six Months

NEW YORK CITY, Feb. 16—Earnings of the General Motors Co. for the six months ending Jan. 31 are reported to be equal to 150 per cent on the common stock. Gross sales increased 100 per cent, amounting to $74,000,000. Undivided profits were $13,000,000, also 100 per cent larger than in the preceding six months. These profits are sufficient to take up within $2,000,000 of the entire outstanding preferred stock of the company.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	70½	71	+2¼
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	..	85	84	87½	—1
Chalmers Motor Co. com	..	94	110	140	..
Chalmers Motor Co. pfd	91	94	99	101	..
Chevrolet Motor Co	..	..	130	132	+4
Electric Storage Battery Co	48	49	65	66	+3
Firestone Tire & Rubber Co. com	370	375	730	..	..
Firestone Tire & Rubber Co. pfd	109	111	112	..	..
General Motors Co. com	94	95	475	485	+30
General Motors Co. pfd	95	95½	113	115	+3
B. F. Goodrich Co. com	33	33¼	72½	73½	+1½
B. F. Goodrich Co. pfd	96¼	97½	113	114	+1
Goodyear Tire & Rubber Co. com	190	194	340	..	+3
Goodyear Tire & Rubber Co. pfd	101	102	116	117½	+ ½
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	22	25	..
International Motor Co. pfd	..	..	35	40	..
Kelly-Springfield Tire Co. com	112½	113	280	290	..
Kelly-Springfield Tire Co. com. (new)	..	..	71	73	+1
Kelly-Springfield Tire Co. 1st pfd	84	85	95	97	..
Kelly-Springfield Tire Co. 2d pfd	121	124	69	72	—2
Maxwell Motor Co. com	22¾	23¼	69½	70¾	—1
Maxwell Motor Co. 1st pfd	61½	62	87	88¾	..
Maxwell Motor Co. 2d pfd	25	25¼	51	53	—2
Miller Rubber Co. com	158	165	273	278	—1
Miller Rubber Co. pfd	101	103	115	117	+2
New Departure Mfg. Co. com	118	123	..	178	..
New Departure Mfg. Co. pfd	105½	106½	110	..	..
Packard Motor Car Co. com	..	100	165	175	—2½
Packard Motor Car Co. pfd	93	..	102	†104	..
Paige Detroit Motor Car	..	..	665	700	..
Peerless Motor & Truck Corp	..	..	26½	27	+ ½
Portage Rubber Co. com	30	36	65	70	..
Portage Rubber Co. pfd	80	85	107	109	..
Regal Motor Co. pfd	..	..	12	..	..
*Reo Motor Truck Co	11½	12	27	28½	..
*Reo Motor Car Co	24½	25¼	34½	35½	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	51	53	88	89	+3
Stewart-Warner Speed. Corp. pfd	100½	102	108	..	..
Studebaker Corp. com	40¾	47	153	155	+4
Studebaker Corp. pfd	95	96½	111½	114	+ ½
Swinehart Tire & Rubber Co	69	71	88	89	..
Texas Co.	71	73½	213	215	+8
U. S. Rubber Co. com	56½	57½	52½	53½	+1½
U. S. Rubber Co. pfd	102	103½	106½	107	+1
Vacuum Oil Co	188	192	217	222	—6
White Motor Co. (new)	..	..	50½	51	— ½
Willys-Overland Co. com	95	97½	221	223½	+1
Willys-Overland Co. pfd	95	97½	104	106	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Chalmers Motor Co. com	..	94	125	..	+5
Chalmers Motor Co. pfd	91	94	99	..	+2
Continental Motor Co. com	175	200	350	360	+60
Continental Motor Co. pfd	75	...	91	96	..
Ford Motor Co. of Canada	500	..	..	415	..
General Motors Co. com	93½	95½	460	490	+12½
General Motors Co. pfd	94	96	112	115	+2¼
Maxwell Motor Co. com	22	23½	69	71	— ½
Maxwell Motor Co. 1st pfd	60	62	87	90	+1
Maxwell Motor Co. 2d pfd	24	25	52	55	..
Packard Motor Car Co. com	..	99	160	..	—5
Packard Motor Car Co. pfd	95	..	..	104½	+1
Paige-Detroit Motor Car Co	..	..	665	700	..
*Reo Motor Car Co	25	25¾	34	35	— ⅝
*Reo Motor Truck Co	..	11⅝	..	28	— ¼
Studebaker Corp. com	44½	46½	153	156	+7
Studebaker Corp. pfd	95	97	109	114	..

INACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
*Atlas Drop Forge Co	..	25	32¼	..	..
Kelsey Wheel Co	195	215	465	..	+30
*W. K. Prudden Co	18¾	19¾	..	33½	..
Regal Motor Car Co. pfd	..	25	12½	..	+ ½

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*Par value $10. †And accrued dividend.

Corona Grand Prix April 8

Will Be Held Over 300-Mile Course—$12,000 in Prizes

Corona, Cal., Feb. 8—The Corona Grand Prix is to be staged on the Grand Boulevard around the city on April 8. The directors of the Citrus Belt Racing Association, the organization which is guaranteeing the $12,000 purse for the race, announced that it could not stage the race on March 17, as originally planned, when the extent of the damage to the roads caused by the recent storms was made known. Then, when the decision of the Motor Cups Holding Association was published, refusing the International Grand Prix to Corona, the local boosters decided that they had better pass up the race this year. At a special mass meeting of the citizens it was decided to reconsider this action, and the racing association directors met and decided to stage the race on April 8 over a 300-mile course for the original $12,000. The official name of the race is to be decided upon at a later date, but it is almost certain that the event will be known officially as the Corona Grand Prix.

Elgin May Try for Vanderbilt and Grand Prize

Chicago, Ill., Feb. 15—At a meeting of the Elgin Road Racing Association, scheduled for Feb. 23, plans will be made for the annual meet on the Watch City course. There is some talk in the air of Elgin applying for the Vanderbilt cup and Grand Prize and running these two classics at the same time that the Elgin National trophy and the Chicago Automobile Club cup are hung up for competition. If this suggestion is favorably acted upon, Elgin will have a week of road racing, the meet opening and closing on Saturday with events on the intermediate Tuesday and Thursday. The prize money will be the same for each of the four contests, $6,000, and $20,000 of the $24,000 total purse will be raised by the sale of 2000 tickets, listed at $10 each and entitling the holder to admission to all four events.

Maxwell Racing Cars to Have New Bodies

Detroit, Mich., Feb. 8—New bodies, different color scheme, and more speed will characterize the appearance upon the race courses this year of the four Maxwell racing cars now owned by the Prest-O-Lite Co., Indianapolis.

The bodies will be narrower and the driver and mechanic will ride much lower than during the past year. Red and white will be the colors. According to Eddie Rickenbacher, who will be captain of the team, the cars will be capable of going 4 or 5 miles faster per hour, which means 109 to 110 m.p.h. Rickenbacher expects to have two teams, racing pairs alternately at different meetings. Ray Harroun, who designed the cars and supervised their construction, will give advice to Rickenbacher. Whatever improvements or parts for the cars are needed will be built at the plant of the Maxwell Motor Co. here.

Santa Monica Wants Grand Prix and Vanderbilt

Santa Monica, Cal., Feb. 8—There may be a race on the famous Santa Monica road race course in 1916. The Santa Monica Chamber of Commerce has endorsed the movement to secure the International Grand Prix and the Vanderbilt Cup Race for Santa Monica next November. The course is now being put in the best possible condition, with nine months in which to prepare for the speed carnival.

The revival of automobile racing at Santa Monica came as a surprise to the most enthusiastic sportsmen of the beach city. Last year all efforts at arousing interest in racing fell flat. Three times this year, meetings were called for the purpose of stirring up interest in the motor sport, but there was nothing done toward putting on a race. But when the Motor Cups Holding Association refused to grant either the Vanderbilt Cup or Grand Prix for any course less than 8 miles in length, Santa Monica woke up. Two meetings were held and a committee was appointed to make formal application for the two races which were so successfully staged at Santa Monica in 1914.

Sioux City To Buy Cars

Sioux City, Iowa, Feb. 16—E. R. Schultz, manager of the Sioux City speedway, now is negotiating for the purchase of two Duesenberg cars, which will be constructed by Fred Duesenberg of St. Paul and entered in the various speedway events this season under the name of the local racing association. This deal, which is practically closed, will bring the total of speedway-owned cars to twelve. Indianapolis has eight, the four Maxwells, the two Peugeots and the pair of Premier Specials, and New York two Delages, one purchased by Harry Harkness in the fall and the other by Carl Limberg in France this winter.

Continental Needs More Men

Muskegon, Mich., Feb. 10—The shortage of mechanics and other skilled workers is said to be the reason why the Continental Motor & Mfg. Co., this city, is advertising extensively throughout the country for such workers. The business here is growing to such importance that within the next twelve months the company is expected to have 5000 men or more on its payroll which is at least one-third more than at present.

It is said the daily output of motors now averages 175, whereas it should be at least 225 per day. At the former figure and based upon 300 working days the output for the year would be 52,500 motors while at the higher figure or 225 it would be 67,500.

Arrangements and plans are already under way to provide for an average daily output of 400 motors during 1917 which is at the rate of 120,000 for the year.

Wheeler is President of Twin City Motor Speedway Co.

Minneapolis, Minn., Feb. 14—F. H. Wheeler has been elected president of the Twin City Motor Speedway Co. H. E. L. Habighorst was elected vice-president, and E. E. Gates, secretary and general counsel.

It was definitely decided to hold the opening race of the 1916 season May 31 and the 300-mile race July 4. A date for the fall races will be decided upon at a later meeting of the company.

N. Y. City Fines Total $417,299

New York City, Feb. 14—Fines from traffic violations and speeding in 1915 cost automobile owners just $417,299, of which $223,618 was from traffic division and $193,681 from the motorcycle squad.

From the office of Police Commissioner Woods the following statement of the total number of arrests in 1915 and the amount of fines for traffic violations is given:

	Traffic Divisions	Motorcycle Squad
Arrests and summonses .	22,983	13,319
Convictions	22,554	13,119
Fines	$223,618	$193,681

Disbrow to Handle Marmon

Cleveland, Ohio, Feb. 11—Louis Disbrow, the well known racing driver, has quit the racing game for good and has organized the Louis Disbrow Motor Car Sales Co., which will handle the Marmon in Cleveland and nine adjoining counties. The officers of the newly organized company are: Louis Disbrow, president; M. A. Hanna, vice-president; D. B. Hanna, Jr., treasurer and Fred Grabien, secretary.

U-S-L To Add 1150 Men

New York City, Feb. 11—The United States Light & Heating Co., which now has 850 men on its payroll will increase its force within the next two months to at least 2000.

Factory Miscellany

Continental Top Makes Lease—The Continental Auto Top Co., St. Louis, Mo., has leased a building at 818 North Leffingwell Avenue, St. Louis, and will remodel the same for the manufacture of automobile tops.

Knapp Top to Build—The A. C. Knapp Co., manufacturer of automobile tops, has awarded the contract for the construction of a one-story addition to its plant at Detroit, Mich.

Chandler to Add—The Chandler Motor Car. Co., Cleveland, Ohio, will erect an addition to its plant at 300 East 131st Street, to cost $18,000. The addition will be 62 by 162 ft., with foundations sufficiently strong to carry additional stories.

Parish & Bingham to Build—The Parish & Bingham Co., Cleveland, Ohio, is to spend $250,000 on several new factory buildings. Present intentions are to build a fireproof addition, 100 ft. wide, to the main building and a small addition to the power house. Later the company intends to build a service station 80 by 220 ft. and three stories high and a steel storage building 54 by 87 ft., one story high.

Plymouth Motor Castings Plant Increased—The production facilities of the Plymouth Motor Castings Co., Plymouth, Mich., are being increased through the addition of equipment and enlargement of the plant.

Eagle-Macomber Plant in Sandusky—The Eagle-Macomber Motor Car Co. will establish a plant and main office in Sandusky, Ohio. The building formerly occupied by the Suspension Roller Bearing Co. will be used for assembling purposes.

To Make Brass Castings—Gallagher, Hutchinson & Campbell Bros., Muskegon Heights, Mich., have secured a factory at Marshall, Mich., and will remodel it for the manufacture of iron, brass and aluminum castings for automobiles.

Price Electric Devices to Build—The Price Electric Devices Corp., Waynesboro, Va., will establish a plant at Basic, Va., for the manufacture of lighting and ignition systems, starting motors and other automobile equipment.

Light Car Axle to Move—The Light Car Axle Co., successor to the Clark Delivery Car Co., 1035 East Seventy-sixth Street, Chicago, Ill., will move its plant to Kalamazoo, Mich. New equipment will be added.

Auto Trimmings Co. Builds—The American Auto Trimmings Co., Detroit, Mich., is building a five-story reinforced concrete plant at a cost of $45,000.

Long Co. to Add—The Long Mfg. Co., Detroit, Mich., maker of automobile radiators, will build an addition to its plant.

Turner & Moore to Build—The Turner & Moore Mfg. Co., Detroit, Mich., maker of automobile parts, is having plans prepared for a factory, 75 by 300 ft. New machinery will be installed, including power equipment.

Ford Kansas Plant Enlarged—Additions to the assembling plant of the Ford Motor Co., Kansas City, Mo., that have been under construction since last May, practically doubling the capacity, have just been completed and the output has been increased from seventy-five or 100 cars a day to 130. The output will be increased later to 150 cars daily.

The opening of the addition brought with it an increased employment of about one hundred workmen in the Kansas City plant.

The Automobile Calendar

Feb. 12-19	Albany, N. Y., Show.
Feb. 12-19	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.
Feb. 14-19	Elmira, N. Y., Show, Elmira Auto Club.
Feb. 14-19	Nashville, Tenn., Show, Hippodrome. J. A. Murkin, Mgr.
Feb. 14-19	Des Moines, Iowa, Show, Des Moines Auto Dealers' Assn.
Feb. 14-19	Winnipeg, Man., Show, Ford Plant, Winnipeg Motor Trades Assn.
Feb. 16-19	Rockford, Ill., Show, Coliseum, Motor Car Dealers Assn.
Feb. 17-19	Racine, Wis., Show, Lakeside Auditorium.
Feb. 19	Newark, N. J., Show, First Regiment, Armory, C. G. Fitzgerald, Mgr.
Feb. 19-26	Harrisburg, Pa., Show, Emerson-Bruntingham Co.'s Bldg., Capital City Motor Dealers' Assn.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Anderson, Ind., Show, Anderson Automobile Dealers' Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory, B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Tacoma, Wash., Show, Tacoma Automobile Club, Glide Rink. C. A. Collins, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 23-26	Bay City, Mich., Show, Bay City Automobile & Accessory Dealers' Assn.
Feb. 28-March 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Utica, N. Y., Show, Utica, Automobile Bldg., Utica Automobile Trade Assn.
Feb. 28-March 4	Cedar Rapids, Ia., Show, Cedar Rapids Automobile Dealers' Assn.
Feb. 28-March 4	Paterson, N. J., Fifth Annual Show, Auditorium.
Feb. 29-March 4	Ft. Dodge, Iowa, Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March	Danville, Ill., Show.
March 5	Los Angeles, Cal., Speedway Race, Ascot Speedway Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline: Tri-City Automobile Trade Assn.
March 8-11	Mason City, Iowa, Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 11-18	Boston Automobile Show, Mechanics Bldg.
March 15-18	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 8	Corona, Cal., Race.
April 10-15	Seattle, Wash., Show, Arena.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
Apr. 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show, Automobile Industries Assn.
May	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 30	Indianapolis Speedway Race.
May 31	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race.
June 28	Des Moines, Iowa, Speedway Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
Aug. 5	Tacoma Speedway Race.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Race.
Sept. 4	Indianapolis Speedway Race.
Sept. 16	Providence Speedway Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.

The Week in the Industry

Godheart All-Steel Sales Manager—Louis Godheart, who was traveling representative of the Lewis Spring & Axle Co., Jackson, Mich., has been appointed sales manager of the All-Steel Motor Car Co., Macon, Mo.

Pearson Promoted—C. E. Pearson, who for the past 15 years has been electrical engineer of the National Coil Co., Lansing, Mich., has been appointed general manager.

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Dealers

News Items from Alabama—The Brownell Auto Co., Birmingham, Ala., has secured the agency for the Studebaker. This concern also handles the Ford in that territory. Joe Anderson, who formerly was the Studebaker agent, has acquired the Franklin line.

Willingham Sons' Manufacturing Co., who are the makers of Superior trucks in Atlanta, have established a factory branch at Birmingham, Ala., at 213 Twentieth Street, South. H. R. Leadbetter will have charge.

American Malleables' Detroit Office—The American Malleables Co., with plants in Owosso, Mich., and Lancaster, N. Y., has opened an office in Detroit, in the Kresge building, in charge of assistant sales manager P. G. Smith.

Represents Acme Die Castings—Niedermiller & Ewald, 965 Woodward Avenue, Detroit, Mich., have been appointed Michigan and Ohio representatives for the Acme Die Casting Corp., Brooklyn, N. Y.

Ohio Trade Items—The Columbus branch of the Midgley Tire Co., formerly located at 224 North Fourth Street, has moved to 85 East Gay Street, with E. E. Loeer in charge as manager.

Formal renewal of the contract between the Maxwell Motor Co. and the Everitt Auto Sales Co. of Columbus, by which the latter concern continues as central Ohio distributor for the Maxwell, has been made.

The Lober Art Brass & Specialty Co, Toledo, has occupied its new home at 126 Eleventh Street. The concern makes and repairs radiators and automobile lamps.

Harding Takes Showroom—The new Harding Motor Car Co. has taken a temporary showroom at 1824 Euclid Avenue, Cleveland, Ohio, and expects to close negotiations for its permanent sales quarters and factory site in the near future.

Motor Men in New Roles

Cornell Appointed Cleveland Mgr.—E. J. Cornell has been appointed manager of the automobile tire department of the Haury Hardware Co., which is distributor in Cleveland of Goodyear tires.

Hubbard Promoted—H. H. Hubbard has been appointed assistant manager of the territory west of the Mississippi River by the United States Tire Co., New York City. He has been manager in St. Louis, Mo., for the company for four years, and will continue to make St. Louis his headquarters. O. S. Johnson, who has been Texas manager for that company, succeeds Hubbard at the head of the St. Louis branch.

McKay Joins Cassidy—D. C. McKay has resigned as Detroit factory representative of the H. W. Johns-Manville Co. to represent Edward A. Cassidy, New York City.

Titus Goes to Buffalo—F. E. Titus has been appointed general manager of the Goodrich branches in Buffalo, Rochester and Syracuse, his headquarters being in the first city named. He was for a long time manager of the Pittsburgh branch of the company.

Prey Scripps-Booth Purchasing Agent—H. C. Prey, who was assistant purchasing agent of the Scripps-Booth Co., Detroit, Mich., has been made purchasing agent to succeed A. J. Downey, who will henceforth devote all his energies to the Scripps Motor Co., Detroit.

Harger Succeeds Corman—R. H. Harger is now in charge of the advertising department of the Saxon Motor Car Corp., Detroit, Mich., in place of E. W. Corman, who resigned.

Levey in Accessories Business—W. B. Levey, formerly buyer for Auto Parts Co., Chicago, has formed the Automobile Accessories Co., Chicago.

Hipple Mitchell Merchandising Counsel—G. W. Hipple, recently vice-president and general manager of the Carl H. Page Motors Co., New York City, has been secured by the Mitchell-Lewis Motor Co. to act as general merchandising counsel.

Sherwood Gibney Branch Manager—F. W. Sherwood has been appointed branch manager of the New York City sales and service departments of the Gibney Tire and Rubber Co.

Jenkins Transferred to Detroit—S. S. Jenkins, who was manager of the Indianapolis branch of the Willard Storage Battery Co., during the past 4 years, has been appointed district manager at Detroit. M. G. Hillman, who was in charge of the Detroit branch, has resigned, and his assistant, E. Resser, has been made manager of the Indianapolis branch.

Radford and Block Combine—H. R. Radford, who was vice-president and general manager of the Cartercar Co., Pontiac, Mich., and W. D. Block, who was comptroller, have formed the Radford-Block Co., to handle the Oakland cars in Detroit and vicinity. Headquarters have been opened at 1225 Woodward Avenue.

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Dealers

Wisconsin Trade News—The Curtis Automobile Co., Milwaukee, for many years located at 142-144 Eighth Street, has leased the large garage and service station building directly opposite, at 143-147 Eighth Street, occupied by the Ford Motor Co.'s Milwaukee branch until the opening of the new $300,000 assembling plant several weeks ago. The Curtis company is distributor of the Reo cars and trucks.

Harry Kohn, until recently manager of the Wisconsin Auto Exchange, 115-117 Sycamore Street, has organized the Paramount Auto Exchange and established a clearing house for used cars in the garage at 142-144 Eighth Street, Milwaukee, which has just been vacated by the Curtis Automobile Co.

The Dicke Motor Car Co., Manitowoc, Wis., has established a branch garage and service station at Two Rivers, Wis., in the former Hamacheck garage. The business will be operated as the Two Rivers Automobile Co. under the management of Walter Whitney.

The Enger Motor Sales Co., Eleventh and Wells Streets, Milwaukee, organized by R. D. Mitchell and E. A. Glab to act as State distributor of the Enger Twin-Six in Wisconsin, has been appointed State distributor of the Pathfinder Twin-Six.

New York City Items—The Carl H. Page Motor Co., New York City distributor of the Mitchell car, has leased the large point store in the American Circle Bldg. at the junction of Broadway and Central Park West, the north end of Columbus Circle.

C. T. Silver has opened another branch in Yonkers, adjacent to New York. The branch is located at 1 Manor House Square.

The AUTOMOBILE

Vol. XXXIV,
No. 8

NEW YORK, FEBRUARY 24, 1916

Ten cents a copy
Three dollars a year

80% Less Friction

Almost Doubles the Endurance of the

$1375
at Detroit

Patented by Hudson
December 28, 1915
Patent No. 1165861

Hudson Super-Six

A Small, Light Six Delivers 76 Horsepower

THE Super-Six motor has a cylinder capacity of 288 cubic inches.

This size develops some 85 horsepower. But heretofore, at its best, it delivered 42 horsepower. Some 50 per cent was lost in vibration and friction.

The Super-Six delivers 76 horsepower. In this patented motor only 10 per cent is lost in vibration. Thus friction loss is reduced 80 per cent. And that gives to the motor almost double endurance.

JUST WASTED POWER

This extra 34 horsepower is simply power that heretofore was wasted. We have added no cylinders or size. We have not increased fuel consumption.

All the advantage of the Super-Six lies in its utter smoothness. It shows in bird-like motion. The motor is small and light —same size as the Hudson Six-40. It is very economical because of the saving in friction. Rarely does this motor run at more than half load. And the engine wear is almost eliminated.

NOW SUPREME

It must be conceded that the Super-Six motor makes the Hudson car supreme. It has broken all stock car records.

No other type—Six, Eight or Twelve—can approach the Super-Six in performance.

You can prove this by one ride. The Super-Six feats will amaze you. You never saw such effortless performance, such flexibility, such quick response.

No man can doubt that the Super-Six is the greatest motor built. And the luxurious bodies on this new Hudson make the car look its supremacy.

A BASIC PATENT

Note that the Super-Six is controlled by a basic patent. There is nothing else like it. Any man who wants this reserve power, this smoothness, this endurance, must buy a Hudson to get them.

And men will want them. If you don't think so, try a ride in the Super-Six.

7-Passenger Phaeton, $1375 at Detroit.

Five Other Styles
of Bodies

HUDSON MOTOR
CAR COMPANY
Detroit, Michigan

World's Record Breaker

All Records up to 100 Miles

These tests were made at Sheepshead Bay with a 7-passenger Super-Six — a touring stock car — under official supervision of American Automobile Association.

100 miles in 80 min., 21.4 sec., averaging ***74.67 miles per hour,*** with driver and passenger.

75.69 miles in one hour, with driver and passenger.

Two laps made at 76.75 miles per hour.

Standing start to 50 miles per hour in 16.2 sec. A new record in quick acceleration.

Vol. XXXIV New York—Thursday, February 24, 1916—Chicago No. 8

The Automobile

Toledo—Second Automobile City

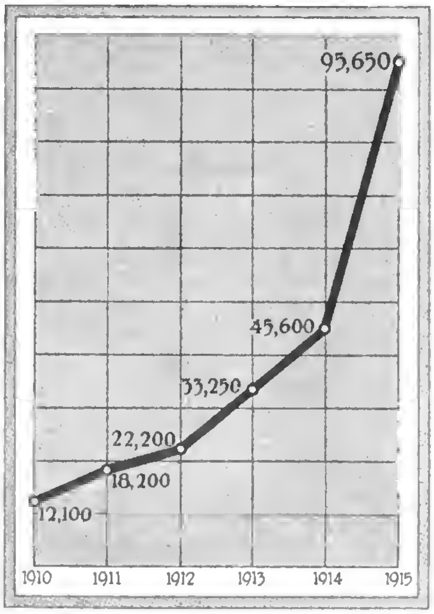
95,650 Cars Left Its Factories in 1915—1000 Electric Systems and 25,000 Spark Plugs Per Day

By L. V. Spencer

TOLEDO is the second automobile city in America. It acknowledges premier position to Detroit, first automobile city of the world. Toledo's rank as second city in automobiledom, to-day the fourth industry in the country, is unique in divers respects. Toledo owes its present automobile status to one manufacturer. Detroit's greatness is in the number and variety of its automobile factories, but Toledo's is in the immensity and concentration of the few. Toledo rose to second place in the last six years; Detroit has held its leadership for more than double that time.

A Rapid Rise

In six brief years Toledo has risen from semi-obscurity as an automobile city until to-day when one-third of its entire army of 75,000 workers is engaged in building automobiles, automobile components and automobile accessories. To-day one-fifth of Toledo's entire army of wage earners is employed by the vast Willys-Overland organization, operating the largest individual automobile factory in the world and occupying second position as the world's greatest producer of automobiles.



Toledo's automobile production since 1910. Note the sharp upward trend in 1915. This is chiefly owing to the expansion of the Overland output

Official figures establish Toledo's rank in second place as an automobile city. In 1915 there were 95,650 automobiles built within its boundaries. Toledo has thirty-five factories connected with the automobile industry, their payrolls constituting a large percentage of the $52,000,000 paid to Toledo wage earners and salaried employees in 1915, although thirty-six new manufacturing institutions of different lines came to the city during the year to help swell the wage and salary total. During 1914, which was somewhat of a time of depression, eighteen plants started operations, whereas in 1913 there were twenty-five.

Population Gains 75,748

Since the automobile industry began to exert its influence on Toledo in 1910 the population of the city has jumped from 168,497 to 244,245, a gain of 75,748.

Bird's-eye view of the great Willys-Overland factories. From a plant of only 300,000 sq. ft. floor area, employing 250 men, in 1908, this 103 acres, employing 15,000 men and building 1000 cars a day

On this basis the growth by 1920 will be about four times what it was for the period from 1900 to 1910 which was 36,675, or from 131,822 to 168,497. In other words, Toledo's population in 1920 may be 390,945. The automobile industry and the business that is allied with it have contributed more than any other single factor to this remarkable growth in population, while Toledo's wealth as well as its population have increased in the past six years far more than they did in any previous period of twice that length.

The increase in the value of the products of Toledo factories almost doubled in the period from 1913 to 1915 as indicated in the tabulation on this page. This increase is largely due to the progress of the automobile and its allied industries although other lines of business in the city have enjoyed somewhat similar growth. The value of Toledo-manufactured products in 1909 was $61,230,000, this practically doubling in 1913, attaining a total of $111,599,000, while the magnitude of increase is shown by the 1915 total of $210,000,000 the value having nearly doubled in the two years' period.

Bank clearings have increased consistently from $186,169,000 in 1908 to $331,579,324 in 1915; while the cost of building construction in the city gained steadily each year over $1,000,000, varying from $2,092,873 in 1908 to $7,622,244 in 1915.

95,650 Cars in 1915

Toledo's increase of production of automobiles has been steady, the ratio of gain rising each year. In 1910 its contribution to the industry was 12,100 cars, increasing to 18,200 in 1911, then to 22,200 in 1912; in 1913 its factories produced 33,250 which was increased to 45,600 in 1914. In 1915, however, the biggest gain took place, the total output being 95,650 or a gain of over 100 per cent as compared with the 1914 figure. For 1916 a production of over 150,000 automobiles is predicted.

Excellent Shipping Facilities

The advantageous position attained by Toledo in an industry that ranks fourth in the United States to-day is not due to any over-night growth, but to steady and solid expansion of its motor car and parts factories that have thrived on the most advantageous kind of manufacturing conditions. Toledo's favorable location as a shipping point, its close proximity to a majority of the markets of the country and the co-operative boosting spirit of its people are factors that are drawing the attention of automobile business men and attracting new industries continually.

Big Accessory Production

There might have been a time several years ago when other motor car producing centers could dispute Toledo's claim to second position, but now the Ohio city has so far outdistanced its nearest rival that such rivalry is a thing of the past. No one now thinks of any automobile city in the world as a sort of understudy to Detroit except Toledo, which during 1915 contributed 95,650 machines to an eager public. Nor is this all. One thousand starting and lighting systems, 25,000 spark plugs and many other parts and accessories were made each day during 1915 by specialists in their lines whose businesses have grown to enormous proportions. Even now these big accessory producers have practically doubled these daily figures of a year ago.

So far as its automobile industry is concerned, at least, Toledo impresses you the same as Detroit. You see enormous factories that only half a dozen years ago were scarcely in

AUTOMOBILES PRODUCED	
1910	12,100
1911	18,200
1912	22,200
1913	33,250
1914	45,600
1915	95,650

POPULATION	
1840	1,222
1850	3,829
1860	13,768
1870	31,584
1880	50,137
1890	81,434
1900	131,822
1910	168,497
1915	244,245

WAGES AND SALARIES	
1899	$6,679,000
1906	10,384,000
1909	13,533,000
1913	22,760,000
1915	52,000,000

FACTORIES OF ALL KINDS BUILT	
1913	25
1914	18
1915	36

BANK CLEARINGS	
1908	$186,169,000
1912	250,594,000
1914	304,459,324
1915	331,579,324

VALUE OF PRODUCTS	
1899	$31,976,000
1904	44,501,000
1909	61,230,000
1913	111,599,000
1915	210,000,000

COST OF BUILDING CONSTRUCTION	
1908	$2,092,873
1910	4,077,735
1912	5,233,912
1914	6,056,800
1915	7,622,244

organization has grown until it occupies factory buildings aggregating

business at all. You see on all sides evidences of a marvelous growth that is so busy taking care of its very bigness that it has not the time to stop and tell you how it was done. Toledo does not care much about the past; does not deal in post mortems, but is looking ever ahead and striving to keep pace with the prosperity and progress that are coming to it in ever-increasing quantities.

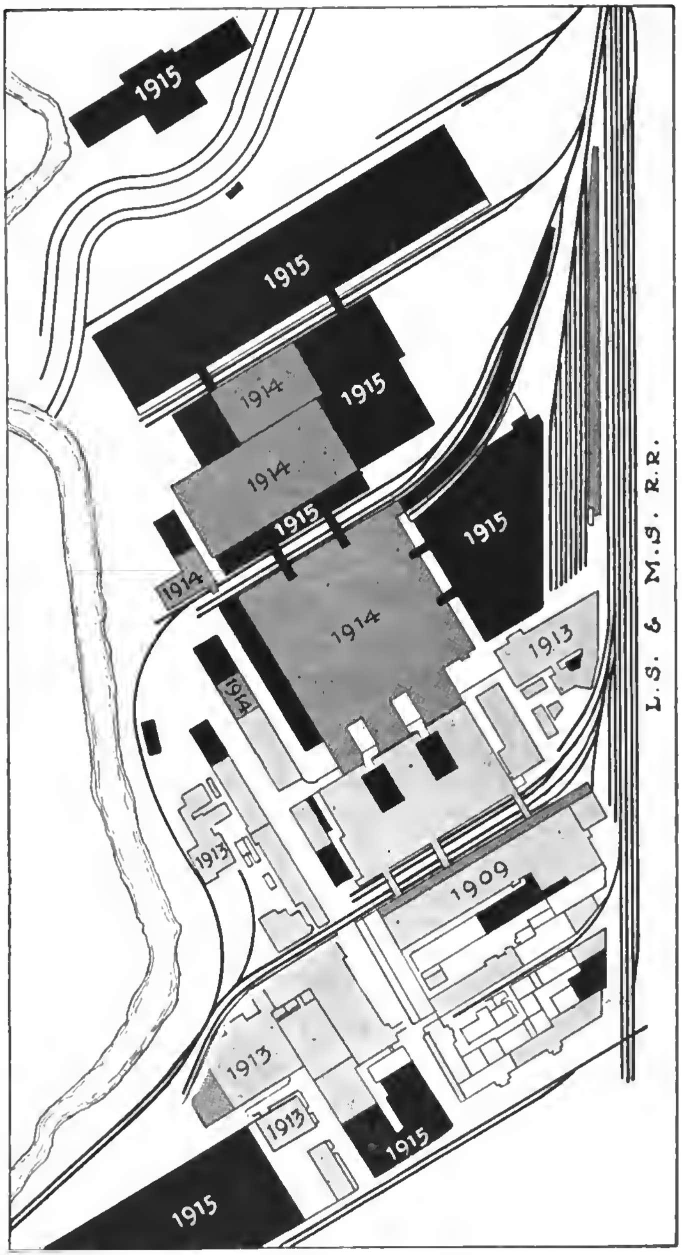
Overland's Phenomenal Rise

From these statistics it will be seen that it was a most fortunate day for Toledo when John N. Willys, wizard of finance and automobile, took serious notice of the thriving Ohio center. It was in 1909 that he purchased the old Pope-Toledo plant and used it as a nucleus around which was destined to be developed the largest single automobile manufacturing institution in the world.

The history of the Overland automobile is like a tale from the Arabian Nights, the only difference being that it is a true story. The name Overland was first applied to an automobile in the fall of 1902, at which time the Standard Wheel Co., Terre Haute, Ind., completed the design of and built a 3½-hp. runabout. A number of these were sold, perhaps a dozen. The following year, the concern succeeded in building and selling seventy-five cars—a large output for that year. But matters did not go very well, and in 1907 the sales of Overland cars, then made in Indianapolis, did not exceed forty. But in January, 1908, Mr. Willys acquired control and took the presidency and the company name was changed to the Willys-Overland Co. This was the beginning of the present great business, and under the able direction of its head the whole administration was reorganized, the first year's business under the new management totaling 465 cars.

1000 Cars a Day

Looking about for a new factory site, Mr. Willys saw the possibilities of Toledo and of the few Pope-Toledo buildings scattered over a 7-acre lot. When he took it over this plant boasted of 300,000 sq. ft. of floorspace and employed 250 men, a factory of no mean size, by the way. Each year since then has seen new buildings spring up in the Overland group until now they have an aggregate floor area of 103 acres, house 15,000 employees and possess a production capacity of 1000 cars a day. Undoubtedly this output will be attained during the present year, for even now the average daily schedule is 700 cars, the record being 722 cars in 24 hr. Some definite idea of the strides which this great factory has made may be gathered from the following:



Diagrammatic view of Willys-Overland plants, showing the yearly additions and the excellent railroad facilities

OUTPUT BY CALENDAR YEARS—OVERLAND CARS

Year	Cars
1907	40
1908	465
1909	4,000
1910	12,000
1911	18,000
1912	22,000
1913	33,000
1914	45,000
1915	94,437
1916 (planned)	150,000

The diagrammatic map of the Overland factory will perhaps best illustrate how the expansion has been kept up steadily to meet the increasing demand for cars. The greatest single year's increase was during the last twelve months, when 1,765,840 sq. ft. were added.

Naturally such an enormous industrial organization has a big influence upon Toledo, employing as Overland does at the present time one-fifth of the total working population of the city. It has not only been a big factor in the rapid advancement of the population, but it has logically served to attract other factories making parts and accessories, and has served to show what the latent possibiilties of the city as a manufacturing center are.

The result has been a gradual increase in the number of establishments dependent either wholly or in part upon the automobile trade, for they know that here they can get experienced automobile labor, can secure co-operation from others in the industry and can have adequate shipping facilities. The same economic reasons are back of the growth of Toledo as an automobile center as are back of the concentration of the rubber goods and tire-making industry at Akron, and the centering of the iron and steel industry at Pittsburgh.

Thirty-five plants are now operating in Toledo that are allied with the automobile. Not all of them are to be regarded as exclusively motor vehicle or parts factories, but a majority are dependent upon the automobile business entirely. In them are working approximately 24,000 persons—one-third of the whole working class of the city. Is it any wonder the industry has meant much to Toledo?

50,000 Spark Plugs Daily

There is, for example, the Champion Spark Plug Co., which has made a striking success of concentration upon one thing alone—the spark plug. The daily output now ranges from 40,000 to 45,000 plugs requiring 300 persons with the aid of the most modern kinds of special machinery to do it. Beginning in a minute plant in May, 1910, with twenty-five employees and pushed to its utmost to make 2000 plugs a week, this concentrated organization has now outgrown a modern four-story factory building and is erecting a six-story addition as well as adding two stories to its main plant, so that, when completed 55,000 sq. ft. will be provided.

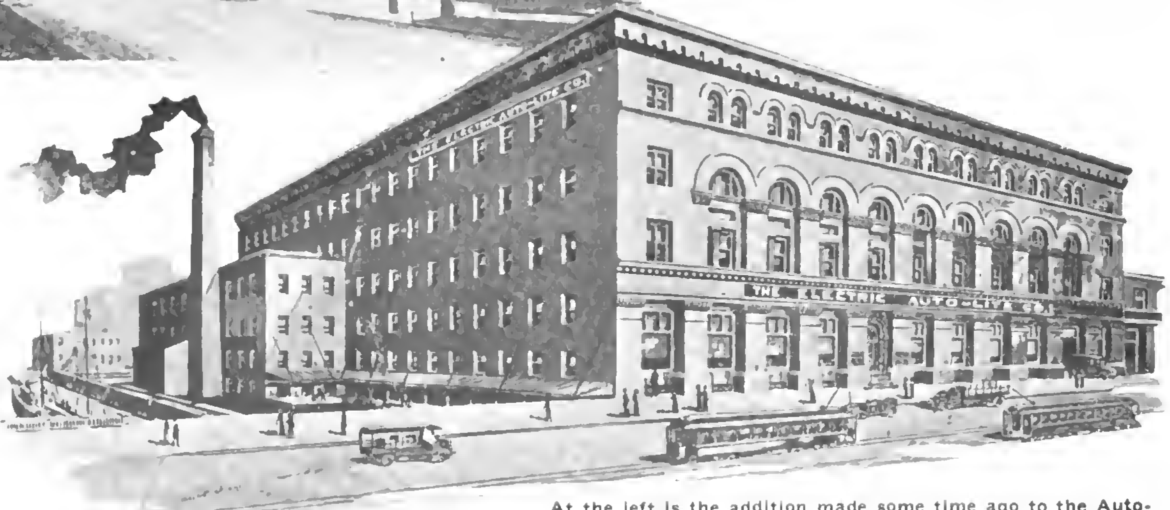
Toledo has two other big makers of motor vehicles. These are Milburn and Ohio concerns, both of which build electric cars. The Ohio Electric Car Co. began in 1910, and strangely enough, occupied at the start a part of the factory of the Milburn Wagon Co., which has long been one of Toledo's big industries. That first year Ohio succeeded in building twelve cars and had ten men on its payroll. In 1912 the present large plant was built which has a three-story main building 60 by 340. Later other buildings were added, each two stories high, one measuring 60 by 240 ft. and the other 80 by 160. The factory has a yearly output of 600 vehicles, and employs 250 men.

The Milburn Wagon Co. launched into the electric automobile business December, 1914, and during last year turned out 600 cars. These are of the light type and have struck out in a new direction so far as electric design is concerned. This year, the Milburn production plans call for 1200 cars, and judging from the business reported for January and the month previous, this figure will be readily attained. Although Milburn makes wagons as well as electric cars, the addition of the motor vehicle has meant an increase in the payroll from 400 to 800 men, and at present they are working 14 hr. a day.

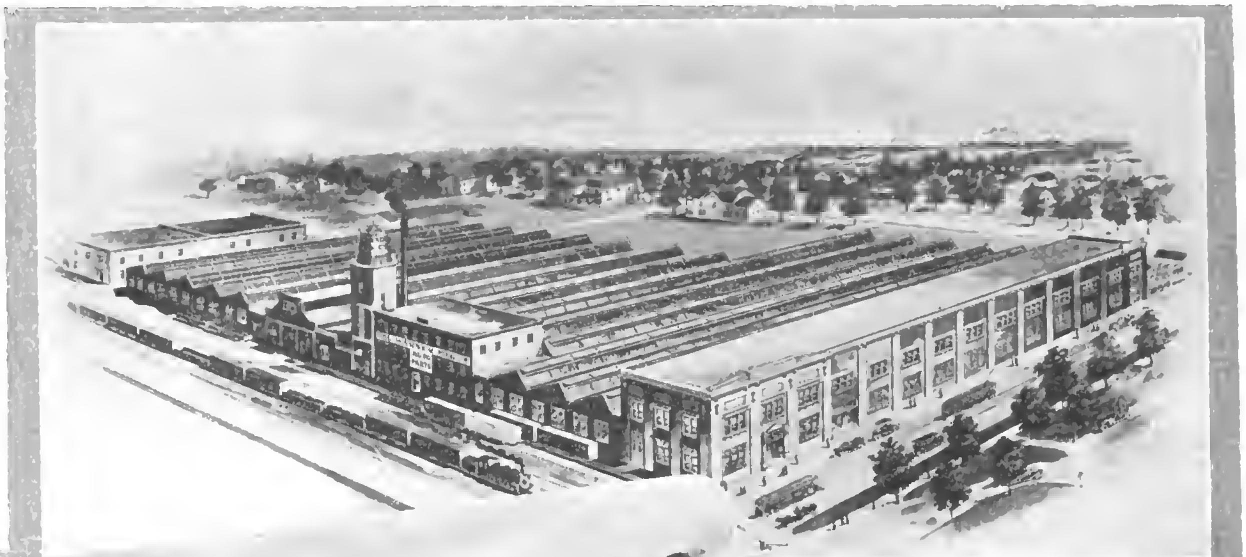
2500 Electric Systems a Day

Concentration has also played an important part in the wonderful growth of the Electric Auto-Lite Co., which now has a daily output of 2500 complete electric starting and lighting systems. Close to the Overland plant, one of its main users, this factory has grown from an original production of ten lighting generators a day, at that time no starting units being built. Fifteen men drew their pay from Auto-Lite then. Production was stepped up to twenty-five generators early in 1912, then to fifty generators and fifty starters in 1913. But the original plant was soon outgrown and in 1914 Auto-Lite moved to larger quarters, with the result that in 1914 the daily output was 350 complete systems with 700 employees. Before the end of 1914 production had jumped to 600 a day, and in June, 1915, when the big plant of 150,000 sq. ft. formerly occupied by the General Electric Co., was added, output took another boost to 800 a day and 1300 persons were employed. Last fall production was again increased to 1000 sets daily, requiring the services of 2100 persons. Since then a new factory building has been completed which makes possible the present enormous output, 2500. The new building is 105 by 380 ft. and four stories, swelling the Auto-Lite concern's space to over 400,000 sq. ft.

Another of Toledo's big automobile concerns is the Warner Mfg. Co. which does a big parts business, such as gearsets and similar components. Since its



At the left is the addition made some time ago to the Auto-Lite plant, illustrated below, more than doubling its facilities



Upper—Plant of the Warner Mfg. Co. This company is a large producer of gearsets and similar components. Its working force is now 600 to 700 men

Middle—Plant of the Champion Spark Plug Co., an organization which has grown from a small establishment, employing twenty-five persons in 1910, with a weekly output of 2000 plugs, to a large plant with 300 employees, turning out from 40,000 to 45,000 plugs per day

Below—Factory of the Ohio Electric Car Co., which manufactures 600 electric cars per year and gives employment to 250 men

inception seven years ago this factory has enjoyed a 75 per cent business increase. The start was made with 200 men, but now it employs 600 to 700.

As an example of intelligent management, and good product in combination with Toledo's facilities for the manufacturer, the case of the McNaull Tire Co. can be cited. Starting not over one year ago, this concern is now located in a 50 by 220 factory with a capacity of 100 tires a day and employs seventy men.

Others that are growing rapidly and which have wisely chosen Toledo in which to cast their lot are the Bock Bearing Co.; Dewey, Anderson Mfg. Co.; Mather Spring Co.; Bunting Brass & Bronze Co.; Doehler Die-Casting Co.; Miller Storage Battery Co.; Seiss Mfg. Co.; Gendron Wheel Co., etc.

From these superficial glimpses of some of the thriving plants that have helped to make Toledo's name known wherever automobiles are sold, it is at once evident that they have played a big part in the making of the city. Yet while this is undoubtedly true to a very large extent, the fact must not be overlooked that Toledo also made them, in a sense. The city offers them its excellent manufacturing advantages, and the factories repay it for what it gives by helping to add to the corporate wealth, to the prestige and to the size of the community.

Big Center of Population

For Toledo is really most advantageously placed on the map of the United States. To realize this examine its strategic manufacturing position. Located at the western end of Lake Erie where the big lake freighters can reach it with no trouble at all, and offering a good terminal point for the meeting of rail and lake lines, it is actually the peer of almost any city of the country in this respect. Half the population of the United States is within a radius of 500 miles, and it is perhaps this fact as much as anything else that has attracted manufacturers.

But this great central location could be discounted somewhat were it not that Toledo is blessed with twenty-three steam and electric railroad lines, tapping nearly every section of the country. A salient point about the entire railroad situation is the terminal belt railroad that extends entirely around the city and has direct track connections with all roads that enter. The advantage of this for quick transfer of shipments from any spur track to any main line is apparent.

Five Steamship Lines

But in addition to this remarkable array of railroads, Toledo also is fortunate in being the terminus of five regular steamship lines of the Great Lakes, besides having a dozen interurban trolley lines whose main business is passenger traffic.

As a further indication of Toledo's industrial position, the

Where Toledo's land and water shipping meet. The New York Central freight house, with a view of some of the wharves

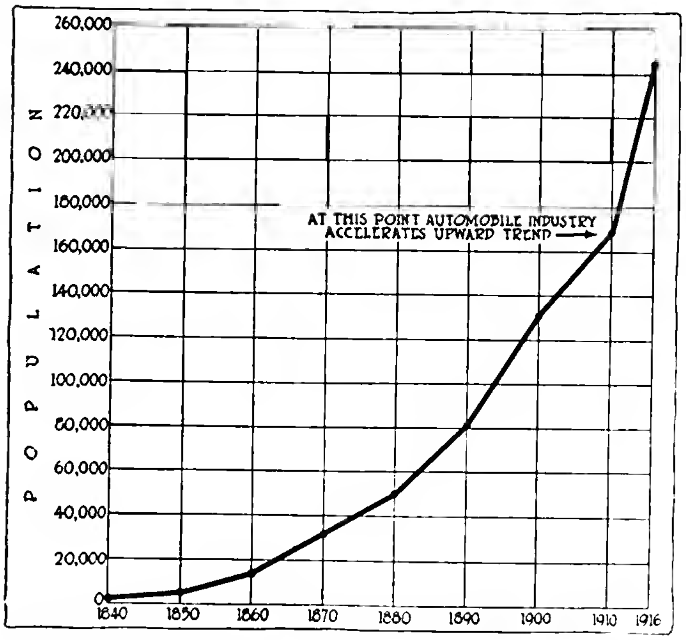
harbor is of special interest. A natural haven, it has been made of immense commercial value by extensive improvements so that the straight channel now is 21 ft. deep and 400 ft. wide, sufficient for the largest freighter. Being the connecting link between lake and rail, the city has received a wonderful coal-and-iron-ore-carrying trade, as well as an enormous grain jobbing business, which during last year swelled to a value of $90,000,000.

These facts are cited to show why the city has been picked as a logical location for centralization of automobile production. The railroads have been quick to realize the strategic position of the city, and they have built adequate dock and terminal facilities, some of them combining their land freight sheds with their lake dockage facilities.

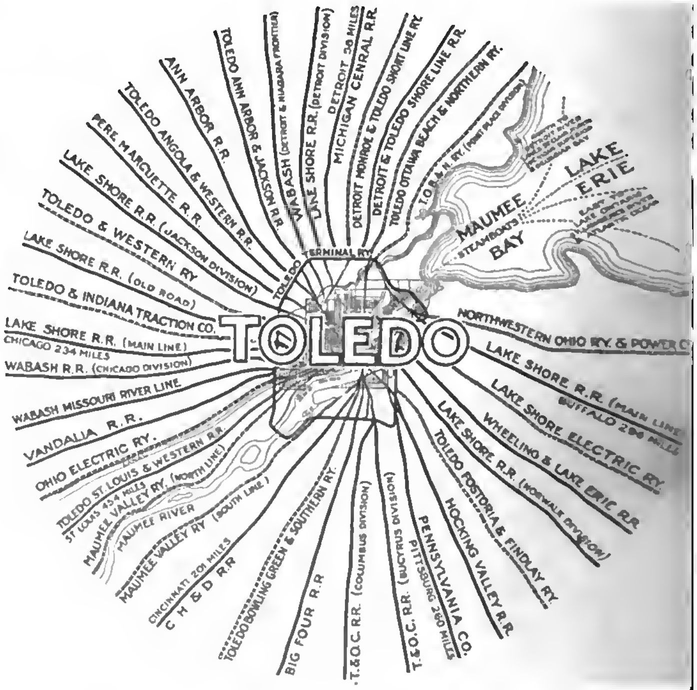
As a retail center, particularly for the sale of automobiles, Toledo is well situated. The same shipping facilities, commercial advantages and wealth that make it an ideal manufacturing community, work to the distinct advantage of the dealer or distributor of cars. That Toledo is a logical center for the distribution over a wide territory is proved by the fact that some of the largest automobile builders have allotted big areas to their distributors here. The five largest distributors alone have contracted for 15,850 cars to sell in their Ohio territories in and around Toledo during 1916. The largest distributor in the city, for instance, who handles a popular-priced car, has a territory covering all of Ohio with the exception of Cleveland, and including West Virginia, Kentucky, four counties in Michigan, nine in Indiana and eight in Virginia. Thus, so advantageous does his factory, which is in another city, consider Toledo as a distributing point that it has allowed him an enormous field radiating from it. This distributor, by the way, has contracted for 5000 cars this year.

Further Facts Are Needless

It is needless to go further with facts and figures to show the great advantage of Toledo as a commercial center. It speaks much for the farsightedness and business acumen of men in the automobile industry that they have picked out a city which is destined to play so important a part in the industrial history of our country, and these will help Toledo as Toledo helps them, for as the city grows so shall develop the men who are a part of it.



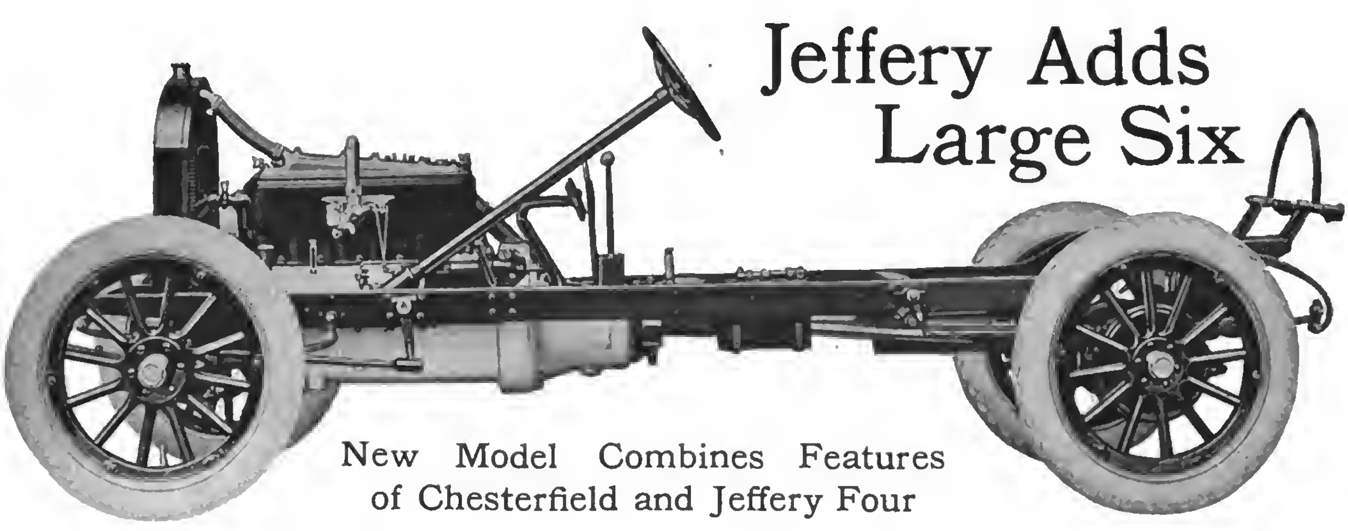
Illustrating Toledo's increase in population since 1840. Note the recent rapid growth, largely due to the automobile industry



Toledo is the terminus of twenty-three steam, twelve electric rail road lines and five steamship lines

Jeffery Adds Large Six

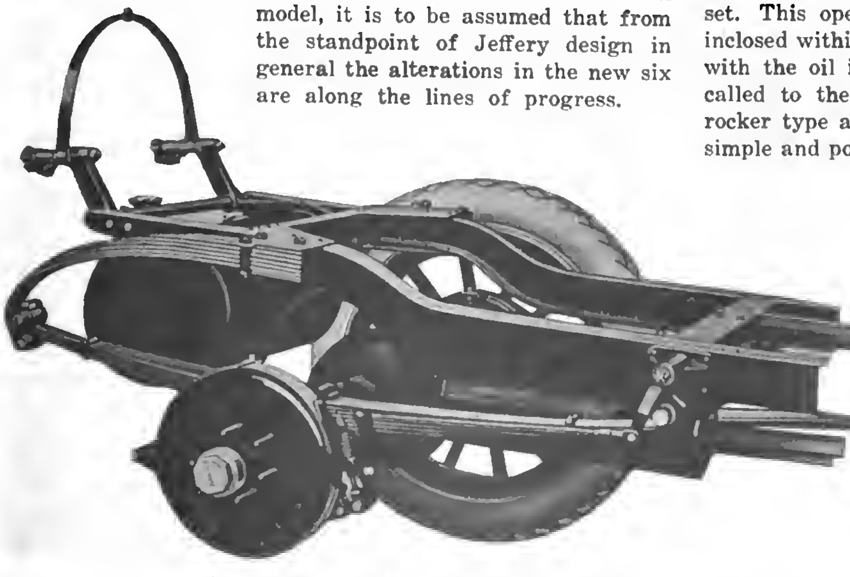
New Model Combines Features of Chesterfield and Jeffery Four



THE Thomas B. Jeffery Co., Kenosha, Wis., has just begun delivery of a new six-cylinder car, model 661. This is more modern in design and larger in size than the Jeffery Chesterfield, the previous six, and with the Jeffrey four, which has been on the market for some time, will comprise the chief unit in the Jeffery passenger car program.

The new six to be marketed as a seven-passenger tourist at $1,450 is externally a very up-to-date car, having a much more pronounced roll inward to the sides than has been characteristic of previous Jeffery designs, and with a straight line from radiator to windshield and smooth hood and cowl becomes the very latest exemplification of the marine motif in motor car superstructure. The radiator is narrow and unusually high, so that it is possible to combine the modish horizontal hood line with a downward sweep to the roll edge of the passenger compartments and at the same time provide a very roomy car. With the wheelbase of 120 in. a very roomy tonneau is provided and one which is uncluttered by spare seats, for when the latter are not in use they fold forward into the backs of the forward seats. The latter are divided, giving the vestibule type of seating arrangement, which permits unimpeded communication between forward and rear compartments.

As compared with the previous six, the new car incorporates a number of changes mechanically. In most of these a design which has been found to work out well with the four has been followed, rather than that incorporated in the Chesterfield six, and as the four is a much more modern model, it is to be assumed that from the standpoint of Jeffery design in general the alterations in the new six are along the lines of progress.



Hotchkiss drive used with three-quarter spring

There is an increase in motor dimensions to 3½ by 5¼ in., which is ½ in. greater bore and a ¼ in. longer stroke than possessed by the former six and gives a piston displacement of 333 cu. in., which is 50 per cent greater than that of the former six.

The new six, too, marks the complete conversion of the Jeffery passenger cars to spiral bevel drive, a design employed in the four and a departure from the practice in former six which included a worm drive in its specifications. Likewise cantilever springing which was a feature of the earlier six-cylinder car has given way to three-quarter elliptic rear suspension. In this respect the new six is similar to the four.

Braking incorporates a design which has proved successful in the four-cylinder car, namely, that is the location of the emergency brake on a drum at the rear of the gearset operating directly on the drive shaft. This gives a very direct and positive application of the emergency brake through short linkages and goes very far toward making an exceptionally clean looking chassis. With the connections to the service brakes carried outside of the frame and springs where they are accessible for adjustment and oiling, there is nothing left within the rear of the exceedingly clean frame except the propeller shaft.

A feature is the very neat arrangement of the drive to the Van Sicklen speedometer. Instead of the two pulleys and belt from the driveshaft previously used, a special gear is provided which meshes with the secondary gear in the gearset. This operates the speedometer drive and is completely inclosed within the gearbox where it is supplied automatically with the oil in the latter. Special attention, too, should be called to the unusually neat accelerator pedal which is a rocker type and provides not only easy foot action, but very simple and positive connection with the throttle.

Details of Engine

To take up the design of the car in detail: The block cast, L-head, motor has both the upper and lower halves of the horizontally split crankcase made of aluminum. The valves and consequently the camshaft are on the right side and the lay shaft, which drives in succession the water pump, air pump, generator and magneto, is utilized along every inch of its length but without such crowding as to make any of the accessories inaccessible.

The pistons are iron 5½ in. in length with pins 1 5/64 in. in diameter; eccentric piston rings are used. Connecting rods are forgings 11¼ in. long, their caps being fastened by

Jeffery Big Six

two chrome nickel steel bulbs. Phosphor bronze piston pin bearings are located within the piston. The crankshaft is 35 to 25 carbon steel and turns on four die-cast babbitt bearings, the two center ones being 2 by 2¼ in. The front 1¾ by 2⅞ and the rear 2⅛ by 3¼ in. The valves have a lift of 5/16 in. in the clear, both being 1 11/16 in. in diameter and made of tungsten steel. The camshaft is a forging with the cams intregral and tappets of mushroom type.

The valve timing of the motor is as follows:

Inlet opens 5 deg. late.
Inlet closes 45 deg. late.
Exhaust closes 5 deg. late.
Exhaust opens 55 deg. early.

The timing gears are helical with a 26-deg. helix and a 10 pitch. The gears all 1⅛ in. across the face, which should be sufficient to give long life before backlash or wear develops. The motor complete with its control parts, complete with fan, carbureter, magneto, starter and generator weighs 700 lb. according to factory specifications. The firing order of the engine is 1, 5, 3, 6, 2, 4, and ignition is cared for by a Dixie magneto.

Lubrication is a circulating system maintained by a gear pump, from an oil reservoir which is located beneath the crankcase and forced through a pipe to the top of the main bearings. From the main bearings, the oil overflows into the bottom of the crankcase into which the connecting rods dip. These pockets have overflow holes in one side which allow the oil to drain back into the reservoir beneath, so that a constant level of oil is maintained. An indicator which shows at all times the level of the oil in the reservoir is placed beside the combination breather and filling tube. The oil pump and strainer are removable from the bottom of the crankcase for cleaning without disturbing the other parts. A separate lead to the timing gears provides a constant stream of oil from the pump for these. The circulation of cooling water is by means of a pump on the lay shaft and a two-bladed aeroplane propeller type of fan is employed.

Vacuum Fuel Feed Used

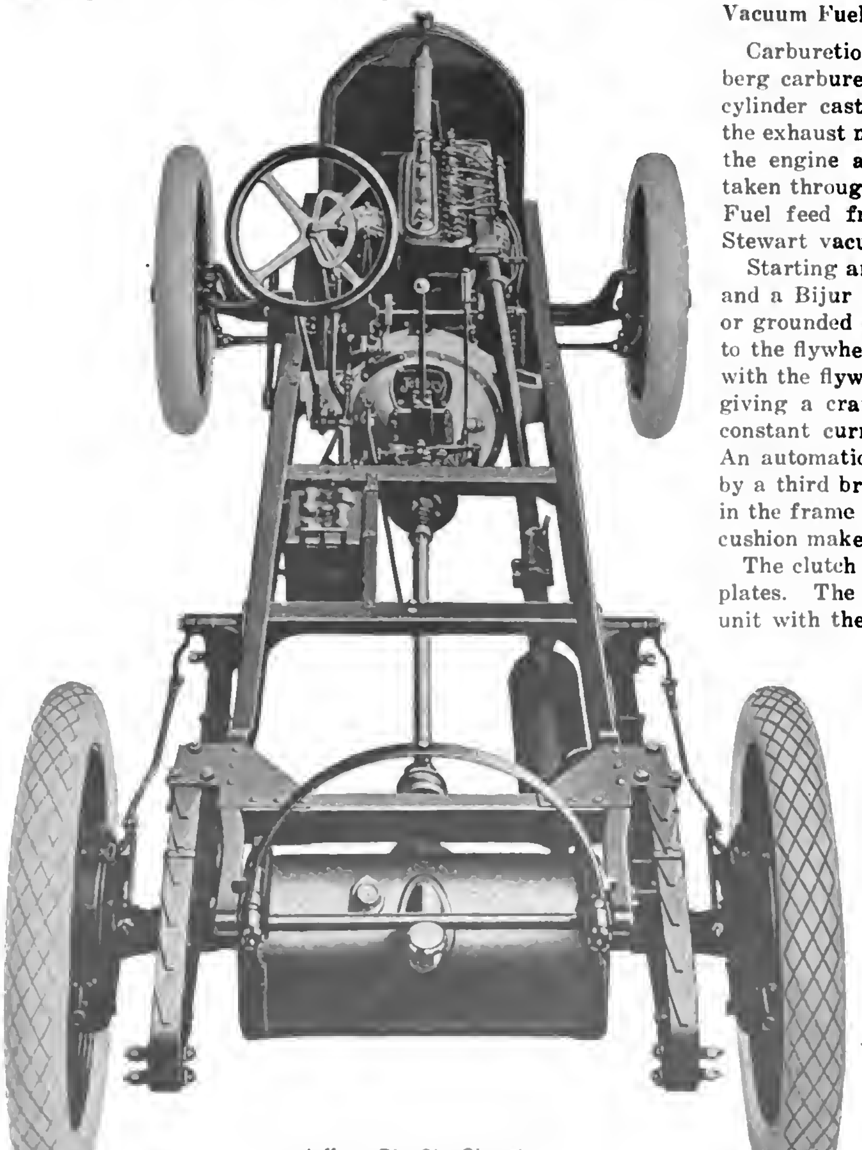
Carburetion is by means of the new model L. B. Stromberg carbureter of the horizontal type bolted directly to the cylinder casting and heated by hot air drawn from around the exhaust manifold. As the exhaust header is on one side of the engine and the carbureter on the other, the hot air is taken through a pipe which goes over the top of the cylinder. Fuel feed from the rear tank is supplied by means of a Stewart vacuum gravity system.

Starting and lighting is taken care of by a Bijur generator and a Bijur motor, which are separate units. A single wire or grounded system is used and the starting motor is geared to the flywheel by a sliding pinion which is shifted into mesh with the flywheel teeth when the starting switch is depressed, giving a cranking speed of 165 r.p.m. The generator is a constant current type with a maximum output of 12 amp. An automatic switch located inside the generator is operated by a third brush. The battery is mounted in a special cradle in the frame in such position that removal of the driver's seat cushion makes it accessible for filling. It is a 6-80 U.S.L.

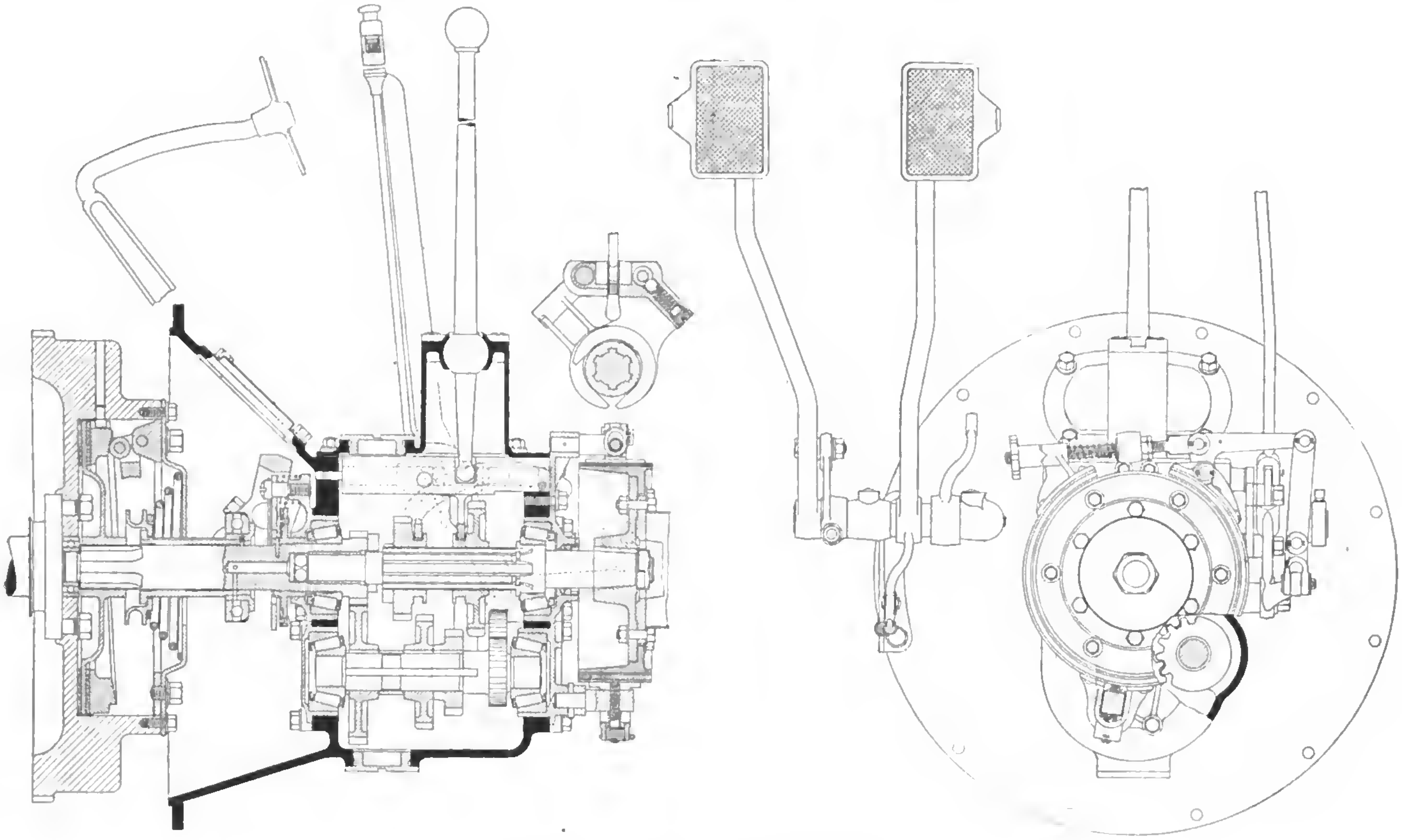
The clutch is a three-plate type, one steel and two asbestos plates. The gearset gives three speeds forward and is in unit with the motor, the whole power plant being suspended on three points. The gears have a ⅝-in. face and the shafts are mounted on taper roller bearings.

The rear axle is semi-floating, having a malleable iron center with alloy steel tubular ends. With this construction it is not necessary to use a truss rod. Removal of a large cover over the differential housing makes the differential readily removable and accessible for adjustment. The pinion and large driven gear are provided with adjustments for taking up wear.

The frame is pressed steel and provided with four cross members which make it very rigid. The side rails are extended to the rear to provide a support for the gasoline tank and a spare tire. The spare tire carrier is a semicircle instead of the usual complete circle and is held by two quick operated hand locks, one at either end of the horizontal diameter of the tire carrier.



Jeffery Big Six Chassis



Details of Gearset and Transmission Brake

Provision for locking the spare tire with a padlock is made, a detail likely to be much appreciated.

Tires are 35 by 4½ straight side on Stanwell demountable rims. The equipment is all that is to be expected of a car of this size and includes the electric lighting instrument board on which are located the Van Sicklen speedometer, electric generator indicator, oil sight feed gage, ignition and lighting switches and fuse box. Double bulb head lamps are mounted directly on the front frame with the wiring carried through the lamp standards.

Another convenient detail is that the ignition switch is operated by a key in the center of the lighting switch and can be locked in any position. All the electric wiring is carried in conduits. The horn is a Hartford Machine Screw Co. product.

As to the actual performance of the car, factory tests have shown that the engine develops 53 hp. at a speed of 2000 r.p.m., although according to the N. A. C. C. formula it is rated at 29.4 hp. at 1000 feet per minute piston speed. Factory tests have shown a speed of 55 m.p.h. with a high gear low limit of 3 m.p.h. Gasoline mileage is given at 15 to 16 and oil 300 to 400 per gallon.

McKeen Highway Coach

The illustration at the bottom of this page shows a type of vehicle put into service some eight months ago. The makers are well-known for their gasoline railroad cars which are similar in appearance, though, of course, somewhat larger than the road automobile car.

Left—McKeen-United Highway Coach. A luxurious chair car on a 3½-ton chassis, intended for interurban transportation. Right—Chair used in Highway Coach. Observe the very long coil spring which supports the weight

Determining Frame Sections

Automobile Frame Section Modulus and Section Characteristics

By A. L. Nelson

THE need of a frame section modulus table for the study of section characteristics is becoming more and more urgent as engineers progress in placing frame design on a rational basis in co-relation with actual road service tests of frames. The purpose of this article is to present a reliable section modulus table covering ⅛, 5/32 and 3/16-in. stock in all sizes of sections likely to be used in pleasure cars; also to call attention to the study of frame section characteristics for comparative analysis. It seems necessary to mention some of the general methods of design, but details of the design are aside from the purpose of this article, so consequently they will not be given.

General Considerations in Design

In designing a frame the bending moments at the most important sections, particularly around the location of the axle center lines where the depth of the sections are decreased for spring clearance, must be determined, and the frame sections designed to resist the corresponding moments. Just what gage of frame stock, depth and width of section is best at each point is a problem well worth considering carefully. A table of section modulus is an important item in aiding the engineer in selecting proper frame section dimensions to resist a given moment for a given stress. (Section modulus equals the bending moment in lb.-in. divided by the allowable stress in lb. per square inch.)

However, a frame section is called upon to withstand a wide range of conditions practically undeterminable in a direct way. To overcome this difficulty a standard of analysis is selected which will give conditions easily analyzed and, at the same time, will be closely proportional to the average actual conditions met in road service. The proportionality factor may then be determined from analysis of frames giving satisfactory service, together with the aid of general engineering experiences. The allowable unit working stress of the frame material is directly related to its physical properties and to the characteristics of the size of sections, thickness of stock used, etc., as will be pointed out later.

Standard Conditions of Analysis

For comparative analysis the loading of the frame may be taken as that resulting from the car with normal passenger load, under static conditions. For instance, such loads as the radiator, motor at supports, transmission, gasoline and tank, body weight at points of support, etc., can be closely approximated and considered as concentrated loads. Furthermore, since the interval of spacing of these loads is somewhat uniformly distributed the miscellaneous loads as fenders, etc., can be distributed with the above principal loads. Having the loading of the frame established, the reactions of the chassis spring and the bending moments at each load may be determined analytically or graphically by standard methods.

Frame-Section Characteristics

As has already been mentioned, the allowable working stress should not be based alone on the physical properties of the material used, but also on the thickness of stock and general characteristics of the sections. Surface defects in ⅛-in. stock bear a larger ratio to the nominal thickness than they do to 5/32 or 3/16-in. stock. Furthermore, the thickness of stock has an important bearing on how much reliance may be placed on the theoretical section modulus. Obviously, for an extra thin stock and a large section the complex stresses set up by simple bending could not even be estimated; hence care must be used in making allowance for complex stresses not accounted for by the methods of computation that are in general use in engineering. It is for such reasons as the above that stresses for ⅛-in. stock used in large sections should be chosen lower than the stresses allowable in heavier stock.

Although the heavier stock makes the more stable section in resisting complex stresses, it does not follow necessarily that it is the most desirable, for the weight per unit length of section may be very great compared with the strength. The thinner stock for the same weight per unit length has its metal placed more effectively to resist bending—that is, the section may be made of more liberal depth and width for the same weight. However, a part of this gain is sacrificed to the lower stresses imposed by the thinner stock. The theoretical gain from using the thinner stock, as for instance ⅛-in., is best studied by graphical comparisons with the heavier stocks, a few of which will now be presented for particular cases.

Effectiveness of Metal Distribution

The effectiveness of metal distribution may be taken as the ratio of the section modulus to the area of the section. Figs. 1 and 2 were constructed for illustrating this property in a comparative way. In Fig. 1, 6-in. depth of section of various widths is compared with 4-in. depth of section, ⅛-in. stock. Curves No. 1 and 2 were plotted by taking values of the section modulus from the frame table for a few widths, and dividing by the corresponding areas of the sections. These ratios were plotted as ordinates and the frame widths as abscissa. Then the smooth curves were drawn through the plotted points. Curve No. 3 gives the results represented in per cent gain in effectiveness of metal distribution of the 6-in. depth of section over the 4-in. for various widths. With widths as used in practice, say above 1½ in. the per cent gain increases with the width of section. The mean gain in this particular camparison is about 38 per cent, a very material increase in effectiveness of metal distribution in favor of the deep sections.

Most of our current frames have comparatively shallow sections, excepting those of some of the cars of recent design. To account for shallow sections, it seems that the designers have been seeking for "looks" rather than actually seeking for the best utilization of metal distribution. Designers trying to use ⅛-in. stock without adopting deeper sections are expecting more than can possibly be realized. As has before been pointed out the ⅛-in. stock should be stressed lower than 5/32 or 3/16-in. stock. This can be done by increasing the section depth of the ⅛-in. stock and still gain in the lightness of construction due to the better distribution of metal. The lower stresses are also advantageous in that the accompanying deflection of the frame is less. The latter necessitates less camber of the frame to take care of the initial deflection;

also lessens body door troubles caused by excessive frame deflections.

Returning to the figures: Fig. 2 is the same as Fig. 1, except variable depths of sections of 1 and 3-in. (⅛-in. stock) were selected. The 3-in. width shows a gain of 26 to 35 per cent over that of 1-in., increasing with the depth of section. Effectiveness of metal distribution is shown by Figs. 1 and 2 to increase both with the depth and with the width of section.

Weight per Unit Length and Strength Comparison

In order to compare the weight per unit length with the strength of section, the section moduli of various sections are plotted as abscissa with their corresponding areas as ordinates. The area is chosen for convenience, since it is proportional to the weight per unit length. Figs. 3 and 4 are given for this comparison.

Fig. 3 is for constant width of sections (2-in.) of ⅛, 5/32 and 3/16-in. stock. The curves were plotted by choosing section moduli at random, then referring these to the section modulus table to obtain the size of the sections and then their corresponding areas were computed. Curve No. 4, Fig. 3, gives the results in per cent increase, 14 and 19, in weight of 5/32-in. stock over that of ⅛-in., while curve No. 5 gives the per cent increase, 26 to 35, for 3/16-in. stock over the ⅛-in.

Fig. 4 is the same as Fig. 5, except for giving variable widths of section with constant depth of 5 in. Here the increase in weight of 5/32-in. stock over the ⅛-in. is from 8 to 12 per cent, and that of the 3/16-in. is from 15 to 24 per cent.

Figs. 3 and 4 tend to show that within reasonable limits of section sizes the lighter gages of stock are the most economical for the same strength of section.

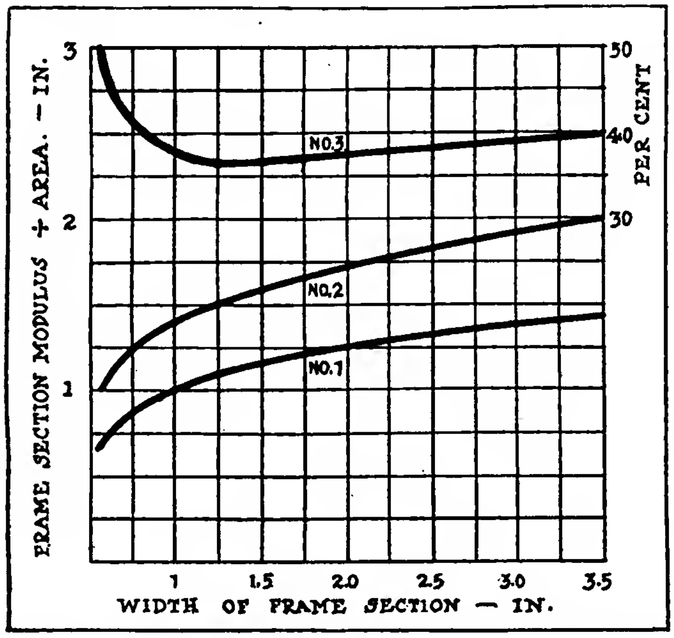
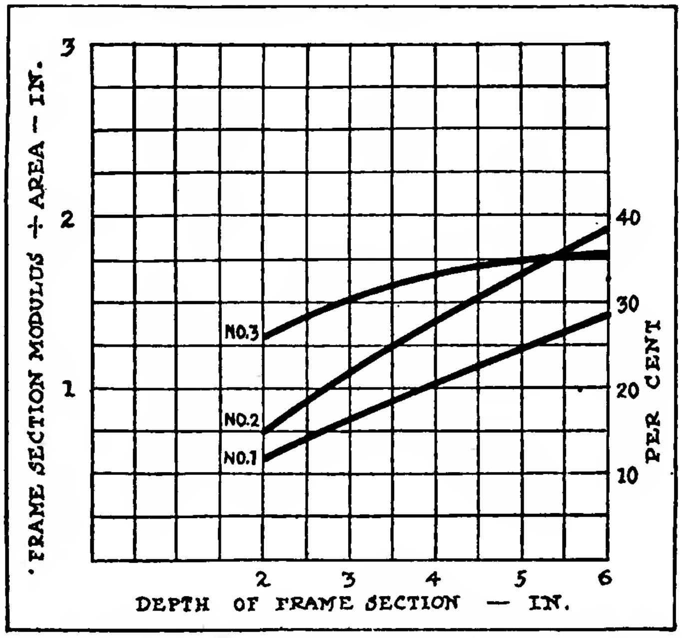


Fig. 1—Effectiveness of metal distribution, 4-in. depth of section compared with 6-in-⅛-in. stock. No. 1, 4-in. depth, No. 2, 6-in. depth, No. 3, % gain 6-in. depth over 4-in.



Fib. 2—Effectiveness of metal distribution, 3-in. width of section compared with 1-in., ⅛-in. stock. No. 1, 1-in. width, No. 2, 3-in. width, No. 3, % gain 3-in. width over 1 in.

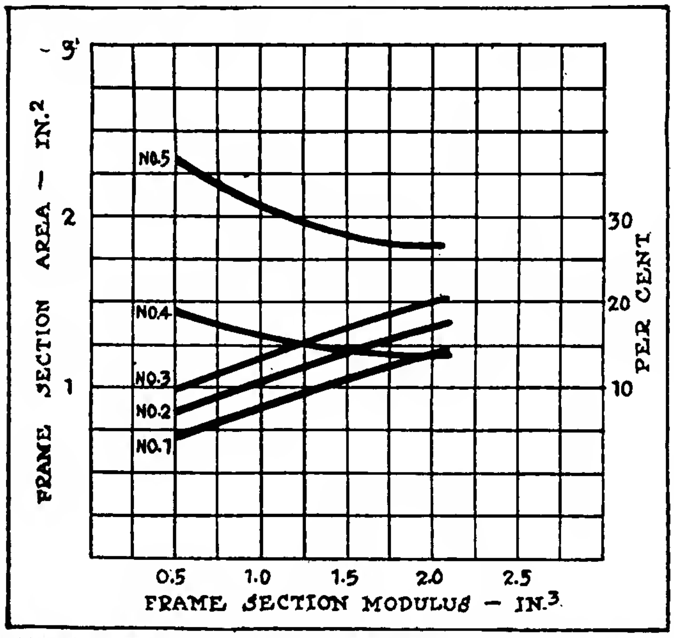


Fig. 3—Weight per unit length—strength comparison. Sections 2-in. wide. No. 1, ⅛-in. stock, No. 2, 5/32-in. stock, No. 3, 3/16-in. stock, No. 4, % increase in weight of 5/32-in. stock over ⅛-in., No. 5, % increase in weight of 3/16-in. stock over ⅛-in.

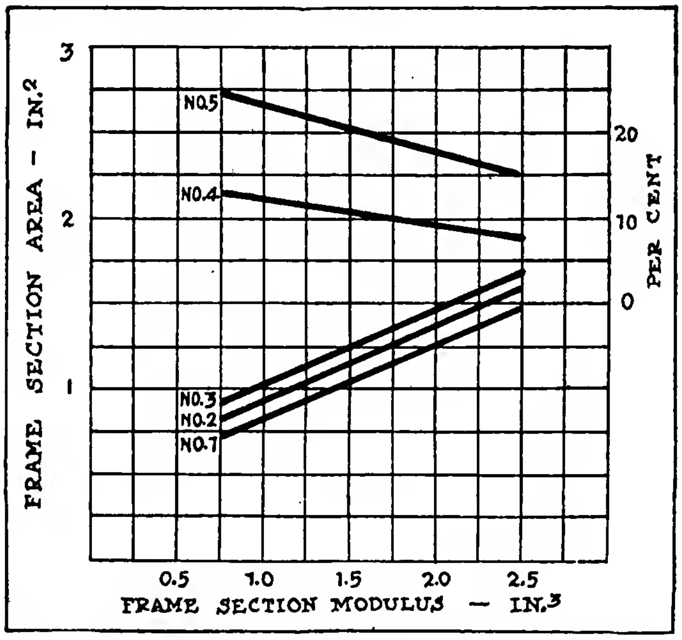


Fig. 4—Weight per unit length—strength comparison. Sections 5-in. deep. No. 1, ⅛-in. stock, No. 2. 5/32-in. stock over ⅛-in., No. 5, % increase in weight of 3/16-in. stock as compared with ⅛-in. stock.

Table of Frame Section Modulus for 1/8 in. Stock

Depth of Section	1	1⅛	1¼	1⅜	1½	1⅝	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2⅝	2¾	2⅞	3	3⅛	3¼	3⅜	3½
2....	.275	.303	.331	.358	.386	.413	.441	.468	.496	.523	.551	.578	.606	.633	.661	.688	.716	.743	.771	.798	.826
2⅛...	.300	.330	.359	.389	.418	.447	.477	.506	.536	.565	.595	.624	.654	.683	.712	.742	.771	.801	.830	.860	.889
2¼...	.325	.357	.388	.419	.451	.482	.514	.545	.576	.608	.639	.671	.702	.733	.765	.796	.827	.859	.890	.922	.953
2⅜...	.351	.384	.418	.451	.484	.518	.551	.581	.618	.651	.684	.718	.751	.784	.818	.851	.884	.918	.951	.984	1.018
2½...	.377	.412	.448	.483	.518	.554	.589	.624	.659	.695	.730	.765	.801	.836	.871	.906	.912	.977	1.012	1.018	1.083
2⅝...	.401	.441	.479	.516	.553	.590	.628	.665	.702	.739	.776	.814	.851	.888	.925	.963	.1000	1.037	1.074	1.112	1.149
2¾...	.432	.471	.510	.549	.588	.628	.667	.706	.745	.784	.824	.863	.902	.941	.980	1.019	1.059	1.098	1.137	1.176	1.215
2⅞...	.460	.501	.542	.583	.625	.666	.707	.748	.789	.830	.871	.912	.954	.995	1.036	1.077	1.118	1.159	1.200	1.241	1.283
3	.489	.532	.575	.618	.661	.701	.747	.791	.834	.877	.920	.963	1.006	1.049	1.092	1.135	1.178	1.221	1.264	1.307	1.351
3⅛...	.519	.564	.609	.654	.699	.744	.789	.834	.879	.924	.969	1.014	1.059	1.104	1.149	1.194	1.239	1.284	1.329	1.374	1.419
3¼...	.549	.596	.643	.690	.737	.784	.831	.878	.925	.972	1.019	1.066	1.113	1.159	1.206	1.253	1.300	1.347	1.394	1.441	1.488
3⅜...	.580	.629	.678	.726	.775	.824	.873	.922	.971	1.020	1.069	1.118	1.167	1.216	1.265	1.314	1.363	1.411	1.460	1.509	1.558
3½...	.611	.662	.713	.761	.815	.866	.917	.967	1.018	1.069	1.120	1.171	1.222	1.273	1.324	1.374	1.425	1.476	1.527	1.578	1.629
3⅝...	.643	.696	.749	.802	.855	.908	.960	1.013	1.066	1.119	1.172	1.225	1.277	1.330	1.383	1.436	1.489	1.541	1.594	1.647	1.700
3¾...	.676	.731	.786	.841	.895	.950	1.005	1.060	1.115	1.169	1.224	1.279	1.334	1.388	1.443	1.498	1.553	1.607	1.662	1.717	1.772
3⅞...	.710	.767	.823	.880	.937	.993	1.050	1.107	1.164	1.220	1.277	1.334	1.391	1.447	1.504	1.561	1.617	1.674	1.731	1.788	1.844
4....	.744	.803	.861	.920	.979	1.037	1.096	1.155	1.213	1.272	1.331	1.389	1.448	1.507	1.565	1.624	1.683	1.741	1.800	1.859	1.917
4⅛...	.779	.839	.900	.961	1.021	1.082	1.143	1.203	1.264	1.321	1.385	1.446	1.506	1.567	1.628	1.688	1.749	1.809	1.870	1.931	1.991
4¼...	.814	.877	.939	1.002	1.065	1.127	1.190	1.252	1.315	1.377	1.440	1.503	1.565	1.628	1.690	1.753	1.815	1.878	1.941	2.003	2.066
4⅜...	.850	.915	.979	1.044	1.108	1.173	1.238	1.302	1.367	1.431	1.496	1.560	1.625	1.689	1.751	1.818	1.883	1.947	2.012	2.076	2.141
4½...	.887	.951	1.020	1.087	1.153	1.220	1.286	1.352	1.419	1.485	1.552	1.618	1.685	1.751	1.818	1.884	1.951	2.017	2.084	2.150	2.217
4⅝...	.925	.993	1.061	1.130	1.198	1.267	1.335	1.404	1.472	1.540	1.609	1.677	1.716	1.814	1.883	1.951	2.019	2.088	2.156	2.225	2.293
4¾...	.963	1.033	1.103	1.174	1.244	1.315	1.385	1.455	1.526	1.596	1.666	1.737	1.807	1.878	1.948	2.018	2.089	2.159	2.230	2.300	2.370
4⅞...	1.001	1.074	1.146	1.218	1.291	1.363	1.435	1.508	1.580	1.652	1.725	1.797	1.869	1.942	2.014	2.086	2.159	2.231	2.303	2.376	2.448
5....	1.041	1.115	1.189	1.264	1.338	1.412	1.486	1.561	1.635	1.709	1.781	1.858	1.932	2.006	2.081	2.155	2.229	2.301	2.378	2.452	2.526
5⅛...	1.081	1.157	1.233	1.309	1.386	1.462	1.538	1.614	1.691	1.767	1.843	1.919	1.996	2.072	2.148	2.224	2.301	2.377	2.453	2.529	2.605
5¼...	1.121	1.200	1.278	1.356	1.434	1.512	1.591	1.669	1.747	1.825	1.903	1.982	2.060	2.138	2.216	2.294	2.372	3.451	2.529	2.607	2.685
5⅜...	1.163	1.243	1.323	1.403	1.483	1.563	1.644	1.721	1.804	1.884	1.964	2.044	2.121	2.205	2.285	2.365	2.445	2.525	2.605	2.685	2.766
5½...	1.205	1.287	1.369	1.451	1.533	1.615	1.697	1.779	1.862	1.944	2.026	2.108	2.190	2.272	2.354	2.436	2.518	2.600	2.682	2.764	2.846
5⅝...	1.247	1.331	1.415	1.500	1.581	1.668	1.752	1.836	1.920	2.001	2.088	2.172	2.256	2.340	2.424	2.508	2.592	2.676	2.760	2.844	2.928
5¾...	1.291	1.377	1.463	1.549	1.635	1.721	1.807	1.893	1.979	2.065	2.151	2.237	2.323	2.409	2.495	2.581	2.667	2.753	2.839	2.925	3.011
5⅞...	1.335	1.423	1.511	1.598	1.686	1.774	1.862	1.950	2.038	2.126	2.214	2.302	2.390	2.478	2.566	2.654	2.742	2.830	2.918	3.006	3.091
6.....	1.379	1.469	1.559	1.649	1.739	1.829	1.919	2.009	2.098	2 188	2.278	2.368	2 458	2 548	2.638	2.728	2.818	2.907	2.997	3.087	3.177

Table of Frame Section Modulus for 5/32 in. Stock

Depth of Section																					
2.....	.329	.362	.395	.429	.462	.495	.528	.562	.595	.628	.662	.695	.728	.761	.795	.828	.861	.894	.928	.961	.994
2⅛...	.359	.391	.430	.466	.501	.537	.573	.608	.644	.680	.716	.751	.787	.823	.858	.894	.930	.965	1.001	1.037	1.073
2¼...	.389	.427	.465	.504	.542	.580	.618	.656	.694	.732	.770	.809	.847	.885	.923	.961	.999	1.037	1.075	1.114	1.152
2⅜...	.421	.461	.502	.542	.583	.623	.664	.704	.745	.785	.826	.867	.907	.918	.988	1.029	1.069	1.110	1.150	1.191	1.232
2½...	.453	.496	.539	.582	.625	.668	.711	.754	.797	.840	.883	.926	.969	1.012	1.054	1.097	1.140	1.183	1.226	1.269	1.312
2⅝...	.486	.531	.577	.622	.668	.713	.758	.804	.849	.895	.940	.985	1.031	1.076	1.122	1.167	1.212	1.258	1.303	1.349	1.394
2¾...	.520	.568	.615	.663	.711	.759	.807	.855	.903	.950	.998	1.046	1.094	1.142	1.190	1.237	1.285	1.333	1.381	1.429	1.477
2⅞...	.555	.605	.655	.705	.756	.806	.856	.906	.957	1.007	1.057	1.107	1.158	1.208	1.258	1.309	1.359	1.409	1.459	1.510	1.560
3.....	.590	.643	.695	.748	.801	.854	.906	.959	1.012	1.064	1.117	1.170	1.222	1.275	1.328	1.381	1.433	1.486	1.539	1.591	1.644
3⅛...	.626	.682	.737	.792	.847	.902	.957	1.012	1.068	1.123	1.178	1.233	1.288	1.343	1.398	1.454	1.509	1.564	1.619	1.674	1.729
3¼...	.664	.721	.779	.836	.894	.951	1.009	1.067	1.124	1.182	1.239	1.297	1.354	1.412	1.470	1.527	1.585	1.642	1.700	1.757	1.815
3⅜...	.702	.762	.822	.882	.912	1.002	1.062	1.122	1.182	1.242	1.302	1.362	1.422	1.482	1.542	1.602	1.662	1.722	1.782	1.842	1.90
3½...	.740	.803	.865	.928	.990	1.053	1.115	1.177	1.240	1.302	1.365	1.427	1.490	1.552	1.615	1 677	1.739	1.802	1.864	1.927	1.98
3⅝...	.780	.845	.910	.975	1.040	1.104	1.169	1.234	1.299	1.364	1.429	1.494	1.558	1.623	1.688	1.753	1.818	1.883	1.948	2.013	2.07
3¾...	.820	.888	.955	1.022	1.090	1.157	1.224	1.292	1.359	1.426	1.494	1.561	1.628	1.696	1.763	1.830	1.897	1.965	2.032	2.099	2.16
3⅞...	.862	.931	1.001	1.071	1.141	1.210	1.280	1.350	1.420	1.489	1.559	1.629	1.699	1.768	1.838	1.908	1.978	2.047	2.117	2.187	2.25
4.....	.904	.976	1.048	1.120	1.193	1.265	1.337	1.409	1.481	1.553	1.626	1.698	1.770	1.842	1.914	1.987	2.059	2.131	2.203	2.275	2.3
4⅛...	.947	1.021	1.096	1.171	1.245	1.320	1.394	1.469	1.544	1.618	1.693	1.768	1.842	1.917	1.991	2.066	2.141	2.215	2.290	2.364	2.43
4¼...	.990	1.067	1.144	1.222	1.299	1.376	1.453	1.530	1.607	1.684	1.761	1.838	1.915	1.992	2.069	2.146	2.223	2.300	2.377	2.454	2.53
4⅜...	1.035	1.114	1 194	1.273	1.353	1.432	1.512	1.591	1.671	1.750	1.830	1.909	1.989	2.068	2.148	2.227	2.307	2.386	2.466	2.545	2.62
4½...	1.080	1.162	1.244	1 326	1.408	1.490	1.572	1.654	1.736	1.818	1.900	1.982	2.063	2.145	2.227	2.309	2.391	2.473	2.555	2.637	2.71
4⅝...	1.126	1.211	1.295	1.380	1.464	1.548	1.633	1.717	1.801	1.886	1.970	2.054	2.139	2.223	2 308	2.392	2.476	2.561	2.645	2.729	2.81
4¾...	1.173	1.260	1.347	1.434	1.521	1.607	1.694	1.781	1.868	1.955	2.041	2.128	2.215	2.302	2.389	2.475	2.562	2.649	2.736	2.823	2.90
4⅞...	1.221	1.310	1.400	1.489	1.578	1.667	1.757	1.846	1.935	2.024	2.114	2.203	2.292	2.381	2 471	2.560	2.649	2.738	2.828	2 917	3.0
5.....	1.270	1.362	1.453	1.545	1.637	1.728	1.820	1.912	2.003	2.095	2.187	2.278	2.370	2.462	2.553	2.645	2.737	2.828	2 920	3.012	3.1
5⅛...	1.319	1.413	1.507	1.602	1.696	1.790	1.884	1.978	2.072	2.166	2.260	2.355	2.449	2.543	2.637	2.731	2.825	2.919	3.013	3.108	3.2
5¼...	1.369	1.466	1.563	1.659	1.756	1.852	1.949	2.045	2.142	2.239	2.335	2.432	2.528	2.625	2.721	2.818	2.914	3.011	3.108	3.204	3.3
5⅜...	1.420	1.520	1.619	1.718	1.817	1.916	2.015	2.114	2.213	2.312	2.411	2.510	2.609	2.708	2.807	2.906	3.005	3.104	3.203	3.302	3.4
5½...	1.472	1.574	1.675	1.777	1.878	1.980	2.081	2.182	2.284	2.385	2.487	2.588	2.690	2.791	2.892	2.994	3.095	3.107	3.298	3.400	3.5
5⅝...	1.525	1.629	1.733	1.837	1.941	2.044	2.148	2.252	2.356	2.460	2.564	2.668	2.771	2.875	2.979	3.083	3.187	3.291	3.395	3.499	3.6
5¾...	1 579	1.685	1.791	1.897	2.004	2.110	2.216	2.323	2.429	2.535	2.642	2.748	2.854	2.961	3.067	3.173	3.280	3.386	3.492	3.598	3.7
5⅞...	1.633	1.742	1.850	1.959	2.068	2.177	2.285	2.394	2.503	2.612	2.720	2.829	2.938	3.047	3.155	3.264	3.373	3 482	3.590	3.699	3.8
6.....	1.688	1.799	1.910	2.022	2.133	2.244	2.355	2.466	2 577	2.68	2.800	2.911	3.022	3.133	3.245	3.356	3.467	3.578	3.689	3.801	3 9

Table of Frame Section Modulus for 3/16 in. Stock

Depth of Section																					
2.....	.376	.415	.453	.492	.531	.569	.608	.646	.685	.724	.762	.801	.840	.878	.917	.956	.994	1.033	1.071	1.110	1
2⅛...	.411	.453	.494	.536	.577	.619	.660	.702	.743	.785	.826	.868	.909	.951	.992	1.034	1.075	1.117	1.159	1.200	1
2¼...	.447	.491	.536	.580	.625	.669	.714	.758	.802	.847	.891	.936	.980	1.025	1.069	1.113	1.158	1.202	1.247	1.291	1.
2⅜...	.484	.531	.579	.626	.673	.721	.768	.815	.863	.910	.957	1.005	1.052	1.099	1.147	1.194	1.241	1.289	1.336	1.383	1.
2½...	.522	.572	.622	.673	.723	.773	.823	.874	.924	.974	1.024	1.074	1.125	1.175	1.225	1.275	1.326	1.376	1.426	1.476	1
2⅝...	.561	.614	.667	.720	.773	.827	.880	.933	.986	1.039	1.092	1.145	1.199	1.252	1.305	1.358	1.411	1.464	1.517	1.571	1
2¾...	.601	.657	.713	.769	.825	.881	.937	.993	1.049	1.105	1.161	1.217	1.273	1.329	1.385	1.442	1.498	1.554	1.610	1.666	1.
2⅞...	.642	.701	.760	.818	.877	.936	.995	1.054	1.113	1.172	1.231	1.290	1.349	1.408	1.467	1.526	1.585	1.644	1.703	1.762	1.
3.....	.683	.745	.807	.869	.931	.993	1.055	1.117	1.179	1.240	1.302	1.364	1.426	1.488	1.550	1.612	1.674	1.736	1.797	1.859	1.
3⅛ ..	.726	.791	.856	.921	.986	1.050	1.115	1.180	1.245	1.310	1.374	1.439	1.504	1.569	1.634	1.698	1.763	1.828	1.893	1.958	2.
3¼...	.770	.838	.906	.973	1.011	1.109	1.177	1.244	1.312	1.380	1.447	1.515	1.583	1.651	1.718	1.786	1.854	1.921	1.989	2.057	2
3⅜...	.815	.886	.956	1.027	1.098	1.168	1.239	1.310	1.380	1.451	1.521	1.592	1.663	1.733	1.804	1.875	1.945	2.016	2.087	2.157	2
3½...	.861	.934	1.008	1.081	1.155	1.229	1.302	1.376	1.449	1.523	1.596	1.670	1.743	1.817	1.891	1.964	2.038	2.111	2.185	2.258	2.
3⅝...	.908	.984	1.061	1.137	1.214	1.290	1.366	1.443	1.519	1.596	1.672	1.749	1.825	1.902	1.978	2.055	2.131	2.208	2.284	2.361	2.
3¾...	.955	1.035	1.114	1.194	1.273	1.352	1.432	1.511	1.591	1.670	1.749	1.829	1.908	1.988	2.067	2.146	2.226	2.305	2.384	2.464	2
3⅞...	1.001	1.087	1.169	1.251	1.333	1.416	1.498	1.580	1.663	1.745	1.827	1.910	1.992	2.074	2.157	2.239	2.321	2.403	2.486	2.568	2.
4.....	1.054	1.139	1.224	1.310	1.395	1.480	1.565	1.651	1.736	1.821	1.906	1.991	2.077	2.162	2.247	2.332	2.418	2.503	2.588	2.673	2.
4⅛...	1.105	1.193	1.281	1.369	1.457	1.545	1.631	1.722	1.810	1.898	1.986	2.074	2.163	2.251	2.339	2.427	2.515	2.603	2.692	2.780	2.
4¼...	1.156	1.247	1.339	1.430	1.521	1.612	1.703	1.794	1.885	1.976	2.067	2.158	2.249	2.340	2.432	2.523	2.614	2.705	2.796	2.887	[illegible]
4⅜...	1.209	1.303	1.397	1.491	1.585	1.679	1.773	1.867	1.961	2.055	2.149	2.243	2.337	2.431	2.525	2.619	2.713	2.807	2.901	2.995	[illegible]
4½...	1.263	1.360	1.457	1.554	1.650	1.747	1.844	1.941	2.038	2.135	2.232	2.329	2.426	2.523	2.620	2.717	2.813	2.910	3.007	3.104	[illegible]
4⅝...	1.317	1.417	1.517	1.617	1.717	1.817	1.916	2.016	2.116	2.216	2.316	2.416	2.516	2.615	2.715	2.815	2.915	3.015	3.115	3.214	[illegible]
4¾...	1.373	1.476	1.579	1.681	1.784	1.887	1.990	2.092	2.195	2.298	2.401	2.503	2.606	2.709	2.812	2.915	3.017	3.120	3.223	3.326	[illegible]
4⅞...	1.430	1.535	1.641	1.747	1.852	1.958	2.064	2.170	2.275	2.381	2.487	2.592	2.698	2.801	2.909	3.015	3.121	3.227	3.332	3.438	[illegible]
5.....	1.487	1.596	1.701	1.813	1.922	2.030	2.139	2.247	2.356	2.465	2.573	2.682	2.791	2.899	3.008	3.116	3.225	3.334	3.442	3.551	[illegible]
5⅛...	1.546	1.657	1.769	1.880	1.992	2.103	2.215	2.327	2.438	2.550	2.661	2.773	2.884	2.996	3.107	3.219	3.330	3.442	3.553	3.665	[illegible]
5¼...	1.605	1.720	1.831	1.919	2.063	2.178	2.292	2.407	2.521	2.636	2.750	2.864	2.979	3.093	3.208	3.322	3.437	3.551	3.666	3.780	[illegible]
5⅜...	1.666	1.783	1.901	2.018	2.135	2.253	2.370	2.488	2.605	2.722	2.840	2.957	3.075	3.192	3.309	3.427	3.544	3.661	3.779	3.896	[illegible]
5½...	1.727	1.848	1.968	2.088	2.209	2.329	2.449	2.569	2.690	2.810	2.930	3.051	3.171	3.291	3.412	3.532	3.652	3.773	3.893	4.013	[illegible]
5⅝...	1.790	1.913	2.036	2.159	2.283	2.406	2.529	2.652	2.776	2.899	3.022	3.145	3.269	3.392	3.515	3.638	3.762	3.885	4.008	4.131	[illegible]
5¾...	1.853	1.979	2.106	2.232	2.358	2.484	2.610	2.736	2.863	2.989	3.115	3.241	3.367	3.493	3.620	3.746	3.872	3.998	4.124	4.250	[illegible]
5⅞...	1.918	2.047	2.176	2.305	2.431	2.563	2.692	2.821	2.950	3.079	3.209	3.338	3.467	3.596	3.725	3.854	3.983	4.112	4.241	4.370	[illegible]
6.....	1.983	2.115	2.247	2.379	2.511	2.643	2.775	2 907	3.039	3.171	3.303	3.435	3.567	3.699	3.831	3.963	4.095	4.227	4.359	4.491	[illegible]

Width of Section

Detroit S. A. E. Holds Big Meeting

K. W. Zimmerschied Receives Presentation—Short Discussion Follows Paper on Trend of Automobile Design

DETROIT, Feb. 16—In the paper read here to-night before the Detroit Section of the Society of Automobile Engineers on the "Trend and Possibilities of Automobile Design" by A. Ludlow Clayden and L. V. Spencer, editorial department Class Journal Co., the large audience was particularly impressed with the plea made for the development of engines which would efficiently use cheaper and heavier fuel. This was suggested as the logical means of combating the advancing cost of gasoline. Extracts from the paper were published in the Feb. 17 issue of THE AUTOMOBILE.

Before the presentation of the paper by Mr. Clayden, Russell Huff, President of the Society, made an address in praise of the work of K. W. Zimmerschied, metallurgist of the General Motors Co., who resigned as chairman of the Standards Committee of the Society, owing to the press of other work. In token of appreciation of his work a framed copy of a resolution of thanks, which was passed by the council, was presented to Mr. Zimmerschied, and on behalf of the members of the Council and of the Standards Committee he was given a leather desk set as a further mark of their high regard for his work and for himself.

Large Attendance

The attendance was perhaps the largest yet enjoyed by the Detroit Section, and several of the automobile centers near Detroit were represented by good-sized delegations. Fifty student members of the Michigan University Section of the Society also came in from Ann Arbor for the occasion.

Discussion Short but Animated

A. P. Brush, Brush Engineering Association, stated that he believed Mr. Clayden had come to an erroneous conclusion when he said:

"I must preface my remarks in connection with certain points in Mr. Clayden's paper, from which I differ, by expressing a profound admiration for the able manner in which Mr. Clayden has handled an exceedingly difficult subject, an admiration which I am confident I share with everyone present this evening.

"Mr. Clayden makes some remarks regarding the future of heavy oil engines for automobile service, and concludes his remarks in this connection with this statement: 'But it has got to be done somehow, the thing has got to be faced and the sooner it is faced squarely the sooner it will be over.'

"Mr. Clayden's reason for this conclusion is expressed in a previous paragraph in this language: 'A practically inexhaustible supply of fuel from which to draw.'

"I believe Mr. Clayden has come to an erroneous conclusion, because he considered only one of the two obvious solutions; that is, the origination of a new type of engine capable of using satisfactorily less volatile hydrocarbon fuels with equal satisfaction to the operator.

Expects Chemical Solution

"It is a well-known fact that the less volatile hydrocarbons are made up of the same two elements, hydrogen and carbon, but with an excess of carbon, and if, or when progress in synthetic chemistry enables us to add the necessary hydrogen and secure a molecular reconstruction, a greater amount of more volatile fuel will be secured than the original amount of the less volatile crude product.

"Mr. Clayden refers briefly to a somewhat unusual use of the conventional leaf spring for car suspension. Being somewhat familiar with this construction, I ask your indulgence for the purpose of amplifying Mr. Clayden's remarks somewhat and correcting an erroneous impression which some engineers and laymen have formed regarding it.

"Because the construction referred to is a compounding of two semi-elliptic springs arranged transversely to the axis of the car, the two springs being attached to each other at the center, it is commonly assumed that, owing to this center attachment, this suspension will not resist the tendency of the car body to roll from the effect of centrifugal force on turning a corner, as much as the more common arrangements of springs arranged longitudinally at the sides of the car.

"A mathematical and geometrical consideration of this suspension will readily show what the most exhaustive tests have demonstrated in practice, that it is better adapted to resist this rolling tendency than any of the other leaf spring arrangements now in use. I might also add that any riding characteristics achievable with any of the other known types of leaf spring arrangements can be at least duplicated and with a lesser amount of spring steel and a much better loading of the rear axle structure.

Detachable Cylinder Head Best in One Piece

"Mr. Clayden calls attention to the advantages of the detachable cylinder head, but comes to some conclusions regarding it, which in my judgment are not sound, in that these conclusions seem to be based upon an over-valuation of certain hypothetical advantages.

"For example: it does not seem to me sound logic to overemphasize the need of extreme rapidity in removing and replacing a detachable cylinder head.

"There are normally only two reasons for removing the cylinder head in service. They are carbon deposits and deterioration of the exhaust valves. Primarily the use of a properly controlled oiling system instead of the horribly unscientific compromise systems which are still too common, and, secondarily, a little care to avoid running the engine with too rich a mixture would eliminate the need of cleaning carbon oftener than once per year of average service.

"Exhaust valve deterioration decreases rapidly and the power output per cubic inch of piston displacement increases rapidly with a proportionate decrease in cylinder and valve sizes.

"If, therefore, as I am confident, cylinder head removals can be reduced to an average of not more than one per season, I fail to see how the saving of *all* of the time necessary to remove a bolted-on head can be any large advantage to the user.

"I must also take exception to the conclusion of Mr. Clayden expressed in the following quotation on page 11: 'In nearly every case half the advantage is thrown away by making the detachable head in one piece.' Where the detachable head carries with it the valves, thus permitting valve grinding at the bench instead of in the car, I believe the one-piece head is a distinct advantage, inasmuch as all cylinders and all exhaust valves will need attention, in a well-designed and constructed engine, at least approximately at the same time, and this construction permits a quick interchange of heads, giving the user the maximum of service in the minimum of time and allowing the garage mechanic to do his valve grinding between times.

"Mr. Clayden calls attention to the inherent accessibility advantage in the adjustable fulcrum overhead valve mechanism, but goes on to say: 'There are many pros and cons for the valve-in-the-head construction.' In this matter I am frankly a partisan, so much so, in fact, that I am quite incapable of appreciating the 'cons' of the overhead construction of the type referred to.

"Of course, I realize that the older types of rocker actuated overhead valves have been so badly carried out that the kinetic energy of the reciprocating valve parts was so high as to seriously interfere with the quietness and flexibility of the engine. Not only that, but the failure to understand the possibilities of proper rocker construction has prevented the securing of other important advantages in the whole valve mechanism.

"Considering the adjustable fulcrum, multiplying rocker valve train in which the multiplication ratio of the rocker is two to one, several things are apparent.

"First, the cam form is such that the flat surface cam rider or tappet may be used with safety. Second, the adjustment of valve train backlash disappears from the moving parts, permitting the use of the thimble type of cam rider or tappet in its best and lightest form. Third, the kinetic energy of the cam rider or tappet and the push rod is only one-quarter what it would be without the use of a multiplying rocker. Fourth, the weight of the reciprocating parts is lower than it could be without the use of the adjustable fulcrum for the rocker.

"These four characteristics are the prime reasons for the quietness and durability of this type of mechanism, particularly at high speeds. It is a fact that the flat-ended cam rider or tappet with a proper co-acting cam has characteristics which make it inherently better adapted for high speed work than the more expensive and heavier roller type of tappet, but for reasons clearly apparent in the second diagram, the flat-ended cam rider calls for a cam form which does not work out advantageously without the use of the multiplying rocker or its equivalent.

"I believe that the overhead valve engine, if properly designed and constructed, is from every standpoint the superior of any other type of poppet valve engine, especially in the hands of the average automobile user. So naturally, I cannot agree with Mr. Clayden that 'There are many pros and cons for the valve-in-the-head construction.'"

McCulla Likes Seat Back Straight

W. R. McCulla, engineer of the Packard company, in commenting upon the criticisms in the paper of the straight backs to the seats in the average car, he said that he had noticed a great many high speed cars recently, both in France and England, and in the majority of cases where they have some form of sway-back seat, such as is advocated in the paper, the driver always had a cushion behind him. Europeans have quite universally known and adopted the low-seated car, said

(*Concluded on page* 379)

New Headlight Mountings Are Rigid

Conditions of Heavy Lamp and Sightly Support Met by Scientific Distribution of Material—Vibration Must Be Dampened by Bracket System

CASUALLY it would not seem that the mounting of the headlamps had a marked effect on the satisfactory condition of the car, and yet if the work is done improperly the headlamps can be the first parts of the car to cause trouble and to indicate that the vehicle has passed its first stage of youth. In mounting the headlights it is necessary for the sake of harmonious appearance of the car that heavy and unsightly brackets do not protrude themselves to such an extent that they catch the eye as something apart from the general lines of the car. At the same time the lamps which are of considerable weight must be rigidly supported.

Bad Effects of Vibration

These two opposing conditions, the heavy lamp and the slender support, give rise to the damaging vibration which oftentimes causes a rupture of the lamp support and necessitates a patchwork job to again restore the lamp to its normal position. When the car passes over the road, striking all sorts of obstructions, vibration is set up which is transmitted particularly to rigid bars in the form of a pillar supported at one end and free at the other. It is in this condition that maximum vibration effects are obtained, and when the lamp is mounted on such a pillar, the full effect of its weight is felt and the supporting structure is soon broken down unless it is so rigid that it is unaffected by the shocks imparted to it.

It is not uncommon, where the lamp has been supported by a bracket bolted directly to the flange of the channel bar frame side member, to see the entire part of the flange of the channel beam broken away due to fatigue brought on by the continued stresses set up by vibration of the lamp support carrying its relatively heavy load.

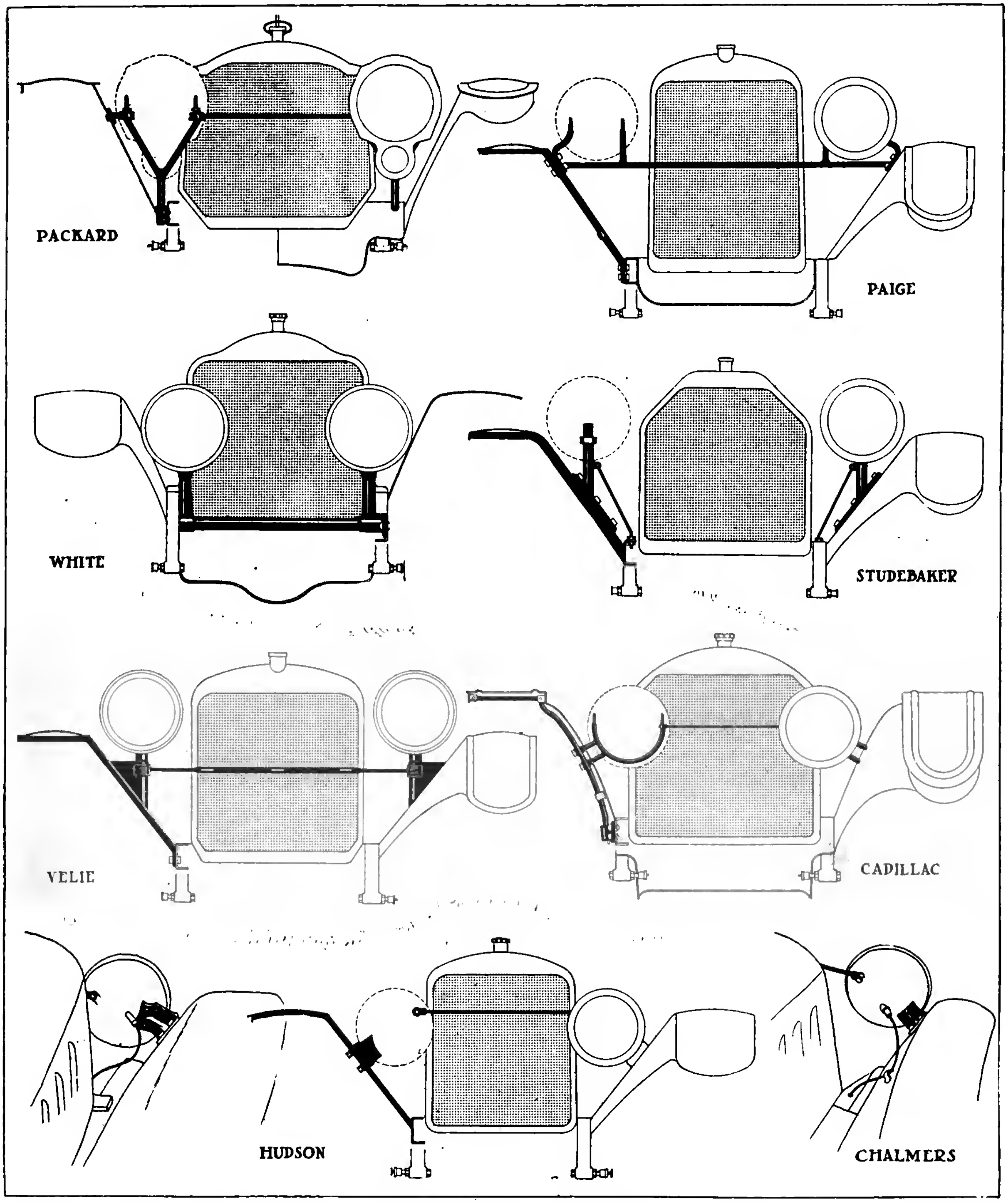
There are two ways in which the stresses can be met and an analysis of the sketches shown on the opposite page brings these to light very clearly. First: The vibrations can be described by eliminating the pillar effect by a cross bar between the two supports. The vibration will then be destroyed, because it would be impossible on account of the differences in synchronism between the two pillars which offset the vibrations by means of the cross support. The second method is by making the lamp supports so rigid that the vibrations are not capable of fatiguing the material.

Examples of where the cross bar method is used are shown in the Packard, Paige, Velie, Cadillac and Hudson cars, while the stiff structure which in itself is capable of resisting vibration is shown in the White and Studebaker. In the White care a stiff tubular structure gives rigidity and at the same time, although there is no cross bar between the lamps, there is a cross connection at the bottoms of the lamp pillars.

High Mounting Favored

There are some very interesting installations also, that are not shown in the accompanying group, although these are quite typical and are indicative of the basic methods of rigid bracing with a minimum amount of metal. It will be noted in passing that there is quite a tendency to keep the lamps high to give a good spread for the cone of light, and there is very little tendency to tilt the lamp downward in order to bring the rays below the eye level of pedestrians. The tilted lamp is at best a makeshift and not a scientific method of meeting the glare problem. It is not surprising, therefore, that it has not found favor and the dimming bulb still retains its popularity with the main lamp designed to cast a beam far in advance of the car.

Headlight Bracketing on Typical Cars



As shown in the above illustrations, there are two systems of headlight mounting, one in which a cross bar is used, which not only breakes the synchronism of vibration of the two headlight pillars, but also acts as a transverse stiffener and the rigid pillar support in which sufficient metal is used and so disposed as to give perpendicular rigidity without cross bracing. Packard, Paige, Velie, Cadillac and Hudson are good examples of different systems of cross bracing, some of the transverse bars being attached to the lamps themselves and others to the supports. Typical supports which are rigid enough in themselves not to require a transverse bar are shown by the illustrations of the White and Studebaker.

Thomas Aero Motor Compact and Powerful

New Small-Bore, High-Speed Eight-Cylinder V-Type Develops 135 hp.—Crankshaft Speed 2000 r.p.m.—Valve Caps Water-Cooled—Aluminum Intake Manifold

SMALL-BORE high-speed motors are going to be the ultimate power plants in aviation work as well as in automobile practice, according to the views of the Thomas Aeromotor Co., Inc., Ithaca, N. Y., which has recently brought out a new eight-cylinder V-motor of this description. According to the claims of the manufacturer, it will develop 135 hp. and yet its dimensions are but 36 in. in length between front and rear gear cover plates and 28 in. in maximum width. The crankshaft speed is 2000 r.p.m. and the propeller shaft operates through spur reduction gears at 1200 r.p.m.

Aeronautical and automobile practice are paralleling each other in simple and accessible grouping of accessories, and in this respect the Thomas motor is thoroughly up to date. In general appearance the new motor is not unlike the conventional eight-cylinder 90-deg. automobile motor. The cylinders are L-head design, 4-in. bore, 5-in. stroke with 1⅛-in. valves of tungsten steel. A feature in the cylinder design which stamps the motor as different from automobile practice is the water-cooling of the valve caps, access to them being by the removal of aluminum cover plates.

The valve springs are of large diameter and of fairly heavy section to prevent floating of the valve at top speeds. Other details of the cylinder design which are worthy of attention are the generous proportions of the cylinder feet and the closeness of the studs to the cylinder bores. The method of holding the push rod guides in an extension of the cylinder feet is also interesting.

High Volumetric Efficiency

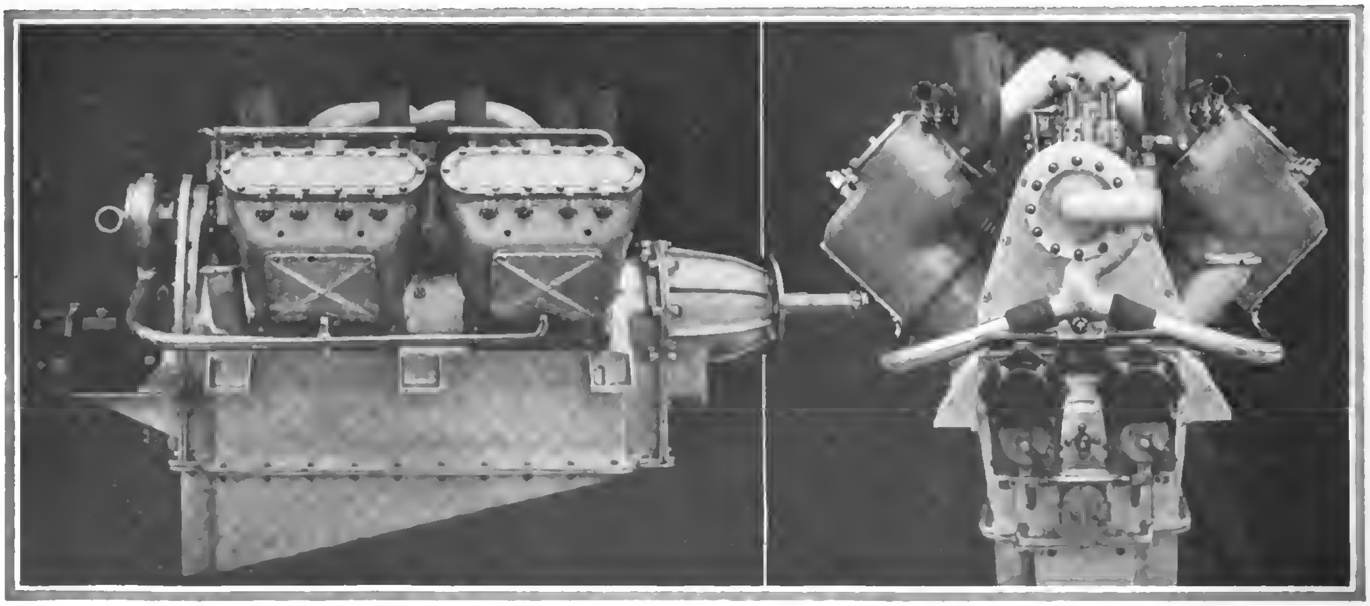
In working out the design of the valves and manifolds particular attention has been given to secure accurate action and high volumetric efficiency. The push rods are of square section and work in broached aluminum guides. They are acted upon directly by the cams without intermediate rockers or followers and are drilled hollow to secure light weight.

An aluminum intake manifold is used which is fitted to a 2-in. double-barrel Zenith carbureter. One nozzle and jet takes care of one block of cylinders and efforts have been made to eliminate bends in the gas passages. The result of this installation is shown in the economy which is claimed to be a consumption of but 13½ gal. per hour. One water pump is used with a siamese outlet to the cylinder jackets. The starter is located in the V with its shaft extending through the gear housing and carrying on its outer end the centrifugal water pump rotor. Two Dixie magnetos are run at crankshaft speed, with four plugs per cylinder.

Force-Feed Lubrication

Oiling is by force feed with the lubricant delivered at 60-lb. pressure. Crankpins, webs and main journals are drilled so as to carry oil to the lower connecting-rod bearings which are side by side arrangements. The pistons, which are of a special aluminum alloy, are lubricated by oil thrown from the crankpins and in order to maintain the oil temperature within the proper limits there is an oil cooling system with a circulating gear pump entirely independent of the lubricating system. The oil in the sump is taken by this separate gear pump and passed through cooling coils exposed to the air stream from the propeller and this again delivered to the sump. Means are provided for shutting off this oil-cooling system in cold weather.

As would be expected in aeronautical use, light-weight reciprocating parts are a necessity. The connecting-rods are of H-section made of chrome-nickel steel machined on all sides. They are 11⅜ in. between centers and the webs and flanges are but 5/64 in. in thickness. A complete assembly of piston, piston pin, connecting-rod and connecting-rod cap weighs but 3¾ lb. The babbitt is applied directly to the steel at the lower end of the connecting-rod. The crankshaft is supported on three bearings.



Two views of the new Thomas eight-cylinder aeroplane motor. The valve caps are water-cooled, being rendered accessible by the removal of the aluminum cover plates

The FORVM

THE AUTOMOBILE'S SUGGESTED IDEAL BODY PROPORTIONS MEET WITH GENERAL APPROBATION—FURTHER CONSIDERATION OF THE TRACTOR PROBLEM

Public Must Be Considered in Body Design

By R. W. Strickland

Chief Engineer Peerless Motor Car Co.

IN regard to Mr. Schipper's article in THE AUTOMOBILE for Feb. 3, such publicity is excellent, but may be misleading unless all the factors in the case have been considered.

For instance, the doorway from which the measurements are taken is not the regular entrance door and is suitable only as an emergency entrance and exit. Of course, the greater distance allowed there the better for the driver, who occasionally gets out in the middle of the street and not on the sidewalk.

In our design we gave what we considered sufficient clearance for entrance and exit without deforming the side of the body and relative proportion of the front and rear doorways, and also without making the right-hand door and front pillar different from the left-hand side. If the left-hand door is widened to give the extreme clearance called for it will be out of proportion with the possibilities of the rear door width unless the front pillar is retired. This is impossible on the right-hand side, as the distance between the front of seat cushion and the front pillar has to be kept at a fixed minimum to facilitate normal entrance.

In regard to the position of the levers, the point of reaching for the levers has been exaggerated. Also the position of the driver which you assume, as most real drivers prefer an upright position to the reclining one. Furthermore, in retarding the change speed and brake levers when located in the center of the car for right-hand control with left-hand drive, the further they are retired the less foot room is left for the driver getting into the seat from the curb side.

Bent Levers Undesirable

A comparison, of course, may be suggested in the way of bent levers, but such things nowadays are being avoided from a manufacturing and service standpoint and I have no doubt that most of the manufacturers have weighed these conditions carefully in locating their levers.

In regard to the brake lever, other difficulties enter—that is, plenty of throw is required in order to set the brakes with power and at the same time provide sufficient clearance to prevent dragging. This means that if the forward position is moved back within very easy reach the "on" position will be past center and a great inconvenience to people getting in and out of the car with the brakes set.

As for engineers getting together on fixed set of dimensions for these points, I believe it would be well-nigh impossible, owing to the balancing of the various points brought out in your article and the points above, which call for compromises to suit the general public.

I believe we sent in the dimensions of our Model 56, which is probably one of the cars measured mentioned in your article.

In regard to folding wheels, we have noted carefully on one model which adopted them that the drivers never used them in spite of the fact that it was a little difficult to get out on the "off" side, but it was more difficult to fold the wheel, even though the device was fairly simple.

Working on Adjustable Seats, Toeboards, Door Locations, Etc.

By G. G. Behn

Chief Engineer Hudson Motor Car Co.

MR. SCHIPPER has covered a good many important points in connection with the design of automobile bodies in his article appearing in THE AUTOMOBILE for Feb. 3.

Undoubtedly, the reason that so many bodies are designed with improper seating space or entrance space is because the the body is usually the last item which is given any consideration. A chassis is first designed and wheelbase determined, and after this has all been done then the body is designed. In a great many cases insufficient space is allotted for the body, which brings about the crowded conditions mentioned in Mr. Schipper's article.

We have been working for some time on a scheme of determining sitting positions and door openings which will enable us to get conditions exactly as they will be reproduced in the finished body, including the upholstering. In other words, the seats, toeboards, door locations, etc., will all be adjustable. When completed, we believe that the device will be very valuable, as it will eliminate all guess-work as to what is correct in the way of body dimensions.

To Develop Light-Weight Ploughs

By Marius C. Krarup

IN this column, issue of Feb. 10, I mentioned some reasons for the belief that the development of light tractors and the use of light motors for farm work, to take the place of the heavy machinery or of the animals now employed, depends wholly upon the simultaneous development of soil-milling tools and methods, by which the movements for working the soil are made to assist in the propulsion of the machine.

You omitted, however, my closing paragraph, for the sake of which the rest was written. No doubt, the omission was due to the exigencies of your space. What I suggested was that the most practicable way for developing light soil-milling machines for use on farms, where they cannot be adopted unless they are sure to pay for themselves from the start, is to gain experience by designing and building them in sizes and types suitable for suburban gardens, whose owners are not so closely bound to either economy or ownership of the machines. While my suggestion was not worded more explicitly, I assumed that every American familiar with suburban and village life in the United States would at once see a picture projected on the movie-screen of his own mentality to the effect of some enterprising young business man in the locality making suitable arrangements with a maker of soil-milling machines, on one side, and with owners of gardens and garden truck farms, on the other side—enabling all to get their soil tilled at a fair price and in quick order, each successive year getting the advantage of improvements in the construction of the machines without the burden of individual investment. I could go much farther with this suggestion, as regards construction as well as in the industrial and sociological features, but fear to encroach on your space with a subject in which only a minority of automobile manufacturers, engineers and users are interested.

Where would the automobile industry be to-day, however, if the public had not carried the main burden of experimental work from 1895 to 1903? And—assuming that soil-milling as distinguished from plowing, is necessary to let the automobile industry into the manufacture of farm motors and tools—how many years will it be likely to take before good results are reached, unless the burden of constructive experimentation is distributed somewhat, as may be done on the plan suggested? The new-born enthusiasm for fancy farming and gardening under the auspices of city people, for which the automobile is largely responsible, should be like mother's milk for the infant soil-milling machine.

Detroit S. A. E. Has Big Meeting

(Concluded from page 360)

he, but he noticed the drivers all hanging on to the steering wheel, sitting up quite straight. He also remarked that he has sat in a few cars himself at high speed which had a low back seat and does not like it.

E. T. Birdsall, Kosmath company, speaking on the matter of body comfort, heartily endorsed a recent article in THE AUTOMOBILE entitled, "Drivers Lot 99 per cent Discomfort." He agrees with the idea of making an effort to put more comfort into the bodies. At the Detroit show, Mr. Birdsall remarked, he went around with a friend who was going to buy a car and tried four of the very well-known makes, and in not one of them could he sit in the front seat, put his feet on the pedals and keep his knees away from the steering wheel. He said that comfort is a point that designers would do well to pay a great deal of attention to.

Chase Favors Transmission Brake

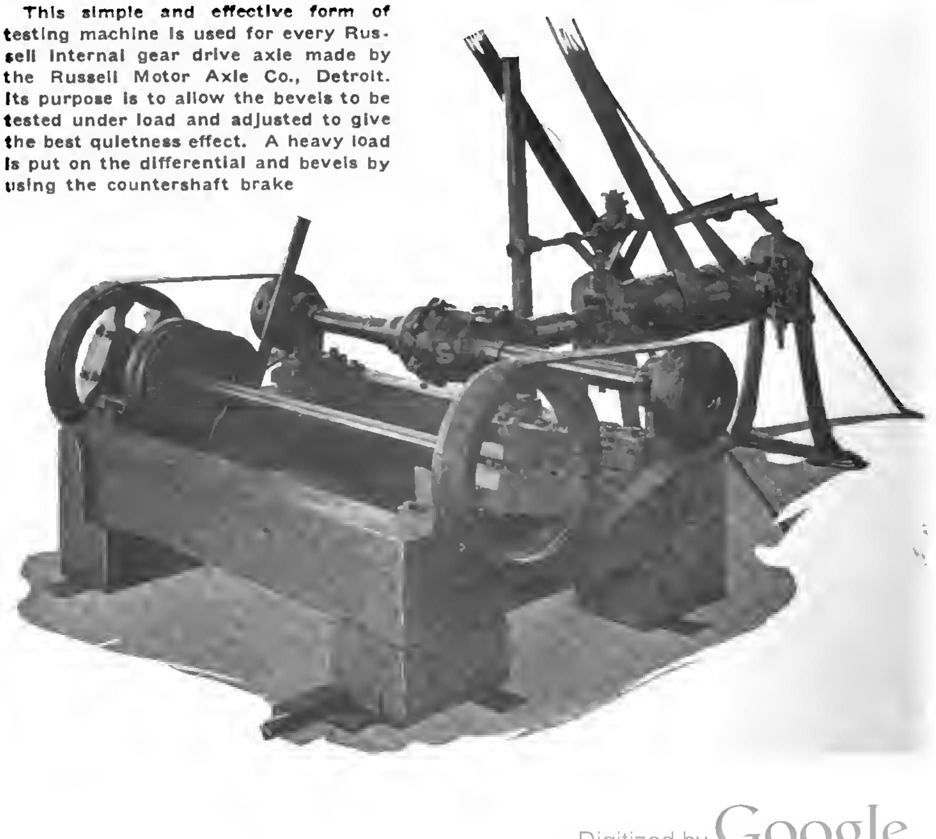
Regarding brakes, which were also dealt with in the paper, Herbert Chase, laboratory engineer A. C. A., spoke in favor of the propeller shaft type. "It is not very much seen in American cars, but it has some possibilities which warrant more consideration. There is also another point which, perhaps, should have quite a little emphasis, and that is the very poor average carburetion that we have on cars. I think it is safe to say that perhaps 10 to 15 per cent of the fuel that is used is never fully burned, and the products of combustion contain large quantities of CO which in itself is a mark of decided inefficiency in carburetion. I look for improvement in that line.

J. G. Vincent, chief engineer of the Packard company, touched upon the body-seating matter and said that while he personally was in favor of the low arm-chair type of seats, it is his experience that the higher seated cars sell more readily. For rough roads he thinks the fairly straight seat more comfortable because it allows one to brace himself to better take the bumps. The remarks regarding brakes, Mr. Vincent thinks, are very timely and that engineers must put more study on them. He thinks front wheel brakes are fine in theory, but they have the objection of increasing the turning radius which, of course, is not desirable. On this point Mr. Vincent said that someone may get up a mechanism to operate a front wheel brake and still keep a short radius, and it would certainly be a good thing. He also commended the steering qualities of the average high-grade car to-day.

As to the matter of transmissions, Mr. Vincent said that he could not possibly agree with the paper where it says there is going to be any tendency toward hydraulic or electric transmission. After looking the situation over thoroughly he believes the answer to be along the lines of a flexible motor. As to the aluminum motor, he said, this is certainly a very interesting development. There are no doubt some things to be solved in it, such as keeping it properly warm in the winter time, not having to take too much time to warm it up, and so forth. Regarding the statement in the paper that power falls off badly in a motor of small cylinder bore, he stated it to be his opinion that the power falls off in a larger percentage in a larger cylinder, on account of the larger valves and the inability to keep the valves in good shape.

Importance of Heavy Oil Experiments

There was very little time left for the author's reply, and Mr. Clayden confined his attention to the question of heavy oil experiments. He stated that he had observed so many disappointments in the development of chemical methods for making gasoline from heavy oil that he had lost faith in chemists. If the high price of gasoline is due to shortage the heavy oil engine is a necessity, and if the price is not due to shortage, then the coming of heavy oil engines will force those responsible for holding up gas prices to ease them off again. Either way there is advantage in developing heavy oil automobile engines as rapidly as possible.



This simple and effective form of testing machine is used for every Russell internal gear drive axle made by the Russell Motor Axle Co., Detroit. Its purpose is to allow the bevels to be tested under load and adjusted to give the best quietness effect. A heavy load is put on the differential and bevels by using the countershaft brake

Milwaukee—Le Roi Motor Designed for Simplicity

Few Moving Parts with Integral Construction Used Wherever Possible—Thermo-Syphon Cooling, Unit Crankcase and Cylinders with Detachable Heads

UNDER the model name Le Roi, the Milwaukee Machine Tool Co., Milwaukee, Wis., has brought out a motor which it has designed especially for simplicity. The motor is for light work, and the brake-horsepower curve shows the motor to reach its peak at about 2300 r.p.m. at which speed it develops about 28 hp.

Moving parts have been cut to the minimum possible with present design and what moving parts there are are completely inclosed when the engine is in the car. The cylinders and crankcase are cast in one piece, and in addition to the rigidity which this construction gives to the engine, tending to prevent cramped bearings and crankcase warping, the bearings themselves are of ample dimensions. This gives a simple rigid structure which is a sample of the policy followed throughout the entire design.

Convection Cooling Employed

Cooling is by thermo-syphon with special attention given to the water spaces around the valves and cylinders. An example of this is that there are no less than fourteen openings between the cylinder and cylinder head through which the water circulates, the head itself being detachable in order to give access to valves, pistons, combustion chamber, etc.

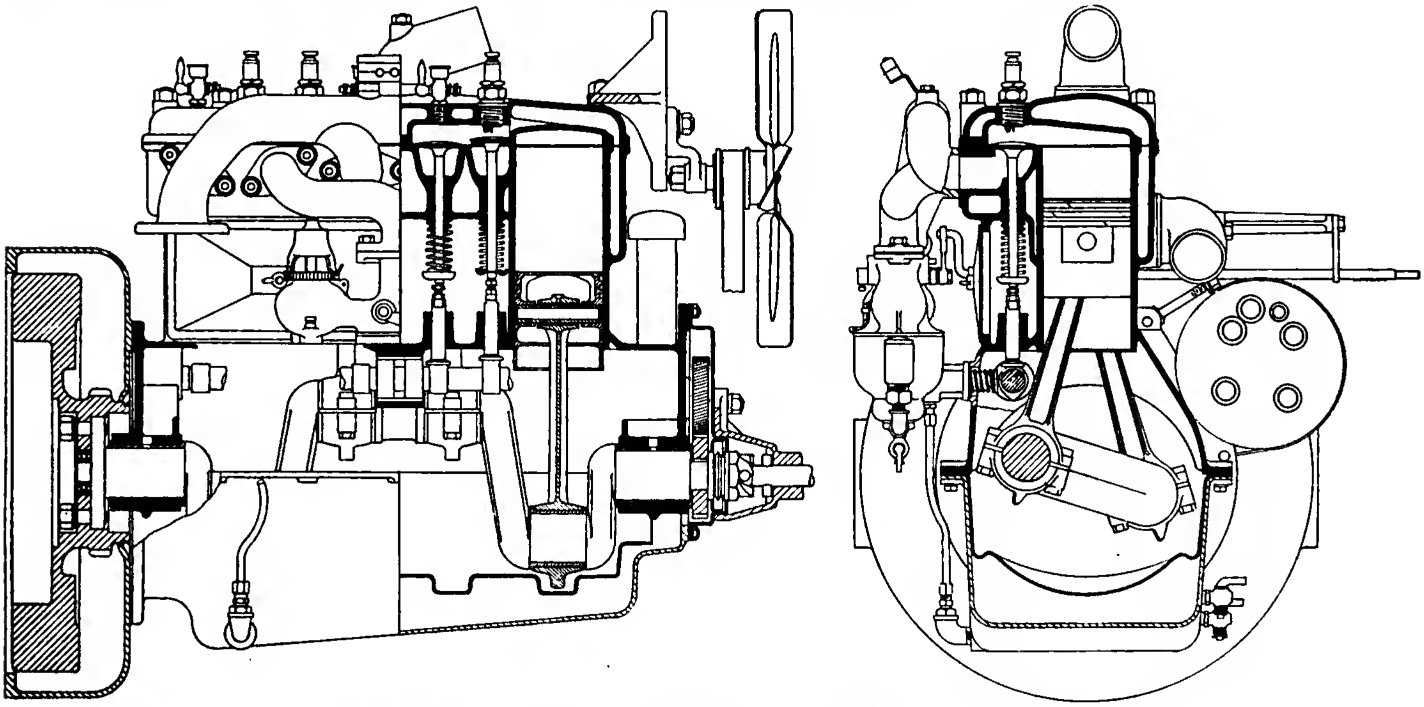
Equal simplicity is found in the lubricating system which is a combination pump and splash. Oil is pumped from the reservoir by a simple positive plunger pump to pockets over the camshaft bearings, whence it flows through the channels provided to pockets over the main crank bearings and from there to the constant level splash troughs and back to the reservoir. The pistons, wrist pins, and timing gears are all lubricated by the spray of oil formed by the connecting-rod splashing into the constant level tray.

Direct Valve Action

Referring to the sectional illustrations, it will be noted that the valve action is simple and direct. The valves are of large diameter and are actuated directly from the camshaft through a mushroom type push rod. Adjustment for clearance is provided in the usual manner between valve stem and push rod. In the sectional illustration the ample water-jacketing space around the valve stem guide is clearly shown.

The cylinders are 3⅛ by 4½ fitted with gray iron pistons closely machined and by careful distribution of the metal as light as possible. The pistons are flush top with three rings above the wrist pin and the piston pins driven into the bosses in the casting. The connecting-rods are I-beam section of light weight and the crankshaft is supported on two main bearings. A spiral gearset drives the camshaft which is of integral construction.

The bell housing for the flywheel is No. 4 S. A. E. standard and there is a ball bearing in the flywheel to support the front end of the transmission driveshaft.



Part longitudinal and transverse sections though the Le Roi motor made by the Milwaukee Machine Tool Co.

The Rostrum

Oil Geology of Goshen Valley, Utah

EDITOR THE AUTOMOBILE:—I notice in THE AUTOMOBILE the price of gasoline steadily advancing, some people giving as a reason scarcity of crude oil. This prompts me to ask a question which I confess is out of your line of work, but since you are interested in automobiles and gasoline you might give me the desired information.

I am living in a valley where there are a number of springs that at times show traces of oil, also an abandoned well on my ranch has shown oil at times to such an extent that stock would not drink from it. Some well diggers have tried to dig wells here and find a layer of rock so hard they cannot get through it with a common drill. One man who had worked with a drill in oil fields said he thought if a person could drill through this layer of rock he would strike oil.

I am told that these indications are very similar to those in the Big Horn Basin, Wyo., where they drilled and found large quantities of oil. This country, to my knowledge, has never been examined by an expert oil man, and any information whereby someone could be induced to make an honest effort to test it out would be very much appreciated. T. L. S.

Elberta, Utah.

—Elberta is located about 9 miles east of Eureka, Utah, in a district which was mapped in detail in 1897 by the United States Geological Survey. The map and associated description are embodied in the Tintic special folio, No. 65, of the U. S. Geological Survey, which is obtainable from the director of the Geological Survey at Washington, D. C. for 25 cents.

The rocks of Goshen valley, in which Elberta is situated, consist of sands and gravels in terraces, bars and deltas, comprising the lake bed series of the extinct lake Bonneville; and they are underlain by andesite and rhyolite lava flows in sheets of uncertain thickness.

As far as it is possible to tell from the general geology, as described in the folio, the area in and around Elberta does not appear to be favorable to the occurrence of quantities of oil.

THE AUTOMOBILE is indebted to the Department of Geology, Columbia University, for assistance in tracing down this inquiry.

Formula for Flow Through Pipes

Editor THE AUTOMOBILE:—I should like to know the principle of operation of a gear pump. Will one operate against a pressure of 5 kg.?

2—What is the formula for determining the flow of a liquid through a pipe? Given a pressure of 5 kg., a pipe diameter of 15 mm., a Saybolt viscosity of 300 sec., please explain fully how to determine the number of liters of oil delivererd per second.

3—Is it possible to make an accurate fit in a dog coupling as shown in the sketch, Fig. 3. I wish to use such a construction in the divided center bearing of a two-piece crankshaft. What method of procedure would it be necessary to employ to make and fit same accurately? F. H. W.

New York City.

—The principle of a gear pump is simple, as it consists merely of two gears rotating within a chamber. The pump chamber is so arranged that the side of the two gears coming into mesh are in the intake compartment and coming out of mesh in the exhaust compartment. The oil is led in, and as the gears come into mesh it is picked up in the clearance space between the teeth and thrown out on the other side. By a pressure of 5 kg. it is presumed that you mean a pressure of 5 kg. per square centimeter. This is equivalent to about 70 lb. per square inch, which is slightly above the capacity of the usual gear pump.

2—Unless you give the pressure in kilograms per square centimeter or some other square unit, it is impossible to interpret your inquiry. There are a great many formulæ for flow of liquids through pipes, depending on the nature of the pipe and various other factors. The theoretical formula for quantity discharge is $Q = ac\sqrt{rs}$, in which a is the area in square feet, c the coefficient of flow, r the mean hydraulic depth or the area over the perimeter, and s equals slope or head divided by length of pipe. To obtain definite values in this formula to substitute in order to secure a definite result, it will be necessary for you to take a hydraulic table and secure your head from your kilograms per square centimeter figure and your other variables from the kind of pipe you are using, etc.

3—It would seem possible to make an accurate fit on the clutch you have sketched in Fig. 3 by grinding the engaging surfaces of the jaws.

Oil Used Probably Too Light

Editor THE AUTOMOBILE:—What is the address of the Northway Motor & Mfg. Co., which manufactures the four-cylinder motor of the model 43 Oldsmobile?

2—Which is the best oil to use in the transmission of the model 43 Oldsmobile? Some tell me to use same as in the motor.

3—What causes the first two cylinders to have poor compression and the spark plugs to be coated with carbon and oil? I use a light oil. It is a valve-in-the-head motor, and the car has run only 1100 miles since it was bought last Fall.

4—Please give me the horsepower curve of the four-cylinder 3½ x 5 valve-in-the-head Northway motor.

5—Does it shorten the life of a storage battery more if it is used for ignition as well as for starting and lighting, or only starting and lighting, if the battery is always kept charged and supplied with water?

6—Which gives the brighter light—a 6-volt lamp or a 7-volt? The battery is a 6-volt storage, and what is the right candlepower to use? Does it harm the battery to use 7-volt lamps? Will a 7-volt lamp burn out as easily as a 6-volt?

7—What per cent difference will a speedometer show that is driven by the driveshaft over one that is driven by the front wheel on the average country roads?

8—Can you give me a sketch or description that will show me how the oil is fed into the different troughs under the connecting-rods, and does it make any difference if machine stands lower in front, as my floor is 2 in. lower? Does it feed an equal amount of oil into each trough? T. A. F.

Kenosha, Wis.

—The Northway Motor & Mfg. Co. is located in Detroit.

2—A heavy oil should be used in the transmission. The oil should be poured in up to the countershaft.

3—Try a medium oil in place of the light. It is hardly possible that the rings are worn as yet.

4—The horsepower curve of the Northway 3½ x 5 overhead valve motor is not at present available.

5—No.

6—On a 6-volt circuit the 6-volt lamp will give the brighter light, although its life will not be as long as the 7-volt. The candlepower can be anything you choose, but the greater the candlepower the more current will be consumed. Lamps which are up-to-date burn about 1 watt per candlepower. It does not harm the battery to use 7-volt lamps, and a 7-volt lamp will not burn out as quickly as a 6-volt on a 6-volt circuit.

7—This figure cannot possibly be given, on account of the great number of varying factors which enter. No doubt, however, if the same car could be equipped with independent speedometers with the two methods of drive, an average figure should be secured, but of this THE AUTOMOBILE has no record.

8—The fact that the car stands on a slope should not affect the oiling system as each trough is fed independently. You can readily test the oil level in the well yourself, as there are four plugs on the right side of the crankcase near the bottom which may be removed and the oil level ascertained.

Hudson Uses Three-Brush Regulation

Editor THE AUTOMOBILE:—Please describe and give advantages and disadvantages of semi-floating, three-quarter floating and full-floating axles.

2—Kindly publish wiring diagram of the new Delco system, third brush regulation, as used on Hudson super six.

New York City. F. W. W.

—See THE AUTOMOBILE for Dec. 2, page 1004.

2—This is shown in Fig. 1.

Connecting Trouble Lamp on 6-42 Kissel

Editor THE AUTOMOBILE:—I have a 1916 6-42 Kissel, and would like to know the best way to connect the wiring to attach a socket on the motor side of the dashboard for an electric trouble extension lamp, the Westinghouse lighting system being used on this car.

Newark, N. J. L. S. H.

—The trouble lamp should be a two-wire type with one wire run directly to the ground and the other wire connected to the tail light circuit. This will leave the socket alive whenever the tail light is in operation and the consumption of current will only occur when the trouble light actually needed is inserted in the socket. If you desire to use the equipment already on the car the instrument light is connected with a removable shelf so that the lamp bulb can be taken out and the plug connection of the trouble light inserted. Therefore, an extra socket is not needed unless you really desire to install one.

Use Graphite Paint to Prevent Rust

Editor THE AUTOMOBILE:—What is the paint to use on the rim of the wheel to keep it from rusting? G. W. C.

Portland, Me.

—Graphite paint is probably the best to use on the rim of a wheel to keep it from rusting.

Information on 1912 Model Everett

Editor THE AUTOMOBILE:—I have recently come into possession of a 1912 Everett model 36 and would like to know what the original equipment was as to ignition, carburetion and transmission systems. I also would like to know the bore, stroke and rating of this engine and the maker's name.

Haverhill, Mass. E. E. S.

—The standard ignition equipment on this car was the Splitdorf and the carbureter was a model H. Holley; the starter system was a Deaco-Prest-O-Lite. The transmission system was an integral part of the rear axle housing manufactured by the Everett company.

The bore and stroke are 4 by 4¾ with four cylinders and a rating of 38 hp. They were manufactured in the Everett company's shop. The cylinders are cast in a block.

Wiring Diagram of Moline-Knight

Editor THE AUTOMOBILE:—Kindly show me by diagram the lighting and starting system of the 1914 series of Moline-Knight.

2—Where is the proper place to connect a spotlight in this car?

3—Could this light be connected to the wires leading directly from the storage battery, if a 12-volt bulb is used?

4—Where should an ammeter be connected in this wiring system?

5—Whenever I refill the battery to the proper level with pure rain water and then charge it by allowing the motor to run, the water in four of the cells starts rising and then almost overflows. I then remove the excess water in these cells after which it does not rise any more. Does this prove these four cells defective or is the water chemically impure; might it be that these four cells are filled up too much, thereby preventing the gas to escape, and then cause this expansion?

Chicago, Ill. E. D.

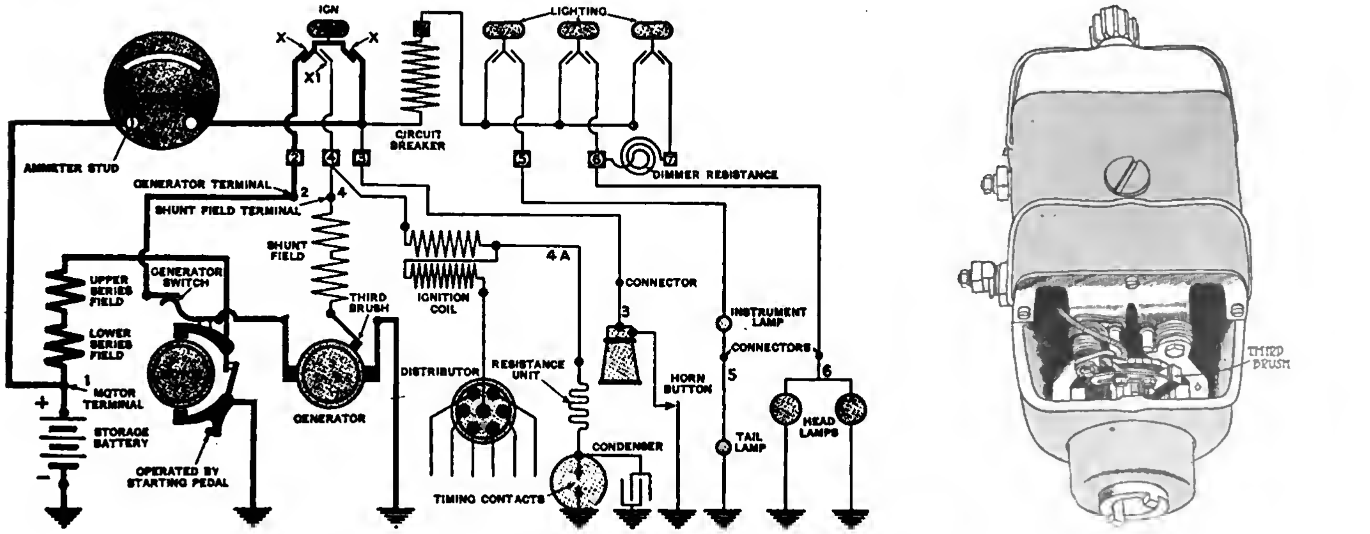


Fig. 1—Wiring diagram and sketch illustrating Hudson-Delco third brush regulation

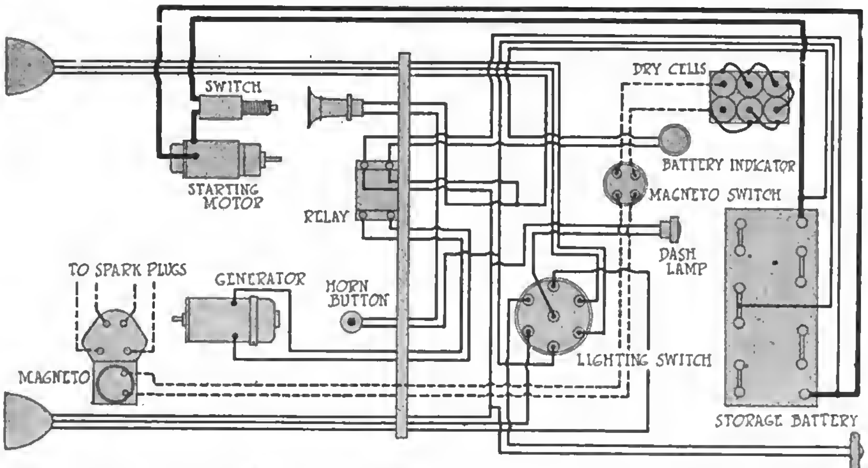


Fig. 2—Wiring diagram of the Moline-Knight with 12-volt storage battery

—The diagram for the lighting and starting system of the 1914 series Moline-Knight is shown in Fig. 2.

2—As there is a 12-volt battery in this car in using a 6-volt bulb the proper thing to do is to connect one side to the neutral side of the switch and the other side to the green or negative wire on the battery.

3—If a 12-volt bulb is to be used it can be connected to the main lead from the storage battery. This is a three-wire cable and the connection should be made on the red and green wires back of the panel board and lighting switch.

4—The wiring diagram shows where the battery indicator should be connected. If an ammeter is to be used in place of the battery indicator the same connection can be utilized. If both are wanted, put the ammeter in series with the indicator.

5—The Moline company uses a six-cell 12-volt battery in this model. If the battery is run down and filled to the proper level with pure rain water the expansion of the plates will cause the water to rise and does not indicate that the cells are not in normal condition. If the water in the other two cells does not act similarly and they contain the same amount of water as the others, it indicates that the solution in these two may be too weak.

Reasons for Slipping Clutch

Editor THE AUTOMOBILE:—I am owner of a six-cylinder car equipped with a disk clutch. The car is geared about 3.3 to 1 with a large wheel and I have experienced trouble in clutch slippage.

Not taking into consideration whether the clutch is too small or not properly constructed, would a lower gear ratio have a tendency to keep the clutch from slipping, or not?

When giving answer will you please give reasons why condition would not be changed or why it would be made better or worse?

Martinsburg, W. Va. C. E. G.

1—A lower gear ratio would tend to keep your clutch from slipping. The reason for this is that the amount of energy through any given period of time transmitted through the clutch is less with the lower gear ratio for a given car speed.

There are two factors in the transmission of horsepower. One is the foot pounds of energy and the other is the time. If the time is increased the foot pounds energy is decreased. Since the revolutions per minute can be considered as a time factor it is quite evident that in transmitting a given horsepower through the clutch the energy at the clutch will be less when the speed of the crankshaft is higher.

Bulbs for Ford Magneto System

Editor THE AUTOMOBILE:—I have a 1916 Ford and am desirous of changing the headlamps. I have a new pair of headlights wired for two bulbs, head and dimmer. I find on taking these lamps apart that the upper bulbs are marked 6.5 volts and the lower ones are 9 volts. I bought these lamps with the understanding that they were for a 1916 Ford. What I wish to know is this: How can I wire these new lamps in series, as the old lamps were, when I bought the car? There are only three wires coming from each lamp. Kindly give diagram.

Allentown, N. J. H. R. D.

—The lamps you have purchased are not the standard Ford lamps and the Ford company has no intention of installing equipment such as this upon its cars. The 9-volt bulbs of your lamps may be wired in series with the magneto but it would be impossible to wire the 6.5 volts to the magneto on account of the low voltage of the lamps which would cause the bulbs to burn out. Storage batteries could be used for the smaller lamps. This is a rather clumsy arrangement, however, and much better results could be obtained by using the standard Ford lamp.

Freezing Point of Charged Battery

Editor THE AUTOMOBILE:—Will a charged storage battery freeze in cold weather? If so, at what temperature?

2—How low does the battery have to be run down before it freezes?

3—How often should a battery be charged when not in use, say, stored for the winter? Some have taken their batteries out of their cars and put them in the cellar. Is it advisable to put them in cellars, or not?

4—Does it injure a battery to let it run clear down.

Plainville, Ill. A. A.

—A charged storage battery will freeze in cold weather an the temperature at which it will freeze depends upon the stat of the charge.

2—Storage batteries will freeze in accordance with the fol lowing table:

Specific Gravity 1.150	Battery empty, 20 deg. below zer
Specific Gravity 1.180	Battery three-quarters discharged zero.
Specific Gravity 1.215	Battery one-half discharged, 2 deg. below zero.
Specific Gravity 1.250	Battery one-quarter discharged 60 deg. below zero.

3—Storage batteries should be recharged at least once a month. Putting a battery in a cellar will not damage i if it is placed in a dry place and where the temperature i known not to go below 20 deg. above zero, and kept full charged.

4—A storage battery should not be discharged below point of 1.7 volts, per cell. A battery is not injured if di charged to this point and immediately recharged. The plate will deteriorate more rapidly if discharged below 1.7 vol per cell and is also injured if left standing in a discharge condition for any length of time.

Ammeter Connection on Chalmers 24

Editor THE AUTOMOBILE:—In your issue of Jan. 2 E. O. H. C. asks about installing an ammeter on a model Chalmers. I have installed on my machine, of the sa model and make, a Weston double scale ammeter reading 10 amp. on charge and 40 amp. on discharge, voltage to 20

By measurement I have found that the maximum dischar on throwing the lever to start is 70 amp. which is only for instant, the needle immediately dropping to below 35. I ha had this installation on my car for two years with perfe success. The circular that comes with the ammeter shows how it should be cut in.

San Francisco, Cal. N. A. Robinson.

Clock to Match Stewart Speedometer

Editor The Automobile:—Could you tell me where I can get a clock to put on my 1916 Maxwell to match the Stewart speedometer that is on it. It is a flush face with narrow nickel rim. It requires a very thin clock, for the space is small between the cowlboard and gas tank. I wish to pay about $6 to $10. The Waltham people supply the Cadillac with a type that would fit only it is too expensive.

Providence, R. I. F. J. R.

—The Stewart-Warner Speedometer Corp. manufactures an electric clock which matches the speedometer. This sells for $15. It is an electric device by means of which one small dry cell will keep the clock wound automatically for six months. It can be installed face flush with the dash and it is believed that there is sufficient room between the cowlboard and gasoline tank on this Maxwell to make its installation possible.

Thomas 35 a 1907 Model

Editor The Automobile:—When was the model 35 four-cylinder Thomas built? What is its bore, stroke, power, weight and speed?

2—I am considering remodeling one into a racer. Is it sufficiently modern to have high grade materials in it? Will two-point ignition from a Bosch double magneto increase the speed?

3—Where can I obtain aluminum pistons for this car?

4—Where can I obtain the right grade of channel steel to strengthen the frame which is continually cracking?

Gallon, Nev. A. D. D.

—The model 35 four-cylinder Thomas was built in 1907. Its bore was 5½, stroke 5⅛ and rated horsepower 60. The Automobile has no record of weight and speed.

2—Yes.

3—Aluminum pistons can now be ordered through any large garage and machine shop as there are now a number of manufacturers.

4—Any low carbon steel will be sufficiently strong to strengthen this frame as the frame in itself must be almost strong enough to sustain the stresses.

Adjusting Willys-Knight Worm Drive

Editor The Automobile:—Will you kindly advise the proper means of adjusting the wheel on the worm drive of a Willys-Knight 1914 car when no index is available?

2—Can the ball bearings of the front wheels be replaced with Timkens without buying new spindles and hubs?

Port Henry, N. Y. F. E. B.

—The adjustment of this wheel is taken care of on each side of the differential by means of shims. It is an adjustment that a repair man should be able to determine readily. The Willys-Overland company states that an allowance should be made of at least 0.005-in., as if the adjustment is too tight a severe binding occurs resulting in the early destruction of the gears. If excessive allowance is used it will result disastrously in that the gears would pound themselves to pieces. In making the adjustment it is suggested that just enough play be allowed to be perceptible between the mesh of the two gears.

2—The Willys-Overland company advises that this can be done.

Lever Slips Out on Rough Roads

Editor The Automobile:—I wish you would publish through the Rostrum a solution that would help me out.

1—My 1914 Packard 2-38 slips out of high gear about every 5 miles if the street is rough, while on country roads it is much worse. I have tightened the top and lower springs that hold the pinion, without results. I have examined the gears and found them as good as new, the connections on the gearbox are all right and it goes in high into full mesh but seems to work out.

2—I have had the crankcase taken off and a 3-in. square piece was broken out behind the starter. Because of the mechanics' failure to take off one of those nuts I had it welded by an expert and the job looked good but in drilling the hole it was cracked about 1½ in. down the side and I am using the car. I don't want to have the car tied up for a couple of days so can you recommend a way that I can temporarily repair it. I have tried shellac but the oil seems to work through.

3—I also have a 1916 Ford. Can a battery be charged from this car's magneto by changing the current to direct? If so, please give full explanations and mention objections if there are any.

Reading, Pa. C. E. A.

—The strongest probability is that the two plungers that drop into grooves in the gear shifter shaft to retain it in any of its four positions are not operating properly. It may be that these plungers have frozen in their guides or that their points have been badly worn, but it is more probable that when the shift to high is made the second speed pinion bottoms in the internal clutch of the direct drive gear before the proper lock groove on the shifter shaft has come squarely under the plunger. If this is the case the rear rod to the shifter shaft may be disconnected and the shaft screwed into the shifter fork until there is left 1/16 in. for travel of this mechanism after the lock plunger has dropped into the clutch but before the second speed pinion bottoms as above described.

If any of the above possibilities should exist it is very possible that in going over uneven roads the driving pressure on the gears might stop momentarily at the sudden slackening of the motor speed just when a sufficient jolt to throw the gears out of mesh was received.

2—From the description given the exact location of this crack is not evident, but the chances are all for its being readily accessible although the motor is in the frame. If so, it would be but a half hour's job for an experienced man to warm up the spot to the proper temperature, clean it and fill the crack very nicely with aluminum solder. Care in using the solder must be taken to avoid oxidization.

3—Yes, by installing a rectifier, but this would be so expensive and troublesome that it would not be worth while. It is not a practical thing to do.

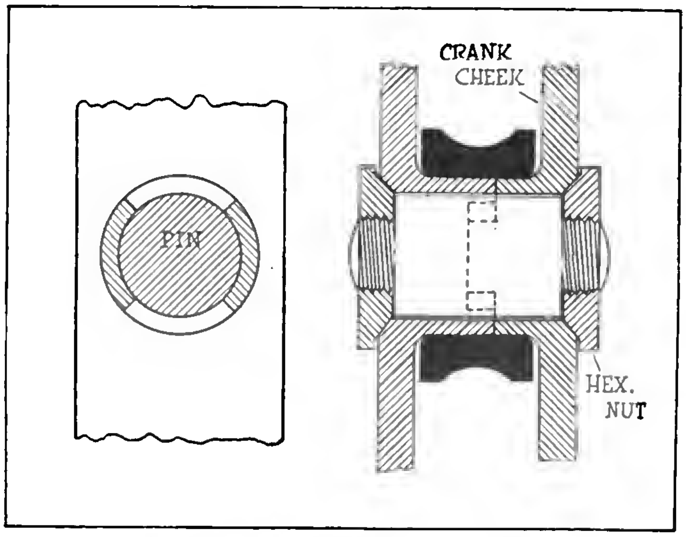


Fig. 3—Suggested jaw clutch for crankshaft connection

The History of the American Automobile Industry—18

Use of Hot Tube and Catalytic Ignition—Perry's Double-Acting Engine Which Resembled a Steam Design—First Induction or Step-Up Coil Invented by Ruhmkorff in 1852 Wins Napoleon's Prize

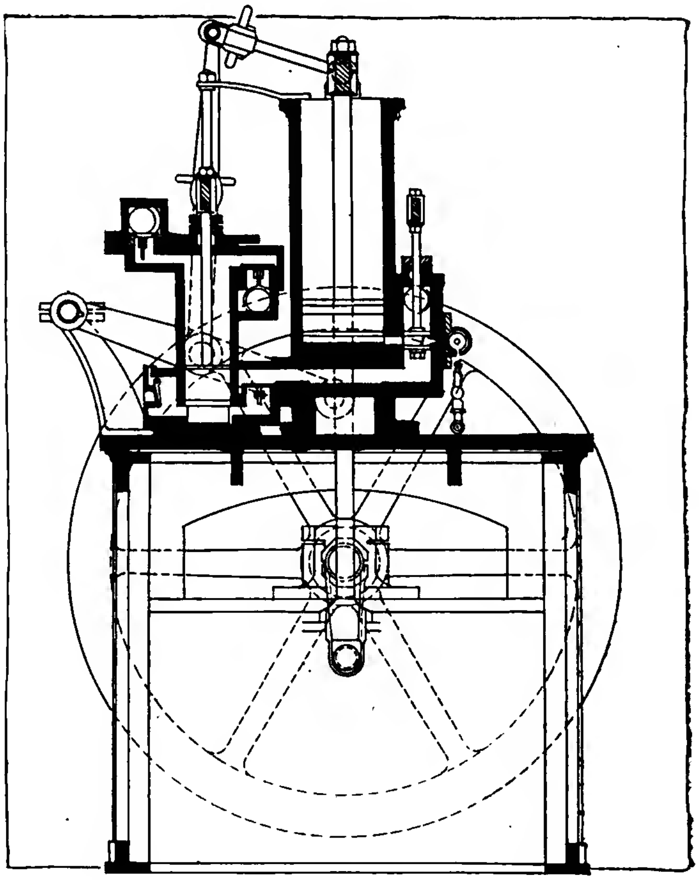
By David Beecroft

IN his British patents, 1615 to 1838, William Barnett shows several valuable ideas. He tried to introduce compression, although it is doubtful if he succeeded in securing much compression in the cylinder, owing to some delay between the ignition and the closing of the admission mechanism, during which time the piston was moving away from the ignition end, and thus reducing the compression.

It was common to ignite the non-compression engine by a flame on the outside of the cylinder and a hole through the cylinder wall, which was uncovered by the piston, after it had moved far enough to get in a partial charge. Some power naturally escaped through the hole, and Barnett, by his devices overcame this objection. He introduced the igniting plug or cock which would be filled with gas from the cylinder, turned round to the flame and ignited and again turned back to the cylinder, where it transferred the flame to the working charge. This igniting device was much used in later years, sometimes as a rotating plug and sometimes as a sliding one. Barnett also shows catalytic ignition and seems to have employed fine platinum wire or sponge for this purpose.

Beginning about 1835 a very persistent American worker, Dr. Alfred Drake of Philadelphia, began experiments which lasted for more than 20 years. During this time he developed an engine that is best known abroad, probably because more widely marketed in England and France by Lenoir. Instead of the jump spark as used by Lenoir he ignited by internally placed hot tubes, these tubes being kept hot by a flame blown into them by a pipe entering from the outside and igniting the mixture which surrounded them by their red heat. One of these engines exhibited at the Crystal Palace in New York in 1858 was seen by many people, who, later learning of the Lenoir, pronounced it the same as Drake's.

Another inventor whose patent descriptions give us much information and whose advertisements appeared in the magazines of that time, was Stuart Perry of New York, whose patents, Nos. 3597 of 1844 and 4800 of 1846, show what even to-day seem to be practical internal combustion engines. He used turpentine for fuel, but mentions that other liquid fuels were usable. The older patent described an air-cooled engine, whereas the later one shows water cooling.



Barnett Gas Engine

Double Acting Engine Tried

Perry's engine was double-acting, being built much as a steam engine. Its action was that of a two-cycle much like the Lenoir of later years, except that the air and vapor were forced into the working cylinder by pumps instead of being drawn in by the piston movement. The new charge was ignited by flame ignition when the piston had traveled about one-eighth of its stroke, which gave considerable length of stroke yet remaining for expansion and, therefore, must have been fairly economical; in fact, it much excelled Lenoir (years later) in this respect because Lenoir did not ignite his new charge until well toward the center of the piston movement.

Perry says that sliding or other valves may be used but he shows rotating cylindrical valves with ports cut in the sides thereof, like the Duryea of 1906 and the Darracq of 1907. His liquid fuel was vaporized by the heat of the cylinder and of the exhaust gas after the engine was started.

Of his air cooling, Perry said: "I prefer to inclose the cylinder and its immediate appendages in a case through which cold air may be blown by means of a rotary fan or other blowing apparatus which may be operated by the engine in any convenient manner." This air-jacket idea for the cylinder is still in use.

In his water-cooled engine he not only surrounded the cylinder with water, but lubricated the piston and inside of the cylinder with water, which both prevented wear and overheating.

In this engine Perry introduced platinum ignition, a form that received much attention from gas-engine inventors about that time. One of the most important features of his patent of 1846 "consists in the employment of a receiver containing condensed (compressed) atmospheric air for starting the engine, in combination with another receiver and with an air pump, . . . said pump being operated by the engine." Thus do we find both from Perry and from Cayley of 9 years earlier, that the self-starting of an air or gas engine was a matter worthy of their consideration. The starter idea is not new to the twentieth century, but is one more example of the grasp inventors had of the problem in 1840.

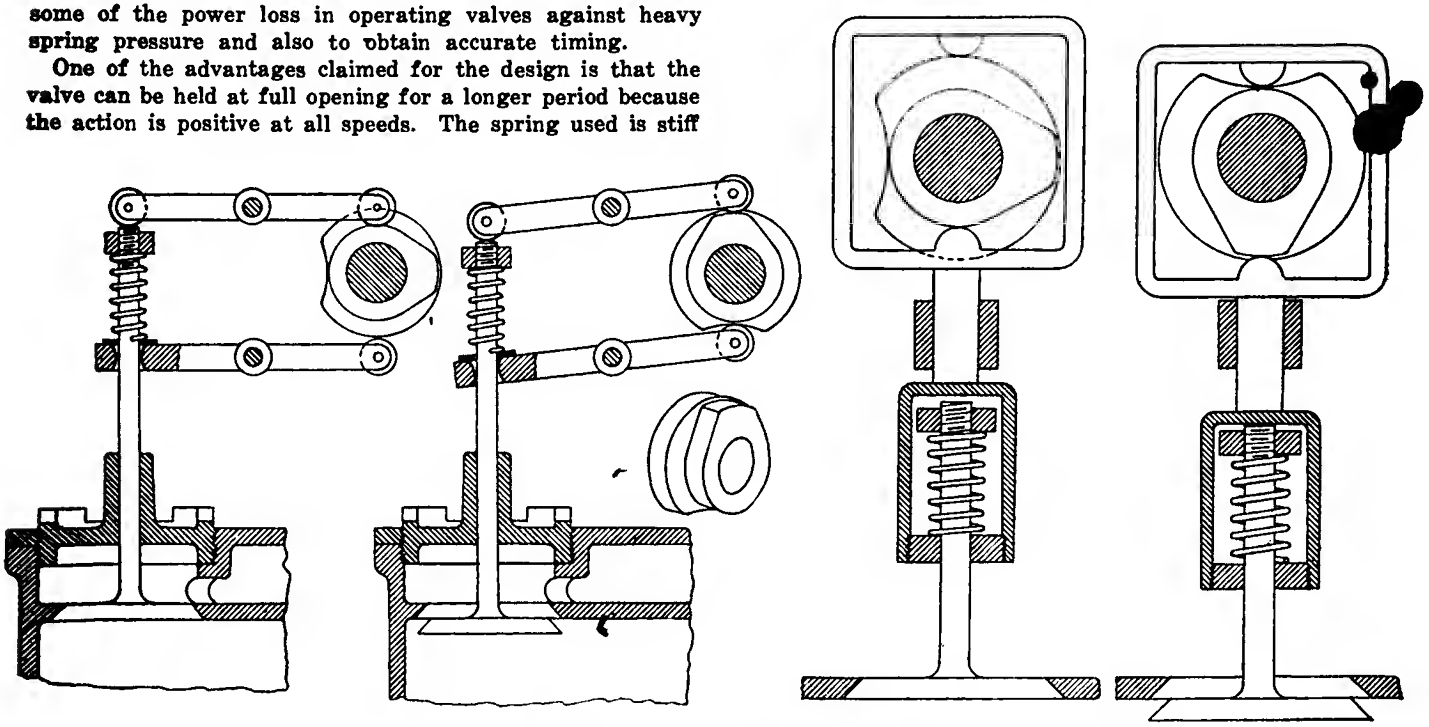
Start of Coil Ignition

Coincident with the work of Drake was the development of the step-up induction or double-coil now used in connection with all jump-spark ignitions. This coil is commonly termed a Ruhmkorff coil, because in February, 1852, the Emperor Napoleon of France offered a reward of 50,000 francs to the man who could produce the most important electric invention during the next 5 years, which period was extended later to a further 5 years. This award was finally given to H. D. Ruhmkorff, a Paris instrument maker, for inventing this coil. It was, however, first developed by Prof. Chas. G. Page of Washington, D. C., following the researches of Faraday, Joseph Henry and W. Sturgeon, about 1831. It should, therefore, more properly be termed Page's coil. As early as 1838 Professor Page and J. H. Abbott built some large induction coils, and in 1836 N. J. Callan described the jump or induction coil having a vibrator or interrupter. This coil was, therefore, well known in America before the award to Ruhmkorff, or its use in a gas engine by Lenoir.

Valve Action Designed to Reduce Power Loss

IN view of the recent controversies on valves and valve spring pressures, a design which was originated by F. F. MacVicar of Syracuse, N. Y., in 1907, is of interest. As the illustrations indicate, the action was designed to overcome some of the power loss in operating valves against heavy spring pressure and also to obtain accurate timing.

One of the advantages claimed for the design is that the valve can be held at full opening for a longer period because the action is positive at all speeds. The spring used is stiff enough to insure the cam acting on the valve, but is arranged to give only slightly when the valve regains its seat, thus preventing the closing cam from bottoming.



Methods of utilizing MacVicar valve mechanism with direct and finger following actions

Dodge Motor Assembly Progressive

System Follows Modern Method of Detail Building Up in Stages

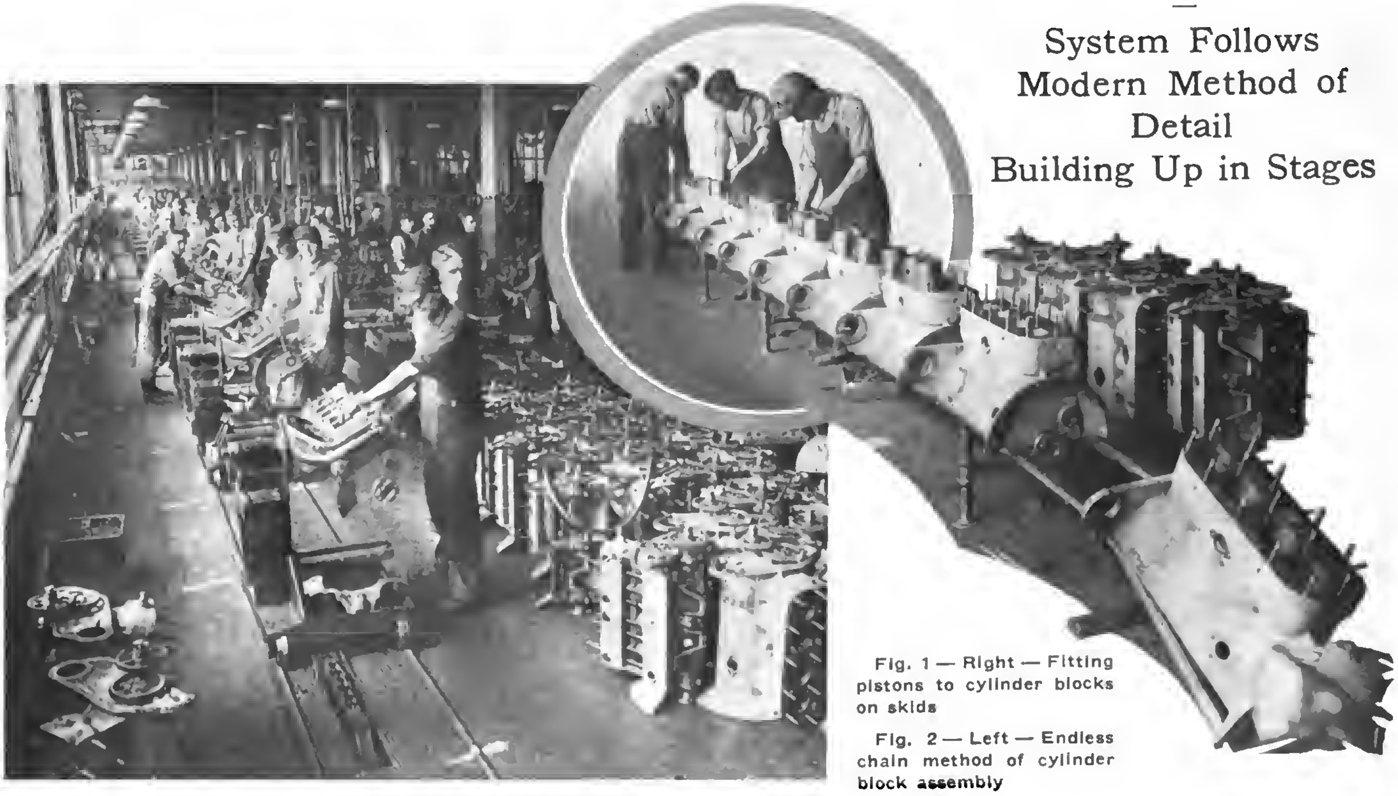


Fig. 1 — Right — Fitting pistons to cylinder blocks on skids

Fig. 2 — Left — Endless chain method of cylinder block assembly

THE two views here shown give some idea of the extensive manufacturing facilities now used by Dodge Bros., Detroit, Mich. They illustrate two phases of the progressive motor assembly department where over 400 motors are assembled daily.

Fig. 1 shows the cylinder blocks after the crankshaft and camshaft have been installed, and the crankshaft bearings properly fitted. The valves have been fitted and ground into their seats, each one being numbered, so that if they are removed at any time, they will be properly replaced. The cylinder blocks are slid onto skids so as to be in the most accessible position for fitting the pistons. The connecting-rods have already been fitted to the crankshaft which is in the cylinder block, and have been numbered properly, so that they can be reassembled in the motor when the proper sized pistons are attached to them.

Correct Balance Insured

Racks of pistons are placed conveniently beside the skids and so arranged that each bin contains pistons of exactly the same weight, so that for each cylinder block, pistons are taken from the same bin, thus insuring a proper balance of the reciprocating parts, as the connecting-rods are also matched in the same way. Each cylinder is then fitted individually, so that the clearance between the cylinders and the piston is exactly the thickness of a 0.003-in. ribbon feeler. The pistons are then stamped on the top to insure their being assembled in their proper places. After they have been fitted in the cylinder blocks the pistons are sent over to an assembly bench, where piston rings of the proper sizes are fitted to them and where the connecting-rods are attached to them and the wristpins locked in place.

With the assembly of the connecting-rod, wristpin and piston complete, all these parts which have been fitted separately for the cylinder block are ready to be installed in it as a unit. This is done after the cylinder block has been placed on the line of the universal assembling stands.

Fig. 2 shows the double line of the cylinder block assembly. Each block is clamped in place in one of the universal assembling stands, which run on tracks and are propelled by an endless chain. After the block has been clamped in place it can be turned over to any one of four positions.

On the universal assembling machine are placed a cylinder head, gearcase cover and piston and connecting-rod assemblies. The smaller units are arranged in bins along the tracks of the assembling line, where the different groups of workmen perform their particular tasks in turn.

The mechanics in the center foreground are installing the valve springs. The next group of men are about to install the piston and connecting-rod assembly, which has been previously fitted.

The third group is mounting and adjusting the starter generator, and connecting up its silent chain drive to the crankshaft sprocket. Similarly, all the way down the line, each group of men has its particular task to perform.

Each Operation Is Checked

Inspectors are stationed along the assembling lines so that each operation of the assembly is carefully checked up. Also each following inspector has an opportunity of seeing that nothing has slipped by the attention of the previous inspection. Thus, by the time the engine has been completed, an extremely thorough inspection of the cylinder block and its parts has been made. When the end of the cylinder block assembly line is reached, the completely assembled gearsets are brought up to the cylinders and bolted on. The power plant is then removed and conveyed upon a special truck to the block test, to be run in and tested under its own power. The universal assembling stand is then returned to the start of the line by a third chain and track.

ACCESSORIES

THE accompanying illustration shows the latest type Van indicator, a Van speedometer with an Elgin watch. This type of speedometer is named the Spedistemeter by its manufacturer. The speed and distance recording part of the instrument is identical with the regular type of Van speedometer, but the Elgin watch is incorporated in a rather unusual manner. The watch dial is set in the main dial of the instrument and connected by a shaft with the watch works in the back. These works are at the back of the instrument and can be removed by unscrewing a cap. The winder and reset, as illustrated, is operated from a watch stem in the same manner as the ordinary watch. The winder and reset can also be operated from a knurled button which projects through a collar directly under the watch dial.—Van Sicklen Co., Elgin, Ill.

Van Sicklen Spedistemeter including Elgin watch

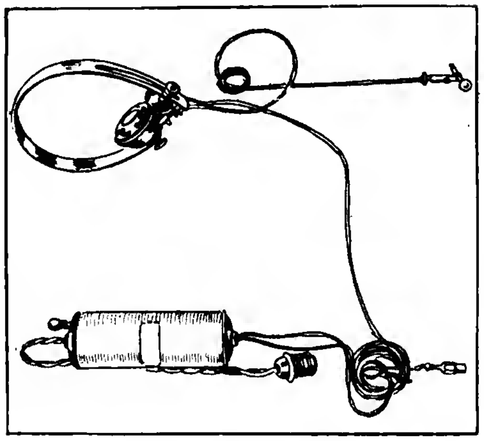
Evergood Channel Bumper

Under the name of Evergood a channel bar bumper has been brought out for the special purpose of taking care of the needs of Saxon four owners. The streamline design of the Saxon car is carried out, the bumper arms being curved in such a way as to seem to lengthen the wheelbase of the car.

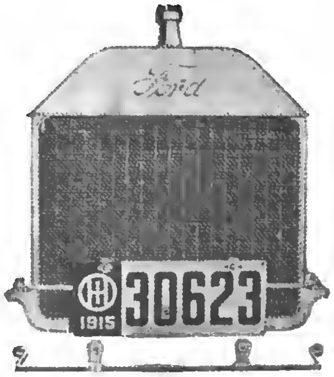
The bumper can be installed in 20 min. according to the manufacturer without the use of any drills or other implements outside the tools which are regularly in the repair kit. The arms are malleable castings and the springs which absorb the shocks are inclosed in tubes.

The round bar with nickel finish retails for $5.65; the combination black and nickel finish for $5.05. The channel bar bumper retails for $6.45. The diamond shape bumper with nickel retails for $7.05 and the combination black and nickel finish $6.45.—Emil Grossman Mfg. Co.

Evergood channel bumper for Saxon four



Boss electric circuit testing outfit



Tomarin license holder for Fords

Nodelay for Sealing Punctures

The Nodelay puncture-sealing compound is in the form of a liquid which is injected into the inner tube where it forms a coating over the inside and the balance of the compound remains in the tube as a liquid. The reason for this is that the compound does not adhere to itself but has a great affinity for rubber. It is claimed that, should a puncture occur, thus baring the rubber, the Nodelay liquid in the tube immediately forms a coating which seals the puncture. The compound is said to be unaffected by changes in temperature or weather conditions and to be soluble in water, so that, should any of it get on the clothes or any part of the car during the process of injection, it may be readily washed off. Injection can be done by any car owner or repairman. A 12-oz. bottle sells for $2, which is sufficient for a 30 by 3½ tire. A 20-oz. bottle or sufficient to treat a 37 by 5½ tire, sells for $3.—Nodelay Mfg. Co., Chicago, Ill.

Boss Circuit Tester

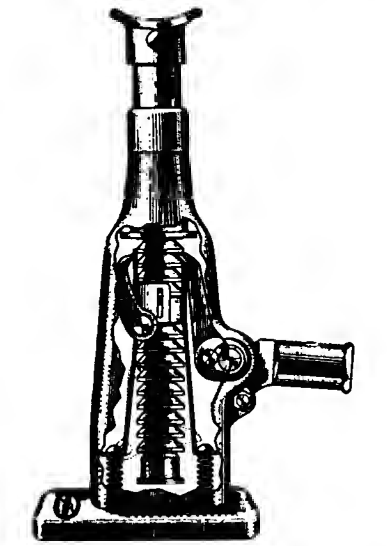
Any electrical circuit may be tested with this apparatus for grounds, short circuits or open circuits. A plug is screwed into any 110-volt alternating or direct current lamp socket, the telephone receiver placed on the head, where it is held by a band, and the terminal clips on the testing wires placed on the ends of the circuits to be tried out. A clear closed circuit is indicated by a clicking sound in the instrument. The amount of current consumed is so small that it will not affect the meter, the makers state, and the device cannot burn out. It sells for $12.75.—Maroa Mfg. Co., Maroa, Ill.

Tomarin License Holder

This license holder is a stout steel bar arranged to be bolted down by the radiator holding bolts of the Ford and extends across the lower part of the radiator. Sliding clamps are adjustable to any width of license plate. The bar adds to the stiffness of the radiator, the makers state, and holds the license plate where it does not interfere with the air coming through the radiator. The holder sells for 75 cents.—William Tomarin, Cincinnati, Ohio.

Peteler Jack

An ingenious feature of this jack, which operates by means of pawls on a stepped lifting bar, as shown in th[illegible] [illegible]llustration, is the automatic dr[illegible]ar. When the car is to be lowered, th[illegible]oper-



Peteler jack with automatic drop bar

ator presses the button on the side of the jack and it flies to reverse and the moment the weight of the car is removed the lifting bar drops automatically, rendering any pumping of the handle unnecessary. The jack is durably made, a large pressed steel shell forming a base reinforced by a wooden block. All parts of the device, in fact, are of pressed and hardened steel, including the pawls, while the lifting bar turns freely, distributing wear. The round swivel lifting bar allows greater freedom in placing the jack than is ordinarily possible. Another point is that the fulcrum is placed very low, giving greater upward play to the handle and preventing the operator's knuckles from striking the ground. For cars with low hung axles, a special head with a low step is provided. The jack is finished in black enamel and nickel. With the regular head it sells for $3.50 and with special drop head, for $4—Moreau & Pratt, Inc., New York City.

Roller-Smith Ammeters

Ammeters and voltmeters made under the name Roller-Smith are for dash installation, the case being of heavy brass with rubberoid finish which is said to be dust and moisture proof. The overall diameter of the instruments is 3⅛ in. and the depth 2⅝ in. Prices run from $5.30 to $7.—Roller-Smith Co., New York City.

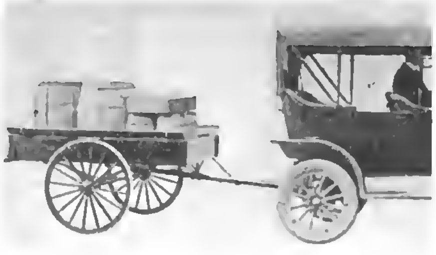
Lion Economy Trailer

This trailer has a capacity of 1000 lb. and is mounted on two wheels 34 in. in diameter with 1¼ in. solid rubber tires and running on Timken roller bearings. The axle is of 1¼-in. steel. The body is 42 by 72 in., of box form and has 8-in. panels and heavy hard wood sills, braced and ironed. Hard wood flare boards and a tailgate are fitted. A coupler is used fo[illegible]ttachment to the rear of the car, an[illegible]s is done without injuring the finish of the machine. The weight of the trailer is 375 lb.—Lion Buggy Co., Cincinnati, Ohio.

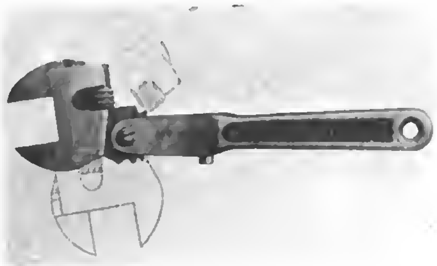
Kelco Batteries

This starting and lighting battery, in which an effort has been made to obtain greater efficiency by improving on the plate design, has been brought out under the name of Kelco. It is pointed out by the makers of this battery that while in charging the current is stored in all parts of the plate it is drawn out through but one point, and that is A at the corner of the plate. Accordingly, the makers have made the lines on metal ribs converge toward this corner, with the result that more metal is concentrated at the outlet. According to the theory of construction of the Kelco battery this puts the material where it is necessary. Other refinements of this battery include an incased handle to guard against corrosion and in a corrosion-proof terminal connector.—Storage Battery Appliance Co., Baltimore, Md.

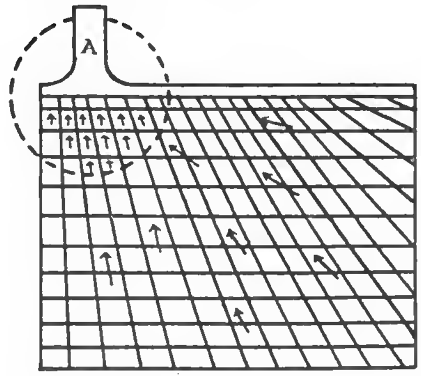
Roller-Smith ammeter for dash installation



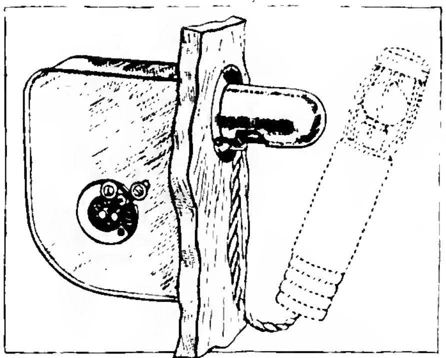
Lion 1000-lb. Economy trailer



Imperial angle wrench, showing some positions



Kelco battery plate, showing converging ribs



Cuno dash and inspection lamp

Imperial Angle Wrench

This is an end-opening, adjustable wrench, but the head, instead of being integral with the handle, is swiveled to it so that it can be turned through a very wide range and locked automatically in any one of eight different positions. A retaining ratchet, released by a button, holds any adjustment. The tool can be used as a ratchet wrench under certain conditions by pressing the button to permit the ratcheting action. The adjustable jaw will take any size up to 1¼ in. —Imperial Tool Co., Bloomington, Ill.

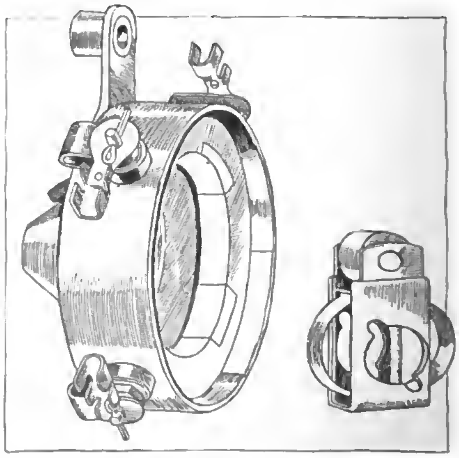
Cuno Dash Lamp and Timer

The Cuno dash lamp is combined with a trouble lamp, the handle of the latter disappearing into the dash together with a 15-ft. cord. The cord is automatically wound by a spring-operated reel in a sheet steel housing at the rear of the dash. Dash and trouble lamp combined sell for $4.25 without bulb; without bull's-eye for $4; and with reel and housing only $2.25.

The Cuno timer for Ford cars is made of steel enameled to prevent rusting, the fiber ring being of specially-heated, hard gray bone fiber, while the spring wire terminals guard against loose connections. The roller is carried in a slide, a large flat spring pressing it directly against the contacts. Price, $1.50.—Cuno Engineering Corp., Meriden, Conn.

Mansfield Top Dressing

This is called Never Leak Waterproof Dressing and is said to be impervious to water and dampness. No paint, varnish, shellac, linseed oil or asphaltum are used in its composition and it does not become stiff. A quart suffices for a roadster top and a half gallon for a five-passenger touring car. A pint sells for 60 cents, a quart $1, ½-gal. $1.75 and 1 gal. $3.—Mansfield Mfg. Corp., Syracuse, N. Y.



Cuno timer for Ford cars

The Automobile

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Body Measurements

CRITICISMS on body design, as made in a recent article in THE AUTOMOBILE, have touched a responsive chord, if the correspondence received on the subject can be any indication. These letters from representative engineers in the industry show that the belief is general that the driver, who, in an actual majority of instances, is the owner, is neglected. Some of the letters are published weekly in the Engineers' Forum department over the signatures of their senders.

Owners have been so gratified to secure efficient performance that they have allowed the feeling of delight in acceleration and economy to completely hide their feeling of resentment at being compelled to double up, jack-knife fashion, in driving, and it is time that a remedy be found for this trouble. To paraphrase Lincoln's famous epigram, the way matters stand at present: All of the people fit some of the cars, some of the people fit some of the cars, but most assuredly all of the people do not fit all of the cars, nor will they until cars are ordered like suits of clothing, by measurement, or a considerable amount of adjustability is offered.

However, it is possible to go a step further and say that some of the cars do not fit any of the people, because they have 5 and 6-in. passages through which anatomies must be squeezed; because the shifting of gears is accompanied by a stretch which almost brings the chin against the steering wheel or because the foot cannot be put upon the clutch pedal without a collision occurring between knee and steering column.

It must certainly be admitted that body design cannot be standardized nor will it be until some mythical date when all human beings are cast in the same mould. Therefore the best that manufacturers can do is to meet the requirements of the man of average stature in working out the stock design. Surely one who is fortunate enough to be of normal proportions ought to reap the benefit of being as nearly standardized as a human being can be, by feeling comfortable in a car designed to meet the needs of average proportions.

Earlier Winter Bodies

IT is to be hoped that the error of delivering winter automobile bodies to dealers in January and February instead of in September, October and November will not be repeated next fall. Many dealers who specified deliveries on closed jobs for last October found them starting to come through in December. The same manufacturers in a few cases want to force the dealer to show closed jobs at such shows as Minneapolis, Kansas City and Des Moines. Dealers in these cities can sell many closed cars but not in January or February. They must make their sales in October, November and December. Buyers of closed winter cars want immediate deliveries, particularly in cities west of the Mississippi where they have not learned to place their orders in May for October delivery. For dealers to sell and make deliveries in October, the cars should be on the floor Sept. 15. It is unfair of manufacturers not to give this service. The dealer deserves every assistance in this new field in Western cities, and those makers who are most considerate in this respect will receive greatest results.

Supply and Demand

IT is frequently difficult to distinguish between cause and effect, and just at present it is hard to determine to what extent the features of automobile design which are now the rule are effects of public demand or causes of it. Occasionally it is possible to be positive, as for instance, in the case of the eight-cylinder engine, for this undoubtedly was not demanded till the first American eight had made its bow to the public. After that moment the increase in the number of eights was certainly due to demand for them.

The automobile itself was not demanded, but rather it was forced upon a distinctly unwilling public in Europe and America alike. So with many features of present-day chassis they were created by engineers and, proving good, made their own demand. The moral of it is that features which prove good when thoroughly tested may be incorporated without much regard for convention. Nothing is a freak to-day, provided it does the work.

Traffic Situation Unchanged

Shipments in Feb. Expected Will Be Equal or Larger Than in Jan.

DETROIT, Feb. 21—Although there is no improvement in the general freight car situation so far as automobile shippers are concerned, it now looks as if the shipments of cars during February, which is a short month, will be equal to or even greater than were the January shipments, which totaled more than any previous month in the history of the motor car industry. No actual figures are yet available bearing on the number of automobiles thus far shipped this month, but from his daily reports, J. S. Marvin, traffic manager of the National Automobile Chamber of Commerce, is able to predict a total for February that may even outdo January's record.

Thus it is apparent that even though the manufacturers are handicapped by lack of railroad equipment and are not able to produce as many cars as they would like to on this account, they are doing better than ever before. There is no telling what the total production and shipments would be if the makers were able to ship all the cars they could make and for which they have immediate shipping orders. But when it is realized that there are in the whole country not over 60,000 automobile freight cars, it is really a wonder that it is possible to move the great number of machines that are moved each day. It speaks well for the efforts of the Chamber's traffic department, as well as the co-operation between the dealers receiving the cars, the railroads and the factories. The 10,000 new automobile freight cars for which the railroads placed orders some months ago, and which have been held up in manufacture due to lack of wheels and other steel parts, are now just beginning to put in their appearance. There are probably 200 to 300 of them already in service and more are coming right along. This will undoubtedly help the situation somewhat.

Some interesting sidelights on the present shortage of cars and the shipments of the previous year are given by the figures herewith which show the number of cars shipped each month during 1915. It will be seen that the January, 1915 total was outdone by 9685 carloads by January of this year, and even September, the palmiest month of 1915, was 864 below the present year's start. If proportionate increases are shown during this year it is difficult to see what the September, 1916, shipments will be. But if the shortage of cars continues, it is very likely that a much greater number of automobiles will be driven over the roads to their destinations from the factories than ever before.

Carload Shipments of Automobiles for each month of 1915

January	8,369
February	11,273
March	16,442
April	17,112
May	13,642
June	15,325
July	12,517
August	15,359
September	17,190
October	16,138
November	15,000
December	16,050
Total	174,417
Add shipments reported late and not distributed in their month	30,000
Total carloads 1915	204,417
Carloads shipped during January, 1916	18,054

Lewis R. Speare Dies

NEWTON, MASS., Feb. 23—Lewis R. Speare, former president of the A. A. A., died at his home here to-day after an illness of several weeks. He was taken to a hospital in January and operated upon for cirrhosis of the liver. Early in February he was brought home, and the physicians in charge stated that he could not recover, his death being a matter of strength.

Lewis Robinson Speare was born at Boston, Mass., June 6, 1861. He came of Puritan stock, having been traced back to 1647, while others were officers in the Revolution.

Mr. Speare was one of the first men in this country to take up motoring. Like everything else he became interested in he proved a dominant force. When the Massachusetts Automobile Club was formed he was one of its early members.

When the Bay State A. A. was formed in 1905, Mr. Speare was chosen president. He was re-elected and did much to get it started along a prosperous career. His activities as head of that organization brought him into the limelight, for he attended all the meetings of the American Automobile Association.

So when the organization needed a strong executive officer in 1909 he was chosen for the position. It was one of the best moves ever made by the association.

Cline Sun Factory Manager

ELKHART, IND., Feb. 17—B. J. Cline will join the Sun Motor Car Co., this city, in the capacity of factory and production manager. Mr. Cline has been identified with the automobile industry since 1898, at which time he assisted in building the first Pierce-Arrow car. Since then he has been with the E. R. Thomas Motor Car Co., Buffalo, N. Y., and later the Chalmers Motor Car Co., Detroit. He then joined the Chandler Motor Car Co., Cleveland, which was just being organized at the time.

The Sun company is now producing cars and will build ninety cars during the month of March.

Thomas To Drive Peugeot

Winner of 1914 Indianapolis Race Will Appear May 30 on Hoosier Track

PARIS, Feb. 17—*Special Cable*—Rene Thomas, winner of the 500-mile race on the Indianapolis Speedway in 1914, will drive a Peugeot in the 300-mile contest scheduled for the Hoosier track on May 30.

The above cable was received as THE AUTOMOBILE for Feb. 17 was on the press, so that it was possible to print it in only part of the edition.

Three Speedway Events for Tacoma

TACOMA, WASH., Feb. 17—Three series of racing events for this season are announced by the Tacoma Speedway Assn.—the first on Decoration Day, the second on July 4, and the third and largest racing event on the Pacific Coast this year, the Montamarathon Aug. 5.

Coupled with this announcement was the further one that F. G. Fisher has been elected president of the association to succeed Frank Allyn, resigned on account of ill health.

A number of short racing events featuring Northwest drivers will be staged on Decoration Day, and which will include a 100-mile event.

The Montamarathon on Aug. 5 will be for a prize of $10,000, with a bonus to the driver finishing the first 100 miles in the best time, and a like bonus to the man finishing the 200 miles in the best time. The race distance will be 300 miles instead of the former 250 miles.

Stutz Denies Rumors

INDIANAPOLIS, IND., Feb. 21—Rumors to the effect that Stutz cars may be seen in racing again, have been denied by the Stutz Motor Car Co. As stated by Mr. Stutz immediately after the Sheepshead Bay race in New York, his cars will not enter racing again until someone breaks or equals the world's records that the Stutz now holds.

$100,000 Corporation to Manufacture Electric Steel

MILWAUKEE, WIS. — Another large corporation to manufacture electric steel has been organized in Milwaukee. It is the Pelton Steel Co., capital stock $100,000, backed by several large bankers. An electric steel foundry will be established at once. The incorporators of the new concern are Fred Vogel, Jr., president, First National Bank; Gustav A. Reuss, vice-president, Marshall & Ilsley

Bank, and William H. Schuchardt, architect and capitalist. The foundry will have a 3-ton furnace. Several large steel foundries in Milwaukee have recently installed electric furnaces of large capacity, and Leo G. Smith, well-known steel founder, is building a large foundry, the Electric Steel Casting Co. of Milwaukee, capital stock $300,000, having been organized for this purpose. Several other founders are contemplating the purchase of electric furnaces.

Gridley Adams Leaves Stewart-Warner

CHICAGO, ILL., Feb. 21—Gridley Adams, advertising manager of the Stewart-Warner Speedometer Corp., is leaving that company to join the Macavoy Advertising Agency of Chicago, having bought an interest in that company. This agency has just secured the Jeffery account. With Mr. Adams will be several other men well known in the automobile field, especially the advertising field, namely, Frank Morse of the Mahin Agency; Berry Rockwell, late of the Mahin Agency and formerly advertising manager of the Maxwell-Briscoe Co., and with *Saturday Evening Post*, and G. N. Bryant, formerly with the Locomobile, Franklin and Moline-Knight.

Mr. Adams has been advertising manager of the Stewart-Warner Corp. for three years. He was formerly advertising manager of the Stoddard-Dayton Co., the United States Motor Co. of New York, and also the Aeolian Co., New York.

Lane Motor Truck Co. Formed

KALAMAZOO, MICH., Feb. 15—The Lane Motor Truck Co., is being formed with a capital stock of $25,000 to make a 1200 to 1500-lb. truck, with four styles of bodies, express, open flare board, stake body and stationary top flare body.

Maxwell to Sell Light Delivery

DETROIT, Feb. 22—The Maxwell Motor Co. is entering the light delivery car field. No special car will be made, but as the company believes that its standard chassis is well adapted for such a purpose, it will furnish the touring car chassis complete with cowl, instrument board and electrical equipment, but without body, at $565, or $90 less than the price of the standard touring car. Purchasers will receive a scale of dimensions which will enable any body builder to fit any type of body to the frame.

McCulla in Aeroplane Work

DETROIT, MICH., Feb. 19—William R. McCulla, who recently rejoined the engineering staff of the Packard Motor Car Co., has been given charge of the aeroplane motor division of the engineering department.

Aluminum Castings Increase Output

Castings Made Jan., 1916, Total 1,709,000 Lb. More than in Same Period of 1915

DETROIT, Feb. 22—While new customers are finding it difficult to obtain aluminum at present, those who have contracts with the casting companies are being well served. A year ago the Detroit plant of the Aluminum Castings Co. was about the right size to care for the demands made upon it, and to-day it is running at so high a pressure that extension in the early future is planned.

For the company's three plants at Detroit, Cleveland and Buffalo, the output of aluminum castings for January, 1916, exceeds that of January, 1915, by nearly 2,000,000 lb., and well over 90 per cent of the whole output goes to the automobile industry.

Cadillac to Use Aluminum Bodies

Of this increase about 125,000 lb. was cast in the form of permanent mold pistons, since no less than 123,000 of these were shipped during January, and they weigh a trifle over a pound apiece. During 1916 it is expected that well over 5000 aluminum cylinder castings will be made, and it is possible that this number will be doubled if the opening of the Southern plant of the American Aluminum Co. in April has the effect on the supply of metal that is anticipated.

The Detroit plant of the Aluminum Castings Co. has lately been supplying the Cadillac Co. with thin panel castings for their coupe body, and it is understood that all future Cadillac bodies will be of this material. At present the limousine will be built as before, but it is planned to use cast aluminum for this body also as soon as the casting plant is able to handle the business. The system of construction employed is exactly tht same as that which has now been used for many years by Pierce-Arrow.

States Motor Car Mfg. Co. Formed—Capital $600,000

KALAMAZOO, MICH., Feb. 17—The States Motor Car Mfg. Co., with a capital of $600,000, has been organized and will immediately begin manufacturing a line of eight and four-cylinder passenger cars and a four-cylinder truck. The plant formerly occupied by the Michigan Buggy Co. will be used.

The officers of the new company are: President, J. A. Ply; first vice-president, B. R. Barber; second vice-president, J. H. Johnson; and secretary and treasurer, Samuel Hoekstra.

The board of directors are as follows: J. A. Pyle, H. E. Johnson, B. R. Barber, G. B. Pulfer, Ira Cadwallader, W. B. Smith, and J. H. Johnson.

The output will be 10,000 cars a year. About 5000 cars will be built the first year.

The Light Car Axle Co. has leased 20,000 ft. of floorspace in the east building of the plant and has entered into contract with that company to supply all the front and rear axles for its cars.

Two New Studebaker Trucks

DETROIT, MICH., Feb. 23—*Special Telegram*—The Studebaker Corp. has announced two new models of commercial cars of 1-ton and ½-ton carrying capacities. The intention is to build 10,000 of them during 1916, and although the corporation has been building commercial cars of ½-ton capacity for several years, it has never attempted production of business vehicles on so large a scale before.

There are three body types fitted to each of the chassis. On the ½-ton are fitted a panel delivery body at $875, an open express design at $850 and a station and baggage wagon at $875. The 1-ton chassis carries either an open express body at $1,200, a stake body type at $1,250 or a sixteen-passenger bus at $1,400. Among the features are an electric starter and lights and a speedometer.

Overland Breaks February, 1915, Record

TOLEDO, OHIO, Feb. 18—On Feb. 11 the Willys-Overland Co. had broken its February, 1915, shipping record by over 500 cars. In other words, during the whole month of February, 1915, the company shipped 5627 Overland cars, while this year this total was shipped in less than half the month.

To Tax Canadian Ford $2,000,000

FORD, ONT., Feb. 19—According to officials of the Ford Motor Co. of Canada, Ltd., the share to be paid by the company to the Canadian government if the new war budget is adopted by parliament will be at least $2,000,000, of the total of $30,00,000, which, it is expected, the special budget will yield. The tax covers the period beginning Aug. 4, 1914, to Aug. 3, 1917, when it is anticipated the war will be at an end. All Canadian corporations are to contribute one-fourth of all their profits in excess of 7 per cent of the capital invested.

Reo Ships 2000 Cars in January

LANSING, MICH., Feb. 16—During January the Reo Motor Car Co., shipped close to 2000 cars as compared with 1000 in January, 1915. More cars were ready for shipment but there were not sufficient freight cars available. Production averages 125 cars a day and this will be kept up and possibly increased to next August.

Pennsylvania S. A. E. Section Completes Organization—Hears First Paper

Officers Elected and Constitution Adopted—A. M. Dean Gives Views on V Motor—Lively Discussion of Paper—Minimum Cylinder Bore 2⅝ in.

PHILADELPHIA, PA., Feb. 16—The organization meeting of the Pennsylvania Section of the Society of Automobile Engineers was held here to-night at the Engineers' Club. The first action taken by the new section after it had been voted that a permanent organization be made, was to elect the temporary chairman, E. S. Foljambe, the temporary secretary, B. B. Bachman, and T. Y. Olsen, temporary treasurer as permanent officers to serve until the end of the administration year, Oct. 1. In addition, W. M. Newkirk was elected vice-chairman and W. H. Palmer, Jr., as held-over treasurer. This is in accordance with the constitution and by-laws as recommended by the council of the S. A. E. and which were also adopted by the Pennsylvania section. The section is affiliated with the Engineers' Club.

Paper on Eights and Twelves

A. M. Dean, engineer of the Ferro Machine & Foundry Co., read a paper on the development of the eight and twelve-cylinder V engine in which he particularly alluded to the development of his concern and outlined the considerations back of this development. In opening his paper he referred to the typical American as compared with the typical European design, stating that the American motor carries the valves in the head while European practice favors the L type, the American motor uses individual cams while the European employs the same cam for opposite cylinders. Another point of difference is in the unit crankcase on American motors while foreign practice inclines toward the employment of a separate cast aluminum crankcase.

Taking up the motor part by part, Mr. Dean first dwelt on the development of the overhead valve construction, showing how the advantages of good combustion chamber shape had been maintained while the objections of large and heavy parts which tended to become noisy had been eliminated. Speaking of the use of the offset rocker, he showed its great advantage in the high-speed motor because it allows advantageous cam shape and at the same time gives quick opening of the valves with a minimum amount of travel of the parts. As an example of the successful use of the offset rocker, the number of years of satisfactory performance of the Franklin valve system was cited by Mr. Dean. Throughout the entire consideration of the valve question, Mr. Dean brought out the fact that the high speeds at which motors are now operated have thrown into position of relative importance the details which were formerly regarded as being unimportant.

A good example of careful detail as brought out in the paper is in the threaded pin adjustment for valve clearance. This governs the position of the pivot point of the rocker arm and has the great advantage that the adjustment parts are stationary, permitting adjustment of the clearances while the motor is running. Another detail which is of relatively great importance, is in the design of the connecting-rod bearings. The rods are so arranged that the bearing split is horizontal, and the reason for this is found in the method of firing across the blocks giving a resultant which makes it necessary in order to secure the best distribution of materials and stresses that the division of the bearing be in a horizontal plane.

Good Lubrication Practice

Taking up the question of oiling, Mr. Dean again contrasted European practice with best American practice. He said that a great many engineers in this country had blindly followed the DeDion system of having high pressures with a short registering interval between the crankshaft opening and the oil lead in the main bearing. He stated that he had found it better practice to use lower pressures for the oil with a longer register in order to feed the oil in proportion to the bearing loads.

A motor operates at its maximum efficiency, according to Mr. Dean, when the jacket temperature is at about 170 deg. In the experiments carried out by the Ferro company with the overhead type of V motor, the author stated that the waterjacket temperature never went over 200 deg. and rarely reached that point except under the most adverse circumstances. In laying out the waterjacket it was pointed out that the water passage should run between adjacent cylinders leaving no blocks of uncooled metal in the casting.

As regards balance, the system used by Mr. Dean is to apply a counterweighting system in which each throw or unit is considered separately. For the eight-cylinder motor this means a four counter-weight balancing arrangement, and for the twelve-cylinder motor an eight-weight arrangement. The added weight to a crankshaft due to this system, he said, ran to about 34 lb., giving a total weight for the shaft of 84 lb., but he then went on to show that the evils which may arise from unchecked centrifugal force were far more serious than added weight to the crankshaft, and the use of the counterbalancing system is fully justified by results.

Fields of Eights and Twelves

Coming to the respective fields of the eight and twelve, Mr. Dean gave an answer as to where the twelve took up the work and where the eight left off. He stated that the minimum diameter for a cylinder should be 2⅝ in. Below that there is trouble due to leakage past the rings and difficulty in securing good piston fits. Not only these conditions arise, but poor thermal efficiency also results from such small diameters. This statement Mr. Dean checks up with the experiences abroad which have gone to show that 75 mm. is the limit for efficient motors. Even taking this bore as the limit, he showed that the smallest twelve is still a large motor. Mr. Dean went on to state that the unbalanced forces in an eight are 1.4 times as large as those in a four, and this naturally immediately limits the size of the eight. With the small bore and light parts the vibrations are so cut down that they do not become serious until the upper limits for eight-cylinder size are reached. This upper limit he sets at 3¼ in. with a stroke bore ratio of 1.4. This gives a piston displacement of just under 300 cu. in. The upper limit for the twelve is only the limit of the chassis, and the lower limit would be about 250 cu. in. Therefore, the field of the eights in the author's opinion ranges from 160 to 300 cu. in. and of the twelves from 250 cu. in. up.

In discussing the paper, B. B. Bachman, engineer of the Autocar Co., asked if difficulties are not found in the block cast motors if the waterjackets are not extended far enough below the piston travel. Mr. Bachman pointed out that the juncture of the waterjacket with cylinder wall created a virtual ring of metal around the cylinder which restricts its expansion at that point because of the amount of unheated metal. To this Mr. Dean replied that such a ring of metal exists and if it is not carefully placed so that the jacket is below the piston travel seizing troubles are sure to be encountered. For this reason it is the practice of the Ferro company to always extend the waterjacket well below the piston travel.

J. E. Schipper discussed the comparative merits of the side-by-side and V rod, stating that although the bearing area in the forked rod is greater than that in the side-by-side design, the advantage of the latter as regards repair work is so marked that it is well worth while to use it if life is not sacrificed. Another point brought up by Mr. Schipper is that in starting the motor with the aluminum pistons since the clearances run up as high as 0.006 in. unless special provision is made, oil is sure to accumulate in the combustion chamber during the first few strokes. Mr. Dean answered these comments by stating that his concern, while usually building the forked type of rod, has had some motors on the road with the side-by-side installation for about a year, and found no difference in bearing life which so far could be indicated. In regard to the oiling trouble, he stated that this is overcome by the use of longer pistons and by special rings which take up the clearance and prevent excess leakage. The slight slap of the aluminum piston, however, can be noticed for the first few moments of operation.

Those present at the meeting included E. S. Foljambe; W. E. Haupt, Engineer Haupt Auto Patent Co.; W. M. Newkirk, mechanical engineer William & Harvey Rowland; T. Y. Olsen, Tinius Y. Olsen Testing Machine Co.; Albert Sutthill, chief engineer James Boyd & Bros.; Russell Hoopes, Supt. Hoopes Bros.; J. E. Chalfant; P. J. Flaherty, general manager American Car & Ship Hardware Mfg. Co.; H. R. McMahon, president of the Standard Steel Spring Co.; J. E. Schipper, technical editor THE AUTOMOBILE; W. H. Palmer, Jr., engineer Electric Storage Battery Co.; B. B. Bachman, engineer Autocar Co. Several in attendance were not members of the S. A. E.

Goodrich Surplus $10,305,679

Equal to 17.17 on Common—Net Sales Equal $55,416,866.55—32½% Gain

NEW YORK CITY, Feb. 19—The B. F. Goodrich Co. in 1915 showed a surplus of $10,305,679, equal to 17.17 per cent on the $60,000,000 common stock, as against $3,371,927 in 1914, or equal to 5.62 per cent.

Net sales for the year ended Dec. 31, 1915, aggregated $55,416,866.55, as compared with $41,764,008.66 for 1914, representing a gain of 32½ per cent. Net profits amounted to $12,265,679, compared with $5,440,427 in 1914.

The directors of the company voted, subject to the approval of the shareholders, to retire 7000 shares of the preferred stock. This is in accordance with the provision of the company's charter, which provides for the retirement of a minimum of 9000 shares of the preferred stock each year, beginning with July, 1914. As last year the company retired 2000 shares in excess of the charter requirements, it was necessary to retire only 7000 shares additional prior to July, 1916.

The company has added to its plant account during the year 1915 extensions and equipment costing $1,332,146.70, and still further additions are now under way.

From the surplus at Dec. 31, 1915, the directors voted to set aside $1,700,000 to increase the reserve for contingencies from $300,000 to $2,000,000, together with a sum of $100,000, as an initial amount, for a pension fund. The directors were led to appropriate this amount for contingencies on account of the general unsettled conditions existing throughout the world and the consequent desire to reinforce the fund available to meet unfavorable conditions should they arise.

The income account in detail is given in tabular form on this page.

	1915	1914	1913
Net sales	$55,416,866	$41,764,008	$39,509,347
Manufacturing, selling and general administration expenses	42,825,908	36,189,642	36,451,234
Net profit from operation	$12,590,957	$5,574,367	$3,058,113
Miscellaneous income	467,690	562,930	491,317
Total income	$13,058,648	$6,137,297	$3,549,429
Depreciation	734,544	573,616	541,358
†Reduction of preferred stock	11,878	....	168,417
Interest on bills payable	46,546	123,254	239,907
Net profit	12,265,679	5,440,427	2,599,747
Preferred dividend	1,960,000	2,068,500	2,100,000
Surplus	*10,305,679	3,371,927	499,747
Appropriation for contingencies	1,700,000	....	....
Preferred stock red	1,100,000	900,000	....
Pension fund	100,000	....	....
Previous surplus	3,177,910	705,982	806,235
Common dividend	....	....	600,000
Profit and loss surplus	10,583,589	3,177,910	705,982

*Equal to 17.17 pet cent earned on $60,000,000 common stock, against 5.62 per cent on same stock previous year.

†Reduction of treasury preferred stock from cost to par value.

The consolidated balance sheet as of Dec. 31, 1915, compares as follows:

ASSETS

	1915	1914	1913	1912
Real estate, buildings, plant, good will, etc.	$71,502,099	$70,772,418	$71,060,802	$70,685,722
Inv. other costs	1,213,477	1,207,058	1,197,058	1,635,958
Preferred stock in treasury	775,700	1,244,200	2,058,700	2,227,117
Society Fran. B. F. Goodrich	2,121,140	1,216,256	570,987	....
Current assets	31,242,023	20,311,557	19,401,460	24,007,698
Deferred charges	231,793	185,465	222,957	229,610
Total	$107,086,232	$94,936,954	$94,511,957	$98,786,114

LIABILITIES

	1915	1914	1913	1912
Common stock	$60,000,000	$60,000,000	$60,000,000	$60,000,000
Preferred stock	28,000,000	29,100,000	30,000,000	30,000,000
Current liabilities	4,402,642	1,459,044	3,505,974	7,679,879
Reserve for contingencies	2,000,000	300,000	300,000	300,000
Pension reserve	100,000	....	....	....
Surplus	10,583,589	3,177,910	705,983	806,235
*Appropriation	2,000,000	900,000	....	....
Total	$107,086,232	$94,936,954	$94,511,957	$98,786,114

*Appropriation from surplus for redemption of preferred stock.

Belgian Trade Leaders Indicted

PARIS, Feb. 1—Van den Plass, the world-famed Belgian bodybuilders, Captain Masui, for many years a leading automobile agent in London, and two other Belgian subjects, are now before the military court at Calais on a charge of defrauding the Belgian Government. It is declared that the sum involved is $10,000,000 to $12,000,000, the case being so serious that the Belgian Government is acting as civil prosecutor. Soon after war broke out, the men involved were sent to England to make purchases of automobiles for the Belgian army. A little later they obtained other purchasing commissions for all kinds of material required by the Belgian army. It is declared that they have obtained enormous fraudulent profits on these transactions, and on an inquiry being opened a few days ago it was discovered that they had made cash deposits in a London bank totalling $340,000.

Before the war Van den Plass was at the head of an automobile body factory at Brussels, where he employed 4000 work people. He was generally recognized as one of the most artistic and best bodybuilders in the world.

Buick Prices Advanced $35

NEW YORK CITY, Feb. 21—An advance of $35 in the price of the Buick light sixes has been made by the Buick Motor Co., Flint, Mich. The roadster will sell for $985 and the touring cars for $1,020 f.o.b. factory.

The light six will carry 34 by 4-in. wheels and tires, instead of 32 by 4-in. as originally on this series. These prices and models will run through the entire 1916 season.

Anderson Joins Master Carbureter

DETROIT, Feb. 21—Raymond M. Anderson, for five years chief engineer of the Stromberg Motor Devices Co., Chicago, and later research engineer of the J. I. Case T. M. Co., Racine, Wis., has joined the forces of the Master Carbureter Corp., this city, in the capacity of chief engineer.

Year's Exports Show Huge Increase—Total for 1916 $111,180,139

Great Britain Much the Heaviest Buyer—French Imports Large—Value of Canadian Imports Drops Though Number of Cars Increases

WASHINGTON, D. C., Feb. 21—The wonderful showing the United States has made in the exportation of automobiles during the last calendar year, as compared with the corresponding period of 1914, is shown in great detail in the figures issued to-day by the Department of Commerce. During the first mentioned period there were 22,082 commercial cars, valued at $59,834,246; 41,869 pleasure cars, valued at $35,045,492, and parts, not including engines and tires, valued at $16,300,401, shipped to various portions of the globe. Of course, a large proportion of these went to the warring countries in Europe.

For the same period of 1914, the figures show that 3430 commercial cars, valued at $8,985,756; 22,335 pleasure cars, valued at $19,521,708, and parts, not including engines and tires, valued at $5,664,104, were exported.

The exports for December last amounted to 1664 commercial cars, valued at $3,920,533; 3664 pleasure cars, valued at $2,710,758, and parts, not including engines and tires, valued at $1,791,805.

These are the figures for the same month of 1914: Commercial cars, 1279, valued at $3,387,729; pleasure cars, 1297, valued at $998,698; parts, not including engines and tires, $1,791,805.

The figures show that the United Kingdom was our best customer in both 1914 and 1915, the purchases of that country increasing from 6799 cars, valued at $6,891,511, in 1914, to 24,355 cars, valued at $35,055,097, in 1915. The December purchases increased from 850 cars, valued at $1,097,007, in 1914, to 1366 cars, valued at $1,969,048, in 1915.

France a Heavy Buyer

The war has likewise made France a good buyer of American cars, no less than 6304, valued at $15,922,313, being shipped there during the calendar year 1915, as against 2816 cars, valued at $5,099,452, imported in 1914. However, during the monthly period the shipments dropped from 969 cars, valued at $2,588,622, in December, 1914, to 423 cars, valued at $1,034,581, in December last.

We shipped 235 cars to Italy in 1914, the value of which was $160,058. In 1915 the number was 257 and the value $160,368. There were no shipments of automobiles to that country in December, 1914, but in December last 31 cars, valued at $15,494, were exported there.

Germany Cut Off

Our export trade in automobiles with Germany amounted to 1063 cars, valued at $799,552, in 1914, while in 1915 the number was only 4 and the value $2,800. There were no shipments to that country either in December, 1914, or in December last.

Under the heading, "Other Europe," a large increase in exports is indicated, no less than 8630 cars, valued at $22,330,357, being exported to those unnamed countries in 1915, as against 2785 cars, valued at $3,411,100, exported in 1914. During the December period these shipments increased from 27 cars, valued at $29,436, in 1914, to 608 cars, valued at $1,272,807, in 1915.

While more cars were shipped to Canada in 1915 than in 1914, the value was less. In 1914 the number was 4214 and the value $5,347,547, while in 1915 the number was 5796, while the value was $4,622,931. In December, 1914, 128 cars, valued at $189,466, were shipped across the border, while in December last the number was 348 and the value $259,110.

The West Indies and Bermuda are developing into good customers for American cars, the exports showing an increase from 646 cars, valued at $525,062, in 1914, to $1,877,680 in 1915. South America's imports of American cars likewise increased from 1149 cars, valued at $863,360, in 1914 to 3537 cars, valued at $1,862,326 in 1915.

The shipments of cars to British Oceania increased from 3475 cars, valued at $2,955,825, in 1914, to 4818 cars, valued at $4,075,299, while the exports to Asia and other Oceania increased from 1454 cars, valued at $1,425,656, to 4319 cars, valued at $6,278,813, during the same period.

Ford Will Not Build at Wichita

KANSAS CITY, MO., Feb. 19—The Ford Motor Co. will not open an assembling plant at Wichita, Kan., as had been announced by the officials of the plant here. That decision came as the result of grants made to the Ford company by the city council that will permit further enlargement of the plant here. Between 7000 and 10,000 cars a year would have been assembled at Wichita if the plant had been built.

Bimel Automobile Co. Now

SIDNEY OHIO, Feb. 21—The Bimel Buggy Co. has reincorporated as the Bimel Automobile Co., increasing its capital to $500,000. The buggy company was established in 1844. The present company took charge of the plant in this city in 1905.

The company has closed out its vehicle line and will concentrate on four- and six-cylinder cars. The four has been built during the last year for $585.

The latest development is a six-cylinder model with a motor, 3⅛ by 5 in., selling at $1,000 and up. This car will be ready for delivery by April 1.

White Resigns from Lozier

NEW YORK CITY, Feb. 21—W. McK. White has resigned as sales manager of the Lozier Motor Co., Detroit, Mich., to form the company of Holden and White, 320 New York Life Building, Chicago. This company will act as general sales agent for four manufacturers of railroad supplies.

Exports of Cars, Trucks and Parts for December, 1915, and Calendar Year 1915

	December				Twelve Months Ending December			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	Value
Motor Trucks	1,279	$3,387,729	1,664	$3,920,533	3,430	$8,985,756	22,082	$59,834,246
Passenger Cars	1,297	998,698	3,664	2,710,758	22,335	19,521,708	41,869	35,045,492
Parts (not including engines and tires)	....	456,014	....	1,791,805	......	5,664,104	......	16,300,401
BY COUNTRIES								
France	969	$2,588,622	423	$1,034,581	2,816	$5,099,452	6,304	$15,922,313
Germany	...	....	....	....	1,063	799,552	4	2,800
Italy	...	....	31	15,494	235	160,058	257	160,368
United Kingdom	850	1,097,007	1,366	1,969,048	6,799	6,891,511	24,355	35,055,097
Other Europe	27	29,436	608	1,272,807	2,785	3,411,100	8,630	22,330,357
Canada	128	189,466	348	259,110	4,214	5,347,547	5,796	4,622,931
Mexico	7	9,660	63	58,065	88	111,344	172	160,467
West Indies and Bermuda	96	67,716	308	197,512	646	525,062	3,248	1,877,680
South America	86	40,476	751	363,748	1,149	863,360	3,537	1,862,326
British Oceania	285	222,975	392	371,323	3,475	2,955,825	4,818	4,075,299
Asia and other Oceania	92	115,792	583	762,921	1,454	1,425,656	4,319	6,278,813
Other Countries	36	25,277	455	326,682	1,041	917,097	2,511	2,081,287

S. A. E. Summer Trip Four Days on Lakes

Start Monday June 1—Noronic Again Chartered—Many New Members Admitted

DETROIT, Feb. 16—At the regular monthly meeting of the council of the Society of Automobile Engineers, the date of the annual summer session was arranged for and will be a four-day one beginning Monday, June 12, and ending Friday evening, June 16. The session will be held on the Great Lakes on the Steamer Noronic. Accommodation for over 500 members will be provided. There will be the usual professional sessions, work of Standards committees, and in addition the trip through Lake Huron and Georgian Bay will afford good opportunity for fishing, picknicking and various out-door sports.

The following applications for membership were approved: Charles R. Bissel, New York City; David W. Burke, Pittsburgh, Pa.; Andrew K. Brumbaugh, Ardmore, Pa.; Richard A. Leavell, Ames, Iowa; Harrold S. Edwards, Madison, Wis.; Frederick S. Elett, Elmira, N. Y.; Hugh M. Harris, Detroit, Mich.; Wm. A. McCosh, Indianapolis, Ind.; Nicolas G. Koutznetzoff, Petrograd, Russia; Eugene J. Ney, New York City; Glen Muffly, Chicago, Ill.; John F. Wade, Bristol, Conn.; W. J. Murray, Newark, N. J.; R. E. Plimpton, New York City; C. A. Obermaier, Harvey, Ill.; Ed. H. Rembe, Cleveland, O.; Westcott J. Smith, Detroit, Mich.; Alfred T. Sturt, New York City; O. P. Stehn, Cleveland, O.; Edw. W. Thurston, New York City; W. R. Vogeler, New York City, and R. L. Heberling, Philadelphia, Pa.

It was decided to move the office of Recorder of the Standards Committee from Detroit, where it has been located since its inception, six months ago, to New York where it will be located in the general offices of the society, 29 West Thirty-ninth Street.

The complete personnel of all of the members of the various Standards committees was passed upon and other routine work carried out.

Testing Symposium for Metropolitan S. A. E.

NEW YORK CITY, Feb. 19—At the meeting of the Metropolitan Section of the Society of Automobile Engineers to be held in this city at the Automobile Club of America next Thursday, Feb. 24, at 8.15 p. m., there will be a symposium on motor testing. The topic will be introduced by Peter Payne Dean, M. A. I. E. E., with a paper entitled "Late Developments in Chassis and Motor Testing." Mr. C. F. Scott, engineer of the Sprague Electric Works, will discuss the topic and the laboratory side of the matter will be presented by Herbert Chase and Ferdinand Jehle of the engineering department of the Automobile Club of America.

This is the last meeting of the fiscal year of the Metropolitan Section and the report of the secretary and treasurer will also be presented. The incoming officers are Leonard Kebler, president of the Ward Leonard Electric Co., chairman; Harry Tipper, advertising manager the Texas Co., secretary, and H. G. McComb, engineer the General Vehicle Co., treasurer. The held-over officers will be R. McA. Lloyd, consulting engineer and J. Edward Schipper, technical editor THE AUTOMOBILE.

Stewart Body Plant to Be Doubled

FLINT, MICH., Feb. 19—The plant of the W. F. Stewart Co., body manufacturer, will be practically doubled, according to an announcement made by president S. S. Stewart. The plant consists of half a dozen large factory buildings and some minor buildings. Additional floors will be put up on some, while in other instances additions to the buildings will be erected. A large number of dry kilns will be added, which will add at least 36,000 ft. of lumber per day to the plant's capacity. About 15,000 sq. ft. of floor space will be added to the sheet metal department.

Lighter Acme Truck

DETROIT, MICH., Feb. 17—The Cadillac Auto Truck Co., Cadillac, Mich. will commence deliveries May 1 on its new 1-ton model. The new truck will resemble the 2-tonner in appearance and will be priced at $1,290. It has a 3½ by 5 Continental engine incorporated in a unit with a Warner dry-disk clutch and three-speed gearset, driving through a Timken worm-driven rear axle. It will have a Rayfield carbureter, Eisemann fixed-spark single ignition and a Pierce governor set at 22 m.p.h. maximum.

Briscoe to Absorb Jackson Motor Shaft Co. July 1

JACKSON, MICH., Feb. 18—A deal has been closed between the Jackson Motor Shaft Co., and the Briscoe Motor Co., whereby the former concern will become part of the Briscoe organization beginning July 1, the Briscoe interests having purchased the plant and business.

The Jackson Motor Shaft Co. succeeded to the Hastings Motor Shaft Co. several years ago. There are now 180 men on the company's pay roll.

Leight C. Bloomfield, who has been with the company since it succeeded the Hastings company, will remain as general manager.

Elgin Plans Week of Racing

Promoters Hope for Vanderbilt, Grand Prize and Two Elgin Classics

ELGIN, ILL., Feb. 19—Elgin has been given the opportunity of becoming the exclusive road racing center of the world for 1916. The four highway classics of America, the Vanderbilt Cup, Grand Prize, Elgin National trophy and the Chicago Automobile Club trophy, may be run over the Elgin course next August. Promoters of the Elgin road races, the Elgin Motor Club and the Chicago Automobile Club, have determined to land the speed carnival for Elgin. Their action followed the announcement of the Motor Cups Holding corporation, that no sanctions of the Vanderbilt and Grand Prize will be issued for speedways. To secure the classic it will be necessary for Elgin to raise $15,000. This will probably be done by selling 1500 tickets at $10 each, entitling the holder to admittance to all four events, Elgin guaranteeing that one-half will be sold.

Want 8-Day Meet

Although Elgin enthusiasts believe that the Classic could be held here in four days, Chicago promoters favor eight days, commencing on Saturday and ending on the following Saturday. The plan of the Chicago enthusiasts is to have an entire week of racing, opening with the Vanderbilt Cup and closing with the Grand Prize. The former will be a 300-mile event and the latter 500 miles. It is proposed that the contests for the Chicago Cup and Elgin National trophy, be staged on Tuesday and Thursday, respectively and the distance of each be cut to 200 miles. The prize money is to be distributed as follows: $3,000 for first; $1,500 for second; $900 for third and $600 for fourth. This is $1,000 less than was offered for the Grand Prize and Vanderbilt Cup at San Francisco last year but double the amount hung for either of the Elgin events last year. The cost for promoting the classics would be about $40,000 or an average of $10,000 for each.

Premier Engineers in Detroit

DETROIT, MICH., Feb. 21—The Premier Motor Corp., Indianapolis, will maintain part of its engineering department in Detroit, where the designing of the new Premier models is to be made. Quarters have been opened in the Kresge Building and E. G. Gunn and C. S. Crawford, who, with J. L. Yarcan form the engineering board of the corporation, will be located in Detroit most of their time.

Colorado Winter Automobile Sales Are Double Those of a Year Ago

Prospects for 1916 Sales are Regarded Excellent by Dealers Who Anticipate Demands for at Least 12,000 Cars—Road Development Will Help

DENVER, COL., Feb. 18—Denver's automobile row winter business averages about double that of last year, and its prospects are declared the best yet. Figured on the basis of the last three months, sales increases ranging from 30 to 500 per cent over the corresponding period a year ago are reported by established dealers, while a doubling or even trebling of last winter's business is shown in many cases.

Greatest Growth in East

Naturally, this substantial showing in growth of sales is most pronounced in the eastern half of Colorado, where moderate snowfall and pleasant weather in general have encouraged winter motoring and winter buying. But the gratifying prospects for total 1916 business are in evidence throughout the State, and also through Wyoming, Utah, New Mexico and all other Rocky Mountain territory supplied by Denver distributors. Sub-dealers throughout the district are backing up their claims concerning the favorable outlook by placing orders for cars in goodly numbers and urging prompt delivery to take care of demands likely to come in a rush with the first settled weather for spring motoring.

Colorado's State license law for motor vehicles went into effect in July, 1913, and every year has shown such a surprising increase in car registration that the Secretary of State has found it necessary to purchase several hundred more license tags than originally ordered upon an estimate allowing for a liberal increase. The 1914 record exceeded that of 1913 by nearly 5000 cars, and 1915 showed an additional increase of nearly 10,000. Colorado dealers are unanimous in supporting Secretary of State Ramer's estimate of another 12,000-car growth in 1916, while many of them declare that 20,000 would be a safe estimate. The exact figures for the three years under the State registration law are as follows:

1913	13,624
1914	18,433
1915	28,254

Twenty-six Inhabitants per Car

This is regarded as an exceptionally good showing for a State having a total population of only a little over 800,000—scarcely a third as many people as are claimed by the City of Chicago alone. Besides, a large portion of the State is mountainous, motor roads are hard to build, and in some sections it would be necessary to travel many miles to find enough citizens to fill a seven-passenger car.

Already three established transcontinental highways cross the main range of the Rockies in Colorado, and three more roads to connect important scenic and industrial sections will be completed across the Continental Divide within the next year or two, one of these traversing almost the entire length of the State. State Highway Commissioner Ehrhart says that more than $2,000,000 will be used for road improvements this year from the State and county funds.

The mining industry of the State shows a gradual growth, which is considered far better than the frequent "booms" of those days when fortunes were made in a day by a rich strike of high-grade ore—and frequently lost in a night through attempts to double them by tackling the other fellow's gambling game. And yet even the last few months have developed a near approach to a real "boom" in Boulder County's world-famed tungsten district 50 miles from Denver, through new strikes of remarkably rich ore, combined with the rapid jumps in the price of tungsten due to the demand for this product for automobile and tool steel purposes.

Adds New Industries

While thinly settled, mountainous, and not extensively an agricultural State, Colorado has also been making rapid progress in this direction during the last few years, and has already won recognition in national markets for fruits, sugar beets, potatoes, alfalfa and other crops. The State has been especially fortunate the last two years in having an abundance of irrigation water in all districts, along with an unusual amount of rainfall sufficient to insure favorable crop returns in the dry-farming sections. Deep plowing and other modern, scientific methods are also making for rapid development of this non-irrigated territory, where thousands of acres still remain to be settled.

An example of Colorado's good fortune in farm returns last year was the excellent potato crop, which brought an unusually good price on account of a marked shortage in other parts of the country.

Stock raising is still a flourishing industry in Colorado and adjacent States, with prevailing high prices, and the last two years have afforded favorable conditions for both summer grazing and winter feeding.

Fully one-half of Colorado's more than 28,000 cars now belong in cities and towns, nearly a third of the total being in Denver alone; but the proportion owned by farmers and stockmen is rapidly increasing, and this class of trade promises to make a big showing within the next decade. Many of these people bought cars at the time of the fall show held by the Automobile Trades' Association of Colorado last October, hundreds more studied new models at that exhibit, and the stimulus given the motor industry throughout this territory by that event is still being felt.

The use of tractors in this district has only begun, and the tractor business is still being handled by implement dealers. Where tractors can be afforded, however, and are being tried out in the cultivation of a big acreage, they are a big success. The tractor method is particularly valuable for deep plowing in the dry-farming sections, where the farmers are able to make the necessary outlay to buy the required equipment.

National Parks an Asset

Another aid to the automobile industry in this region is the national part movement, with the recent establishing of the Rocky Mountain National Park, a wild, scenic tract of 360 square miles of mountain playground 100 miles northwest of Denver, the opening of the Yellowstone National Park to motor cars, the proposed government road connecting these and other national parks in the West, and other enterprises for developing scenic resources, building better and more attractive highways and in general promoting motor travel. One result of this increased travel is the attracting of more and more capital from the outside to help develop the resources of the mountain States, which, in turn, builds up general business and broadens the smile of the dealer.

To take care of their growing business in the Rocky Mountain district, the Ford Co. built an assembling plant in Denver two years ago to supply Colorado, Wyoming, Utah and New Mexico. A practical indication of how the business of this one concern has increased here since that time is furnished by the fact that ground will be broken within a week for the erection of an additional building to double the new plant's present capacity of between sixty and seventy cars a day. This will also mean a considerable increase in the present force of 300 men employed, and will thus contribute a substantial increase to general business in Denver.

During the last three months, the Ford increase over last year has been about 300 per cent here in Denver, and 200 per cent throughout the rest of the territory.

The Hudson, Dodge, Oakland, Dort, King, Grant, Saxon, Buick, Chevrolet, Overland, Studebaker, Metz, Maxwell, Haynes, Pierce, Packard, Paige, Abbott, Chalmers, Hupmobile and other established makes also show sales increases running to 100 and 200 per cent over a year ago, while the Scripps-Booth, Enger, H. A. L. and some other new makes in the territory are getting a gratifying start. The tire and accessory houses likewise report a substantial growth in business throughout the district.

The record sales increase found, where an established and extensive business is concerned, is the 500 per cent gain reported by W. W. Barnett, Oldsmobile distributor and president of the Automobiles Trades Association. This trades body, incidentally, by standardizing many features of the industry, introducing improved business methods, promoting harmony and co-operation among the dealers and otherwise building up the best and most practical interests of the motor industry, has accomplished a great deal in an organized way toward helping along this favorable showing in sales.

Koenig & Luhrs Wagon Co. Builds Truck Chassis

QUINCY, ILL., Feb. 19—The Koenig & Luhrs Wagon Co., this city, has begun the construction of motor truck chassis, the first one being completed on the fifteenth anniversary of the founding of the company. Before undertaking its new line the company installed the necessary machinery and employed a number of experienced mechanics to look after the new department. With the rapid substitution of motor vehicles for horses, the company may extend its activities to other fields of the industry.

Wisconsin Car Registrations Gain 100 per Cent on January, 1915

MADISON, WIS., Feb. 19—An increase of more than 100 per cent in the number of licenses issued to private owners of Wisconsin is noted for the month of January, 1916, compared with the corresponding period of 1915. Up to the end of January 28,500 licenses were issued, against 13,100 in January, a year ago. On February 15, the number of licenses issued 32,500, which figure maintains the 100 per cent increase. Applications are coming into the Secretary of State's office at Madison at the rate of 275 a day, and as the season advances it is expected that more than 500 requests will be filed daily. The 1915 registration of private owners was 79,791 and it is figured that the total for 1916 will be at least 110,000.

Omaha Expects Many Dealers

90 Per Cent of Those in the Territory to Attend Record Show

OMAHA, NEB., Feb. 21—Ten times greater than the first Omaha show of 1906, the eleventh annual exhibition, held in the municipal auditorium, displays over 200 cars, every available inch of space on the main floor and in the basement being taken. More than 90 per cent of the dealers in the Omaha territory are expected to attend the show and even a large portion of the remaining 10 per cent will probably drop in for at least a day during the week. Over sixty dealers are represented at the show.

There will be "days" for the ladies, the visitors from out of town, the farmers, and all the rest, of course, and extensive preparations have been made to make each of these an occasion in itself. For instance, on Farmers' Day there will be on hand a special corps of demonstrators from the factories who will supply any information which may be desired; there will be a special exhibition of tractors, as a direct recognition of the importance of the agricultural interests in the show, and special music designed will be furnished. And for every other day a similar provision has been made.

The decorations form a Japanese garden setting, the colors being orange, black and white lending themselves well to blend with the glow of the thousands of electric bulbs.

"Velie" is New Southern Town

VELIE, LA., Feb. 17—Many Velie cars are owned in the southern district, and as a result the name is well and favorably known. A community directly north of Shreveport, La., has assumed such importance that it was entitled to the post-office privileges.

Many meaningless titles were suggested and finally an enthusiastic Velie owner suggested the town be called "Velie." The name was indorsed by several other Velie owners present and adopted unanimously. Uncle Sam promptly approved the petition and Velie, La., is now an established fact.

Fisk Sales Total $14,500,000

CHICOPEE FALLS, MASS., Feb. 17—Sales for the fiscal year of $14,500,000 with net profits of $1,791,579 were reported at the annual meeting of the Fisk Rubber Co., held here yesterday.

On account of insufficient time action on the authorization of additional capital stock was not taken up and the meeting was adjourned until March 8 for action on this question. The present capitalization is made up of $5,000,000 first preferred, $2,000,000 second preferred, and $8,000,000 common.

The regular quarterly dividends of 1¾ per cent on the preferred stock, payable May 1 and on the second preferred stock, payable June 15 were declared.

The officers and directors were reelected, as follows: President, H. T. Dunn; vice-president, E. H. Broadwell; chief engineer, John Kearns; sales manager, J. D. Anderson.

Garford Truck Officers Re-elected—Report Prosperous Year

LIMA, OHIO, Feb. 19—The annual statement of the Garford Motor Truck Co., read at the annual meeting of the stockholders and directors, showed that the year just closed has been the most prosperous one in the history of the concern.

All the stockholders expressed themselves as well pleased with the report and voted to re-elect the same staff of officers and directors for the coming year. E. A. Williams will again serve as president and general manager; J. M. Carver will be secretary.

$800,000 Company to Take Over Delco House-Lighting Industry

DAYTON, OHIO, Feb. 19—The Domestic Engineering Co., incorporated with a capital of $800,000, has been formed to take over the Delco domestic light industry of the Dayton Engineering Laboratories Co., this city. The incorporators of the new concern, which will have practically the same organization as the Delco, are Edward A. Deeds, R. H. Grant and R. D. Funkhouser.

Mr. Deeds is one of the men who are backing the project to make a model community and industrial center south of Oakwood, approximately 3500 acres of land either having been purchased outright or secured by option for that purpose. Adam Schantz and C. F. Kettering are associated with him in this enterprise, and it has been announced that the new plant of the Delco, to be devoted to the manufacture of electric light outfits for farm and rural communities, will be built in that section.

Champion Spark Plug Gets Injunction

TOLEDO, OHIO, Feb. 20—The Champion Spark Plug has secured a permanent injunction against the Keystone Auto Supply Co., restraining the latter concern from manufacturing or selling an imitation of the Champion X spark plug for Ford cars. The decision was handed down by the District Court of western New York.

State of Iowa Now Has One Automobile to Each Fifteen Inhabitants

Farmers Estimated to Be Worth $1,000,000,000—This Means $100,000,000 Available for Automobile Buying—2587 Dealers in State

DES MOINES, Feb. 20—The Des Moines automobile show, which was held this week, is a show of promise. The dealers from all parts of the States which are served by Des Moines are looking for an increase, and not a decrease in 1916 business. The big distinguishing characteristic of the State is her always present market for her products, and this is because those products are foodstuffs.

Iowa now owns one car to every fifteen people, men, women and children. Line the population up in a row and every fifteenth person owns a car. In Buena Vista county there is a car to every person in nine, and by the end of 1916 the figure will be still more startling.

Products Worth a Billion

The per capita wealth of the United States is $1,965. In Iowa it is $3,345. The State has money; and it made a lot in 1915, and, furthermore, the Iowa farmer, with his modern lighting plant, plumbing and other improvements is not averse to buying a car if his year's business warrants it.

With products estimated at $1,000,000,000, the Iowa farmer should be a good car buyer. Of course, a large percentage of the billion will go for living expenses and operation of the farms, but if only 10 per cent of it is used for cars it means $100,000,000, and this means 100,000 cars averaging $1,000.

It probably will not be 100,000, because the normal progress of business is not subject to such sudden jumps. The following table shows the gains and percentage of gains during the past few years, and these must be taken into consideration in estimating for the coming year.

Year	Cars Owned	Cars Bought	Percentage of Gain
1911	27,998	,.....	..
1912	44,188	16,190	57
1913	70,068	25,880	58
1914	106,087	36,019	51
1915	145,076	38,989	36

The decrease in gain from 51 to 36 per cent for 1915 may be attributed to weather conditions. A normal gain, estimated on the three preceding years, is about 50 per cent. A 50 per cent gain would be approximately 75,000 cars for 1916. A gain of one-third would be 50,000 cars. With the possible buying power and the percentages of gain of preceding years as a basis, it is safe to estimate that Iowa will buy 75,000 cars in 1916.

There are in the State 2587 dealers. This means thirty cars to each dealer, and there are some who will sell many more than that. If each sale averages a profit of $200, which is low, it means a profit of $6,000 for each dealer. It means $15,000,000 in profits for the dealers of the State.

The Wealth of the State

Corn and hogs are a big product in Iowa. They have said that in Iowa corn is king; nobody has placed the hog on a throne, but if corn is king the hog is queen. The co-relation of these two products has helped Iowa through her present year. An early frost and rain hurt the corn; it produced what is called "soft corn," a corn which does not mature and harden in the ear. This might seem to be waste—but it isn't. It is excellent hog fodder if rightly fed. When the weather man said: "I'll spoil your corn," the Iowa farmer answered: "All right, I'll take my profit from pork." When Iowa is blocked at one point she pushes through at another. She won't be stopped.

Diversity of Products

That is why a 1915 crop of corn valued at only $154,530,000 is not a setback when compared with a 1914 crop valued at $214,183,000. It looks like a loss of 28 per cent—but it isn't. May and July corn are to-day selling within a few cents of the price of a year ago. Pork products are about $1 lower.

Iowa knows her salvation is in a diversity of products. For that reason the State is promoting agricultural study and research. Popcorn is becoming an important crop; 30,000,000 lb., valued at $625,000, were yielded in 1915. The farmers are scientific. The national government sent a man on a long pilgrimage to learn about popcorn, and it wasn't until he reached Iowa that he found what he wanted to know, which was what puts the pop in popcorn. The pop of perfection is caused by 12½ per cent of moisture in the kernel. And Iowa knows how to put it in, take it out and put it back in again.

Corn is a big crop, of course; so also are oats, wheat, potatoes, hay, barley, apples—which are a newcomer—and then there are the hogs, the beef cattle, the dairy products and other lesser food products. Iow'a specialty is feeding people.

It is true that the total value of the corn, oats, wheat, hay and barley crops are less by 13 per cent, and that the value of the live stock on hand Jan. 1 is 2 per cent less than a year ago, but it is also true that bank deposits increased about $20,000,000 during the year. Some of this money would have bought cars in 1915 had there been cars to buy, but car shortages were the big trouble of the dealers last year. There was plenty of money, plenty of orders—but no cars. Therefore, part of this banked $20,000,000 is still waiting to buy cars, and added to it is the natural production of the year.

As was stated previously, much of the poor corn was used to feed swine and cattle. Beef raising is becoming more and more a strictly Iowa industry. In the past it has been the custom of the Iowa farmer to go into the Omaha market and buy what are called "feeders," cattle which are bought for fattening during the winter and sold about now and during the spring. But the Iowa farmer has had to pay a higher price this

Iowa Farming Statistics

	Amount		Value	
	1914	1915	1914	1915
Corn (bu.)	363,689,600	303,000,000	$214,183,000	$154,530,000
Oats (bu.)	172,696,000	198,000,000	67,650,000	63,360,000
Wbeat (bu.)	15,427,280	15,557,000	14,463,000	13,535,000
Barley (bu.)	11,423,310	....	5,397,053	5,362,000
Potatoes (bu.)	9,540,200	15,540,000	5,533,316	8,392,000
Hay (tons)	5,094,650	6,692,000	52,769,626	66,920,000
Total			$359,995,995	$312,099,000

Decrease of $47.896,995, or 13 per cent.

	Number on Farms Jan. 1		Value Per Head		Total Value Jan. 1	
	1916	1915	1916	1915	1916	1915
Horses	1,580.000	1,600,000	$105.00	$105.00	$165,900,000	$168,000,000
Mules	61,000	58,000	110.00	111.00	6,710,000	6,438,000
Milk cows	1,390,000	1,377,000	58.50	57.00	79,249,500	78,489,000
Otber cattle	2,740,000	2,683,000	38.30	37.50	102,795,000	100,612,000
Swine	9,070,000	8,720,000	9.30	11.00	84,351,000	95,920,000
Sheep	1,270,000	1,219,000	6.30	5.50	8,001,000	6,994,000
Total value Jan. 1					$447,006,500	$456,453,000

Decrease of $9,446,500, or 2 per cent.

past year for feeders and anyway he is raising his own feeders. Swine, of course, are an Iowa product from pig infancy up.

Milk cows are not sold, but the State's dairy products are sold all over the world, and this industry is spreading. Horses have been and are being sold for war purposes, and the mule industry is gaining a footing. Some of the $20,000,000 that was banked in 1915 came from last spring's sales of stock, and during the next few months there will be a big income from feeders and swine.

One progressive step made last year in Iowa was vaccination against hog cholera. The results were invaluable. There was little of this trouble. What the coming months may mean in stock revenues is indicated by the value of the live stock on hand Jan. 1.

Bank Deposits High

Having cited production figures which show a lesser value for 1915 than for the preceding year, it is only fair to cite at the same time the bank deposits. They were, as given in a report of the banking department, $329,633,636.12 at the call of Sept. 11, 1915, and this exceeded the call of Nov. 4, 1914, but ten months previous, by $21,522,719.16, a gain of 6 per cent. Of this total deposits, 70 per cent is in savings banks.

Wants New Foodstuff

Iowa is all the time looking around for a new foodstuff to add to her resources. There is now on an agitation for apples. The Iowan believes the old State will grow almost anything—and he seems to be nearly right. And the more crops he can grow the smaller and smaller becomes the chance of breaking the record of "many misfortunes, but never a failure."

Farmers and Boosters

The Iowan is regarded as a farmer. It is true, he does this for a living, but his next biggest occupation is boosting. In not more than 60 seconds after an Easterner wandered into the automobile show the other evening he had been told that Iowa is first in value of farm products, value of live stock, value of farm property per farm, in increased valuation from 1900 to 1910, in percentage of improved farm land, in percentage of area in farms, in number of automobiles per capita, in value of horses, in value of cattle, in value of hogs, in number of poultry, in value of egg production, in tonnage of forage crops, in production of corn, in production of oats, in production of grass seed and a few other things too numerous to mention here—but the Iowan mentions them everywhere.

There is no question but what Iowa is a great State. If in doubt just mention the subject in the neighborhood of an Iowa man and hear him admit it.

How Pouring Gas Creates Electricity

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Moline Co. Finds Fires Can Be Caused Even When No Chamois is Used

MOLINE, ILL., Feb. 21—In January, the Moline Automobile Co., East Moline, Ill., manufacturer of the Moline Knight engines and automobiles, had two fires caused by the ignition of gasoline when being drawn from one of their filling stations. The Moline Automobile Co.'s supply tank is located at some distance from filling stations. The gasoline is pumped through a 1½-in. iron pipe by means of an electrically-operated pump controlled at each of the filling stations. The two fires both occurred at the service department's station and within about a week of each other. This filling station is at the end of a long pipe line which leads through a duct beside an asbestos covered steam pipe. It had been noticed that the gasoline, especially that first to be drawn in the morning was very warm and, therefore, gasified readily. In both of these fires, it was noted that the gasoline ignited when the can had about four gallons of gasoline in it and before the control switch for pump was pulled.

Switch Spark Eliminated

As the control switch for the electric motor was situated near the drawing faucet, it was first assumed that possibly the explosion and fire occurred by the fumes catching from a spark due to bad switch connection. Therefore, immediate steps were taken to remove the gasoline pipe from the steam duct so that the gasoline would not be heated.

In about another week there was a similar fire, although not so much damage due to the presence of mind of the operator to shut off the gasoline. This time the explosion occurred after about 3½ gal. of gasoline was drawn. The man drawing the gasoline distinctly heard the snap and the explosion.

Investigation showed that the former theory of the fire was in error. It is believed that the fire was caused by static electricity jumping from the funnel of the can to the faucet. A 5-gal. can with a funnel but no chamois skin was used. The funnel rested in the neck of can and came in direct contact with the can. The can rested on a wooden box which formed a complete electrical insulator for the can. The height of the funnel was about the same as the faucet. Thus by movement of the can, the air gap between the funnel and the faucet could be changed. We found that static electricity is generated by the flowing of gasoline into the can. When there was sufficient static electricity generated in the surface of the can, making its potential great enough above that of the faucet, it would break down the air gap and jump from the funnel to the faucet. This would set fire to the gasoline.

Experiments showed that a spark could be drawn from can after it was partly filled with gasoline, providing it was left undisturbed on the wooden box. This spark could either be drawn by a wire direct connected to the piping system and therefore grounded, or even through a man's hand who was standing on the floor as he approached with his hand the surface of the can to about the distance of ¾ in. This spark is similar to one secured under certain atmospheric conditions by scuffing along a heavy carpet and touching some other person or conducting article.

Principle an Old One

This principle was discovered in the early days of the discovery of electricity and we find reference to an apparatus known as "Lord Kelvin's water dropping apparatus." We have learned since our fires that there have been similar cases of fires from apparently the same causes. In a recent publication of one of the trade papers there is published an article in which the author claims that the fire resulted from the gasoline being strained through a chamois, which generated the static electricity on the can or funnel. The experience of the fires at the Moline Automobile Co. shows that the chamois is not necessary, and that providing your can is well insulated and nothing touching it but electrical insulating material a charge of electricity will be stored on the surface of the can as gasoline is being poured into it.

Hang Can on Faucet

The reason for not having trouble at the other filling station is thought to be due to the fact that the cans are either hung on the faucet by the handle or rest on some metal grounded support.

The Moline company has installed at this filling station a metal rest instead of the wooden box. This metal is perfectly grounded to all piping.

The Moline Automobile Co. therefore wishes to warn all filling stations to be sure that the charge collecting on the can is properly disposed of and not allowed to build up. The can should be resting on some conducting metal properly grounded. If metal pipe is used, then pipe and can should be metallically connected in some way.

It is also to be noted that under this theory the can, while resting on some insulating material might be filled and carried by someone wearing gloves, which would keep the can still insulated and would allow the can to discharge static electricity to car tank or other metal and possibly when this spark is discharged, to set fire to the can of gasoline.

Security Prices Steady

Chevrolet and G. M. Stocks Higher—Chalmers Common Rises 20 Points

NEW YORK CITY, Feb. 21—Notwithstanding the statement of C. W. Nash, president of the General Motors Co., that the stockholders of the company could not expect it to make as great earnings for the remainder of the fiscal year as were made from July, 1915, to Jan. 31, 1916, a number of the automobile and accessory issues showed substantial gains for the week. Some of the automobile securities, however, have been extremely weak. The statement caused a little selling of Maxwell Motors and Studebaker, but nothing of any importance. These two issues, together with Willys-Overland, were quoting considerably lower than in the previous week. However, the market, notwithstanding these declines, was on the whole, about 20 points higher than last week.

Chalmers featured the securities with a 20-point rise, closing on Saturday at 130. General Motors, on the strength of its recent financial statement, managed to hold above 475, closing on Saturday 2 points above that mark. Chevrolet also held strong at 134 with a gain of 4 points. It is stated that this company should show $6,000,000 earnings this year.

A few of the tire issues last week showed strength. Firestone common went up 5 points, closing at 735, and Goodrich common went up ⅛ point. This company announced its 1915 earnings last week, showing a surplus of 17 per cent on its common stock, and paid out $600,000 as a dividend on its common stock. This is 1 per cent on the issue of $60,000,000 of the common stock. Two quarterly dividends on the $28,000,000 preferred stock have been declared at the rate of 1¾ per cent quarterly, payable April 1. Miller Rubber common also showed a gain, closing at 275, just 2 points higher.

The drops this week were for the most part in the automobile stocks. Studebaker common, which has been one of the chief speculative stocks, closed on Saturday at 146 at a loss of 7 points; Maxwell common, first and second preferred, dropped 4¼, 1 and 1¼ points, respectively, and Willys-Overland common, which has shown considerable strength during the past few weeks, declined 13 points, closing on Saturday at 208.

The Detroit issues were featured last week with 100-point rise, after a 60-point rise the previous week. Chalmers common rose 16 points and Packard common 5 points.

The stock of the Auto Body Co., Lansing, Mich., will be listed upon the Detroit Stock Exchange. The capital stock of the company is $500,000. During 1915 the company paid its stockholders a 15 per cent cash dividend and 75 per cent in stock dividends.

Edmonds & Fulton Is New Firm

DETROIT, MICH., Feb. 21—Edmonds & Fulton, is a new firm formed in Detroit to act as manufacturers' representatives. J. D. Edmonds and H. S. Fulton are the partners who have taken quarters in the Majestic Building. The Perry-Fay Mfg. Co., Elyria, O., and the Pittsburgh Screw & Bolt Co., are among the concerns represented by the new firm.

American Motor Corp. Organized

$1,250,000 Co. To Build Cars—Louis Chevrolet Chief Engineer

NEW YORK CITY, Feb. 21—Louis Che rolet and a group of Eastern busine men, including W. H. Hoople, preside of the Interstate Electric Corp.; J. Spiers, formerly general manager of t Autocar Co. and factory manager of t Locomobile, Mercer, S. G. V. and Stan ard Roller Bearing companies, and G. Baright, formerly advertising manag of the Prudential Life Insurance C Newark, N. J., have completed the orga ization of the American Motors Cor which is to engage in the manufactu of automobiles on a large scale.

The company is capitalized at $1,250,0 Its first output will consist of a mod ate-priced car. Louis Chevrolet, vi president and chief engineer of the co pany, is also president of the Fronten Motor Co., Detroit, builder of racing c of his design.

The main plant of the new compa will be located in the East in order gain ready access to this market.

Copper and Aluminum Prices

NEW YORK CITY, Feb. 21—Materi prices last week were generally stea most of the prices remaining unchang Both copper and aluminum prices vanced while Up-River Para rubber clined 3 cents a pound to 76. Elec lytic and lake copper are quoting at

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	71	72	+ ½
Aluminum Castings pfd	95	100	..	..	..
J. I. Case pfd	..	83	85	87½	+1
Chalmers Motor Co. com	..	93	130	138	+20
Chalmers Motor Co. pfd	..	94	99	101	..
Chevrolet Motor Co.	..	..	134	135	+4
Electric Storage Battery Co.	48	49	64	66	—1
Firestone Tire & Rubber Co. com	375	380	735	..	+5
Firestone Tire & Rubber Co. pfd	108	109½	112	..	..
General Motors Co. com	88	90	477	479	+2
General Motors Co. pfd	94	95	114	115	+1
B. F. Goodrich Co. com	30½	31¼	72⅛	73⅜	+⅛
B. F. Goodrich Co. pfd	96¼	98½	113	114	..
Goodyear Tire & Rubber Co. com	192	193½	342	347	+2
Goodyear Tire & Rubber Co. pfd	101½	102½	116	117½	..
Gray & Davis, Inc., pfd	..	..	98	102	..
International Motor Co. com	..	..	22	25	..
International Motor Co. pfd	..	..	35	40	..
Kelly-Springfield Tire Co. com	108	108½	280	300	..
Kelly-Springfield Tire Co. com. (new)	..	..	71	72	..
Kelly-Springfield Tire Co. 1st pfd	82½	93½	95	97	..
Kelly-Springfield Tire Co. 2d pfd	120	127	71	72	+2
Maxwell Motor Co. com	23⅝	24	65¼	66¼	—4¼
Maxwell Motor Co. 1st pfd	60	60½	86	88	—1
Maxwell Motor Co. 2d pfd	24¼	24¾	49¾	50½	—1¼
Miller Rubber Co. com	150	156	275	278	+2
Miller Rubber Co. pfd	101	103	113½	116	—1¾
New Departure Mfg. Co. com	118	123	174	177	..
New Departure Mfg. Co. pfd	105½	106½	111	..	+1
Packard Motor Car Co. com	..	99	170	180	+5
Packard Motor Car Co. pfd	95	..	102	†104	..
Paige-Detroit Motor Car	..	..	665	700	..
Peerless Motor & Truck Corp	..	..	26	27	— ½
Portage Rubber Co. com	34	36	65	70	..
Portage Rubber Co. pfd	85	95	107	109	..
Regal Motor Co. pfd	..	..	13	16	+1
*Reo Motor Truck Co	11	12	27¼	28	+ ¼
*Reo Motor Car Co	25¼	26¼	34	34½	— ½
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	48	49½	86½	87½	— ½
Stewart-Warner Speed. Corp. pfd	101	103	108	..	
Studebaker Corp. com	44¼	44⅝	146	147	-
Studebaker Corp. pfd	92¼	95	109	112	-
Swinehart Tire & Rubber Co	71	73½	87½	90	-
Texas Co.	132	133	207½	208¼	-
U. S. Rubber Co. com	54	54¼	51⅛	52⅛	-
U. S. Rubber Co. pfd	101½	103	106	108	
Vacuum Oil Co	188	192	228	235	+
White Motor Co. (new)	..	..	49¾	51¼	
Willys-Overland Co. com	92	93	208	212	—
Willys-Overland Co. pfd	94	94¼	104	108	

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHA

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	
Chalmers Motor Co. com	..	93	141	147	-
Chalmers Motor Co. pfd	91	94	..	101	
Continental Motor Co. com	175	200	450	500	+
Continental Motor Co. pfd	75	..	91	..	
Ford Motor Co. of Canada	500	..	..	410	
General Motors Co. com	88	92	450	480	-
General Motors Co. pfd	92	95	112	115	
Maxwell Motor Co. com	22½	24	65	68	
Maxwell Motor Co. 1st pfd	58	60	86	88½	
Maxwell Motor Co. 2d pfd	23	25	50	52½	
Packard Motor Car Co. com	..	99	165	176	
Packard Motor Car Co. pfd	95	..	..	104½	
Paige-Detroit Motor Car Co	..	..	665	700	
*Reo Motor Car Co	25¼	26½	33¾	34¼	
*Reo Motor Truck Co	11	12	..	27¾	
Studebaker Corp. com	43½	44½	146	149	
Studebaker Corp. pfd	91	95	108	113	

INACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	
*Atlas Drop Forge Co	..	25	32⅛	..	
Kelsey Wheel Co	195	215	435	..	
*W. K. Prudden Co	18¾	19¾	..	33	
Regal Motor Car Co. pfd	..	25	13	16	

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*Par value $10. †And accrued dividend.

advance of 1 cent a pound over last week's quotations, which were 27½ cents for each of the two grades. Aluminum has gone up to 57 cents a pound at an advance of 1 cent. The metals have been the feature of the materials market. The demand has been very large, notwithstanding the high prices.

Rubber prices, which created much comment recently, have again reached something like normal. Fine Up-River Para, which fluctuated throughout the week, closed on Saturday at 76. The Ceylon, First Latex Crepe grade, saw a gradual rise of about a cent a pound per day, closing on Saturday at 91, just 2 points higher. The demand for rubber is active, but manufacturers do not show much disposition to anticipate requirements in making purchases of crude material.

Prices in the oils and lubricants were constant. Linseed oil advanced 1 cent. The rest of the prices were unchanged. Gasoline is still quoting at 23 cents with rumors of a further advance in the near future.

Rayfield Motor Car Co. Defunct

CHRISMAN, ILL., Feb. 19—The Rayfield Motor Car Co., this city, is now defunct. The entire belongings were sold at auction under decree of the Federal Court. The machinery and office fixtures were distributed among St. Louis, Indianapolis and Chrisman buyers, the amount realized aggregating $14,000. F. K. Thayer, of Chrisman, purchased the building for $2,500. No bids were received when the plant was put up as a whole and it was necessary to sell each portion separately.

Cornell, Speaker at Indiana Section of S. A. E.

INDIANAPOLIS, IND., Feb. 19—The February meeting of the Indiana Section of the Society of Automobile Engineers will be held at the Claypool Hotel, Friday, Feb. 25 at 8 p. m. The topic is "Anticipating Complaints" and the author of the paper is F. A. Cornell, formerly head of the service department of the Willys-Overland Co.

Atlas Ball Co. to Expand

New Plant Will Quadruple Production—To Be Finished in 3 Months

PHILADELPHIA, PA., Feb. 16—In about three months the Atlas Ball Co. will move into its new plant which will have a capacity four times as great as the present factory. The growth of this concern is indicative of the tendency toward buying parts in this country which manufacturers formerly believed could not be made as well here as abroad. The European war has afforded an opportunity for many of the domestic manufacturers to show that their products can readily take the place of the European and the Atlas Ball Co. is a concrete example of this, as the business for 1915 is 95 per cent greater than it was in 1914 and the plant is at present working 22 out of 24 hr. The rate of manufacture has grown to such an extent that the company is now turning out in one month as many balls as were made in the entire year 1911. The balls made by this concern range in size from 1/16-in. up to 2½-in. and are used by very many of the ball bearing manufacturers in the country.

Fletcher Resigns from Stewart Motor

BUFFALO, N. Y., Feb. 17—H. R. Fletcher, for several years past connected with the Stewart Motor Corp., Buffalo, N. Y., as sales manager, has resigned to become a director and manager of the Triangle Motor Sales Co., 1872 Broadway, New York City, this company having been organized as the New York City selling agency for Stewart delivery trucks.

Many Dealers Driving Home New Cars

DETROIT, MICH., Feb. 18—Although this is not yet exactly drive-away weather, a number of such events have taken place from local and other Michigan automobile factories. They were, however, planned simply as a means of securing cars quickly or rather quicker than it would be possible to get them when shipped by rail. It is all due to the freight car shortage situation.

While in Toledo a few days ago, your correspondent was informed by the Saxon distributor that thirty of his agents responded to his suggestion to come to the factory in Detroit and drive away their new cars, as otherwise it might be a case of at least ten days before the cars would reach them.

From Lansing came the news that Reo dealers have already started the annual drive-away period, only because they are clamoring for cars and can't get the promise of an early delivery by rail.

The Hupp Motor Car Co., the Studebaker Corp., the Maxwell Motor Co., and others already had a few drive-aways and will have more from now on.

The Charles E. Reiss Co., New York distributor for the Hupmobile will have its cars shipped only as far as Poughkeepsie, N. Y., from where the cars will be driven overland. Some shipments may also be coming by lake steamer to Buffalo, from where there will then be a drive-home.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge
Aluminum	.56	.57	.57	.57	.57	+ .01
Antimony	.44	.44	.44	.44	.44	...
Beams and Cbannels, 100 lb	2.17	2.17	2.17	2.17	2.17	...
Bessemer Steel, ton	34.00	34.00	34.00	34.00	34.00	...
Copper, Elec., lb	.27½	.27½	.27½	.28½	.28½	+ .01
Copper, Lake, lb	.27½	.27½	.27½	.28½	.28½	+ .01
Cottonseed Oil, bbl	9.40	9.70	9.60	9.65	9.65	+ .25
Cyanide Potash, lb	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl	.23	.23	.23	.23	.23	...
Lard Oil, prime	.95	.95	.95	.95	.95	...
Lead, 100 lb	6.30	6.30	6.30	6.30	6.30	...
Linseed Oil	.74	.74	.74	.75	.75	+ .01
Open-Hearth Steel, ton	35.00	35.00	35.00	35.00	35.00	...
Petroleum, bbl., Kansas, crude	1.30	1.30	1.30	1.30	1.30	...
Petroleum, bbl., Pennsylvania, crude	2.35	2.35	2.35	2.35	2.35	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.79	.79	.80	.78	.76	— .03
Rubber, Ceylon, First Latex, Crepe	.89	.89	.90	.92	.91	+ .02
Sulpburic Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	42.00	42.00	42.00	42.13	42.13	+ .13
Tire Scrap	.06¼	.06¼	.06¼	.06½	.06½	+ .00¼

New Bus Bodies Much Improved

NEW YORK CITY, Feb. 22—The new metal bodies designed and built by the Fifth Avenue Coach Co. for application to its bus chassis are being installed in place of the old ones at the rate of one every two days. The new bodies are 800 lb. lighter than the twenty-four-passenger bodies formerly used, yet they seat ten more persons. They are even lighter in comparison with the forty-five passenger bodies used on other of the chassis.

The new bodies are being equipped with Perfection exhaust heaters, made by the Perfection Spring Co., Cleveland, Ohio. These heaters will use all of the exhaust and while in use will eliminate the silencer. A new type of sign is being developed which is more legible than the former type, it is more accessible for adjustment and it is expected that both front and rear signs will be used when the latter are perfected.

Sheridan Truck Motor 2¾ by 4 In.

NEW YORK CITY, Feb. 19—In THE AUTOMOBILE for Jan. 22 a typographical error made it appear that the four-cylinder motor of the Sheridan light truck built by the Sheridan Commercial Car Co., Chicago, Ill., was 2 by 4 in. This should have been 2¾ by 4 in.

Now Continental Motor Co.

DETROIT, Feb. 17—At the stockholders' meeting of the Continental Motor & Mfg. Co., it was decided to shorten the name of the company which will hereafter be Continental Motor Co.

Factory Miscellany

Michigan Truck Adds—An addition, 32 by 100 ft., is being put up at the plant of the Michigan Truck & Lumber Co., Holly, Mich.

Dunlop Tire Adds—The Dunlop Tire & Rubber Co., Toronto, Ont., will immediately commence the erection of an addition to its plant.

Motor Truck Body Co. to Build—The Motor Truck Body Co., Detroit, Mich., is constructing a one-story, 64 by 245-ft. factory in that city.

Ajax to Build—The Ajax Rubber Co., Trenton, N. J., has taken out a permit for the erection of a three-story brick and steel plant to cost $75,000.

Fleetwood to Add—The Fleetwood Metal Body Co., Fleetwood, Pa., has increased its capital from $25,000 to $115,000, and plans to increase its business in proportion.

Murray Parts Co. to Add—The J. N. Murray Mfg. Co., Detroit, Mich., manufacturer of automobile parts, will construct an addition to its plant costing approximately $10,000.

To Make Tractors—The Bettendorf Trailer Co., capitalized at $100,000, has been formed to build tractors in Bettendorf, a manufacturing center near Davenport ,Iowa. J. W. Bettendorf is president of the company.

Packett Co. Formed—The Packett Motor Car Mfg. Co., St. Paul, Minn., has been formed with a capital of $150,000 to manufacture a light delivery truck and will build a factory. Henry Orme is president of the company.

Fisher Body in Krit Plant—The plant formerly occupied by the Krit Motor Car Co., Detroit, Mich., has been leased by the Fisher Body Co. and is now one of this concern's local manufacturing branches. About 150 men are on the payroll now.

Howe Rubber Adds—The Howe Rubber Co., New Brunswick, N. J., advises that on account of the protracted delay of 3 or 4 months before it could rebuild its tube plant, which was destroyed by fire at a reported loss of $150,000, it has decided to put up a concrete addition to its new tire department and move its tube business into that building. It plans to start operations in the new building about March 1.

Ford Community at Milwaukee—A Ford community is being built around the new Ford branch plant at Prospect Avenue and Kenilworth Place, Milwaukee, Wis. The latest addition is a banking institution, known as the East Side Bank, which is incorporated with $25,000 capital, and will open about March 1 at Farwell and North Avenues, a block from the Ford works. The bank will cater to employees.

To Make Electrical Apparatus—The Lake Superior Electrical Co., Superior, Wis., organized by M. B. Benson, E.E., to manufacture electrical apparatus, signal devices and similar appliances, has started operations in leased quarters in the plant of the Superior Iron Works. The initial force consists of forty-five skilled electricians. The new company has established a storage battery department and has installed a complete battery charging outfit for the convenience of Superior motorists and electric owners.

The Automobile Calendar

Feb. 19-26	Newark, N. J., Show, First Regiment, Armory, C. G. Fitzgerald, Mgr.
Feb. 19-26	Harrisburg, Pa., Show, Emerson-Bruntingham Co.'s Bldg., Capital City Motor Dealers' Assn.
Feb. 20-27	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.
Feb. 21-26	Anderson, Ind., Show, Anderson Automobile Dealers' Assn.
Feb. 21-26	Bridgeport, Conn., Show, State Armory, B. B. Steibler, Mgr.
Feb. 21-26	Louisville, Ky., Show, First Regiment Armory.
Feb. 21-26	Omaha, Neb., Show, Omaha Automobile Show Assn.
Feb. 21-26	Portland, Me., Show, Exposition Bldg.
Feb. 21-26	South Bethlehem, Pa., Show, Coliseum. J. S. Elliot, Mgr.
Feb. 21-26	Tacoma, Wash., Show, Tacoma Automobile Club, Glide Rink. C. A. Collins, Mgr.
Feb. 21-26	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Feb. 21-26	Reading, Pa., Show, Berkshire Hotel.
Feb. 23-26	Bay City, Mich., Show, Bay City Automobile & Accessory Dealers' Assn.
Feb. 28-March 3	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4	Utica, N. Y., Show, Utica, Automobile Bldg., Utica Automobile Trade Assn.
Feb. 28-March 4	Cedar Rapids, Ia., Show, Cedar Rapids Automobile Dealers' Assn.
Feb. 28-March 4	Paterson, N. J., Fifth Annual Show, Auditorium.
Feb. 28-March 4	Shamokin, Pa., Show, Shamokin Automobile Show Assn.
Feb. 29-March 4	Ft. Dodge, Iowa, Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March	Danville, Ill., Show.
March 5	Los Angeles, Cal., Speedway Race, Ascot Speedway Assn.
March 4-11	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
March 8-11	Mason City, Iowa, Show, Armory.
March 8-15	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 11-18	Boston Automobile Show, Mechanics Bldg.
March 15-18	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 21-25	Deadwood, S. D., Show, Auditorium. Deadwood Business Club.
March 25-Apr. 1	Wheeling, W. Va., Show, Market Auditorium.
March 27-Apr. 1	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 8	Corona, Cal., Race.
April 10-15	Seattle, Wash., Show, Arena.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
Apr. 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show, Automobile Industries Assn.
May	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13	New York City, Vanderbilt Cup, Sheepshead Bay Speedway Race.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway Race.
May 31	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race.
June 28	Des Moines, Iowa, Speedway Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Race.
Sept. 4	Indianapolis Speedway Race.
Sept. 16	Providence Speedway Race.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Sneedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.

The Week in the Industry

Hillman Resigns from Willard—M. G. Hillman, district sales manager in Detroit for the Willard Storage Battery Co., Cleveland, Ohio, has resigned.

Fisher is Steinhart Manager—Walter M. Fisher, formerly manager of the Cadillac Co. of Illinois, has been appointed manager of the E. W. Steinhart Co., Indianapolis, State distributors for the Dodge.

Townsend Resigns from Bowser—G. A. Townsend, Jr., of S. F. Bowser & Co., Fort Wayne, Ind., has resigned as advertising manager of that concern, effective March 3. He has been with the Bowser company for six years. As yet no successor has been named.

Dealers

Philadelphia Trade News—The Braender Rubber & Tire Co. has opened a branch at 1327 Race Street, Philadelphia, in charge of W. L. Porter.

The Berrodin Rubber Co., Philadelphia, will add to its present line of tires an automobile-accessories department.

Chicago News Items — The Braender Rubber & Tire Co. has opened a branch at 1350-54 South Michigan Avenue, Chicago. This branch is in charge of W. J. Heathcock.

The McCullough Motor Supply Co., Indianapolis, Ind., has opened a branch office in Chicago and Cleveland. This company handles automobile parts and accessories.

The Joseph T. Ryerson & Son Co., Chicago, will carry Fahrig metal and fill orders to the retail trade in the territory west of and including Pittsburgh.

New York City Items—J. A. & W. Bird & Co., maker of the Ripolin enamel paint, Boston, has changed the location of its New York City offices from 66 Beaver Street to the Equitable Building, 120 Broadway.

The Elkhart Carriage & Motor Car Works, makers of the Elcar, have placed their wholesale and export business in the hands of the Kent Motors Corp., 1704 Broadway, New York City, distributor of the Marion car.

Texico Garage Capital $1,000,000—The Western Tire & Garage Co., which was recently organized in Texico, N. M., has a capital stock of $1,000,000. It has begun business, however, with a cash capital of $2,000. The big capitalization of the company gives it plenty of room for expansion. It is perhaps the largest capitalized garage concern in the United States.

Motor Men in New Roles

Bender Joins St. Louis Packard—Paul Bender, formerly European manager of the Burroughs Adding Machine Co., with headquarters at Berlin, on March 1 will join the force of the Packard Missouri Motor Co., St. Louis.

Gill Saxon Factory Manager — R. O. Gill, who has been assistant factory manager of the Saxon Motor Car Co., Detroit, has been promoted to factory manager. Before coming to the Saxon organization Gill was with the Chalmers Motor Co.

Dold Heads St. Louis Goodrich—W. C. Dold, formerly of the Kansas City Goodrich branch, has been appointed manager of the St. Louis Goodrich branch to succeed L. K. Rittenhouse, resigned. O. E. Hoerger, who has been acting manager at St. Louis, will remain as assistant to Mr. Dold.

Dyke Issues Free Supplement — A. L. Dyke of St. Louis has just issued a free supplement in two colors treating on the construction, principle, operation, care and adjustment of the Packard Twin-Six, King Eight, Willys-Knight, Ford and Maxwell. This is included free without extra cost with Dyke's 1915-16 Encyclopedia.

Holden Joins Service Truck — A. E. Holden has joined the Service Motor Truck Co., Wabash, Ind., as assistant sales manager. For over five years he was advertising and sales manager of the Double Fabric Tire Co. Previously he was connected with the sales department of the McIntyre Automobile Co., Auburn, Ind.

Nicholai Joins Leavitt—L. G. Nicholai, well known in automobile and newspaper circles on the Coast for a number of years past, is now identified with J. W. Leavitt & Co., Pacific Coast distributers for Overland and Willys-Knight. Mr. Nicholai will have charge of the advertising of this concern and Overland publicity and promotion work in the Northwest territory. His headquarters will be at San Francisco.

Bauer in Tire Business—H. A. Bauer, identified with the automobile industry for twelve years and for a long time connected with the Oakland Motor Car Co. in various capacities and finally the assistant sales manager of that company, has gone into business for himself in Detroit, having organized the Wolverine Rubber Co. He will be located at 2301 Woodward Avenue, and he will specialize in the wholesaling of automobile tires.

McCallum Joins Doehler—H. C. McCallum has joined the Doehler Die Casting Co., Toledo. He is in the sales department.

Wood Firestone Seattle Mgr.—E. R. Wood of Los Angeles has been named manager of the Seattle branch Firestone Tire & Rubber Co. C. W. Brown, retiring manager, has been made special representative on the Pacific Coast.

Pyke with N. Y. Mitchell—Harry Pyke has been made manager of the Carl H. Page Co., New York City distributor for the Mitchell. C. M. Welch has joined the sales force of that company and will assist Mr. Pyke.

Dealers

Overland Building in 'Frisco—The Willys-Overland Co. has purchased a lot on Van Ness Avenue, San Francisco, Cal., and will immediately start the erection of a $400,000 building, which is to be used as the headquarters of J. W. Leavitt & Co., Coast distributer of the Overland car, and the Coast factory headquarters. The building will be a six-story structure with approximately 185,000 sq. ft. of floor space.

Denver Trade News—The Schwalbert-Dorris Co., a new concern, has opened a Dorris distributing agency for Colorado at 1240 Broadway, Denver.

A. C. Wagner, manager of the Wagner Garage Co., 1541 Cleveland Place, Denver, and W. H. H. Cranmer have secured the Colorado distributing agency for the Kelly-Springfield truck.

The International Rubber Co. is the new name for the Colorado Tire & Leather Co., 985 South Broadway, Denver, which manufactures rubber and leather half-soles and treads for tires.

F. J. Silbanck has opened an agency at 1541 Cleveland Place, Denver, for the Even Lite for Ford cars.

The Gessler-Williams Tyre Co., agent for Swinehart tires, has moved from 1560 Broadway, Denver, to 1312 Broadway.

The Wagner Garage, 1541 Cleveland Place, Denver, has been appointed as a Buick service station.

The C. & S. Sales Co., 1742 California Street, Denver, is a new concern manufacturing Randolph springs for distribution in the Rocky Mountain territory. F. E. Coe is president and C. R. Stedman is secretary-treasurer.

Payne Bros. have opened an International tire half-soles agency at 1560 Broadway, Denver, under the name of the International Sales Co.

Marathon Tire Enlarges at Omaha—The Marathon Tire & Rubber Co. has taken over the business of the Akron-Marathon Rubber Co., consolidating the latter with the factory office and warehouse in Omaha, Neb., enlarging their staff and facilities. The management and selling force are the same with additions. H. H. Replogle is division manager for the Middle West, with headquarters at Omaha.

Overland Builds in Kansas City—The Willys-Overland Co. has completed the purchase of the acre tract of land at Twenty-first Street and Grand Avenue, Kansas City, Mo., and will start construction work at once on a seven-story sales and storage building. The four-story building at 2110 Grand Avenue, now housing the local branch of the Overland company, will be sold, despite the fact that plans had been drawn and contracts let for its enlargement.

The proposed building will have a frontage on Grand Avenue, McGee and Twenty-first Streets, and will cost about $600,000. Work on it will probably start March 5 and be rushed so that it may be occupied in August. It will be constructed to afford a large salesroom for new cars, a salesroom for second-hand cars, a repair department with space sufficient to permit work on a hundred cars, a department in which $250,000 worth of Overland parts will be kept on hand, a paint shop, a body shop, a machine shop, a storage capacity for 500 machines and the offices of the factory branch.

The building will not be a warehouse or an assembling plant. In announcing the contemplated improvement, it was given out that the company intends to acquire a warehouse site on the outskirts of the city and that an ultimate investment will be made here of $1,500,000.

Minnesota News Items—The Maxwell Motor Sales Corp., distributer for the Maxwell car, has bought a block of land 330 ft. long at Twenty-sixth Avenue, Southeast, and Delaware Street, Minneapolis, upon which it will erect an assembling plant. The company is now at Seventh Avenue, South, and Third Street in a large building, but the new structure will be adapted to more efficient use. F. W. Warrington is district manager.

B. W. Harris, representing Harris Bros., Chicago, announces a $350,000 plant will be erected in the Midway district to make gasoline engines. The C. A. Stickney Co. plant at St. Paul was recently bought by Mr. Harris and he said either a milling concern or an automobile factory may be established there. The new plant will make gas engines of the Stickney type, will operate a repair department and manufacture several lines of machinery.

Kansas City Changes—The Western Auto Supply Co., 1426 Grand Avenue, Kansas City, has been reorganized, and Don A. Davis has been elected president and treasurer. Mr. Davis purchased half interest in the company from George Pepperdine, who still retains an ownership, but is retiring from active work on account of his health. H. R. Baker is vice-president and E. R. Baker secretary.

The Studebaker branch has moved into its new six-story distributing warehouse on the northeast corner of Twenty-first Street and Grand Avenue. The new quarters are 120 by 150 ft., with storage room for 300 cars and additional space for a showroom, shop and used car storage. In the year 1915 the Kansas City branch handled cars valued at about $4,000,000. A. W. Daley, the retail salesmanager, predicts an increase of 50 per cent for 1916.

St. Louis News Items—W. L. Hausman, secretary of the Velie Automobile Co., St. Louis, has resigned to become associated with Price, Waterhouse & Co., public accountants. Mr. Hausman also has disposed of his stock in the Velie company.

The Entz Automobile and Battery Co., St. Louis, announces that it is now the official Detroit Electric garage and Southwestern representative of the Philadelphia Storage Battery Co.

The Cartwright Motor Car Co., has moved its salesroom from 3003 Locust Street to the new building occupied by the Commercial Auto Body Co. at Sixteenth and Pine Streets. Hugh F. Cartwright is president of both companies.

The Moon Motor Car Co., St. Louis, has moved its showroom from 3003 Locust Street to larger quarters at 3040 Locust Street. Similarly the Newell Motor Car Co. of St. Louis has increased its display space considerably by moving from 308 North Twelfth Street to 3003 Locust Street.

The Imperial Motor Car Co., St. Louis, has moved from 1045 North Grand Avenue to 2000 De Kalb Street in order to obtain larger quarters.

Plans for the immediate erection in St. Louis of a $250,000 Overland branch building were announced recently by the Overland Automobile Co. of that city, which acquired a quarter of a city square on the southwest corner of Twenty-third and Locust Streets.

The Park Automobile Co., St. Louis, has opened a new sales room at 2226 Locust Street for the display of the Chalmers line.

The Steele-Morgan Motor Car Co., Euclid and Taylor Avenues, has been given the agency for the Autocar in the St. Louis district.

The St. Louis Sectional Garage Co. has been formed by Eugene H. Angert, Frank H. Sullivan and Edward W. Lake with a capital stock of $5,000 to manufacture a portable garage.

Trade News from the Northwest—Gerlinger Motor Car Co., Portland, Ore., has taken the Oregon agency for Swinehart tires. J. F. Chapman is in charge of the tire department.

The Northwest Buick Co., Spokane, has opened new quarters at 1308 First Avenue.

The Interstate Auto Co., Spokane, distributor Interstate and Velie lines, has moved into new quarters at 1223 Sprague Avenue.

Glendale Auto Brokerage Co., Tacoma, has opened at 2913 Sixth Avenue. W. G. Rowland and G. N. Bissell are proprietors.

The Sieler-Inman Auto Co., Spokane, have been organized to handle he Case automobile in the Inland Empire. The territory includes eastern Washington, northern Idaho and western Montana. Henry and Victor Seiler and Elmer Inman are members of the new firm. The salesroom and service station are located at W-1017-19 Sprague Avenue.

Auto Tire & Rubber Co., Seattle, has opened new quarters at Seventh Avenue and Pine Street. D. E. Marriott is president and treasurer. With him is now associated H. J. Holmes as treasurer of the company.

J. P. Corey of the Seattle sales staff of the Rothweiler Truck Co. has left for San Francisco, where he will look after the interests of his firm and establish a branch, and S. F. Donnell of the same company will establish a branch in Minneapolis and direct the sales campaign for Rothweiler trucks in the Middle West.

New Chalmers in Kansas City—The factory branch of the Chalmers Motor Co. here has been discontinued and the distributing agency in the Kansas City territory has been taken over by the newly-organized Chalmers Motor Co. of Kansas City. The new company is headed by Lewis T. Shelton, part owner and manager of the Packard company here. He will also continue to manage the Packard agency. E. L. Knott will be the manager of the new Chalmers company.

The Chalmers company will open a new salesroom at 1506-8 McGee Street, but will continue its service and stock depot at 1728 Walnut Street.

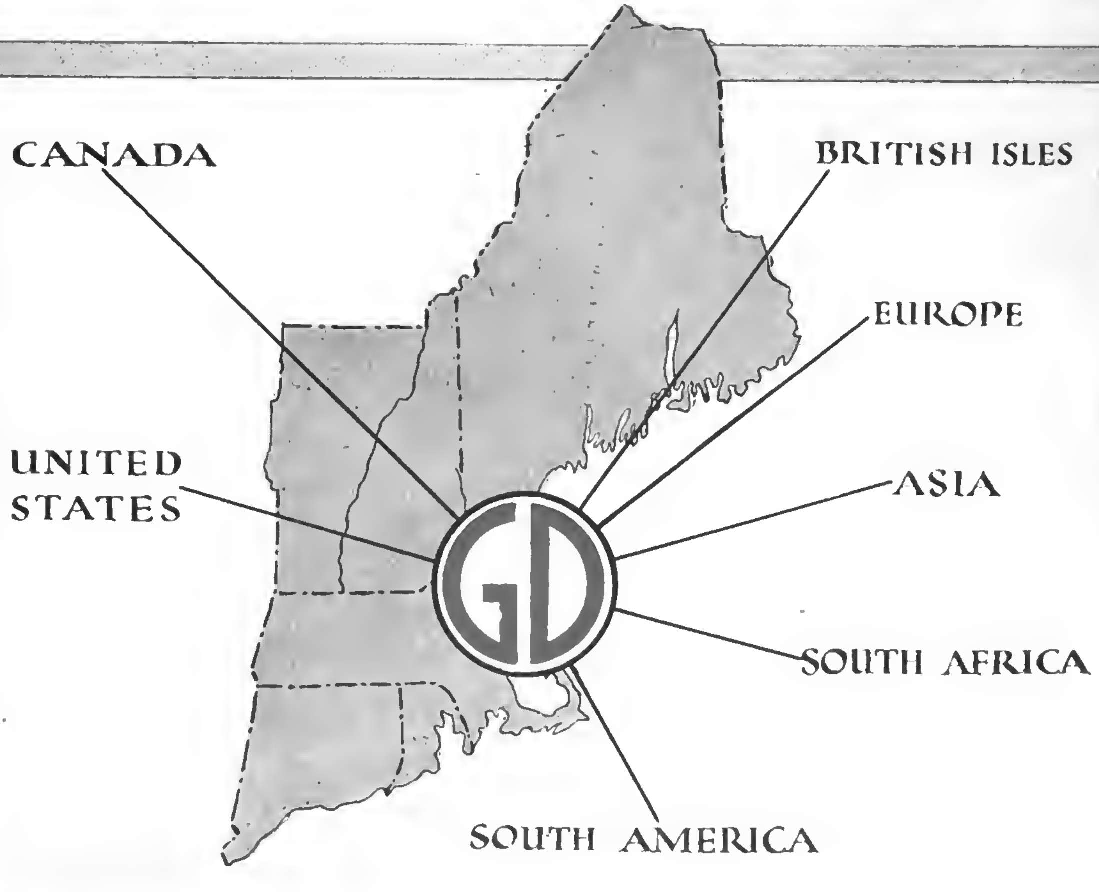
Gets Rainier Park Concessions—Concession for all privileges within the Rainier National Park, including transportation to the park from Tacoma, Seattle and Ashford for a period of twenty years has been granted to the Rainier National Park Co. composed of Tacoma and Seattle business men, by the Interior Department. Headquarters of the new company will be in Tacoma. The company is capitalized for $200,000. All concessions within the park with the exception of the National Park Inn have been turned over to the Rainier company.

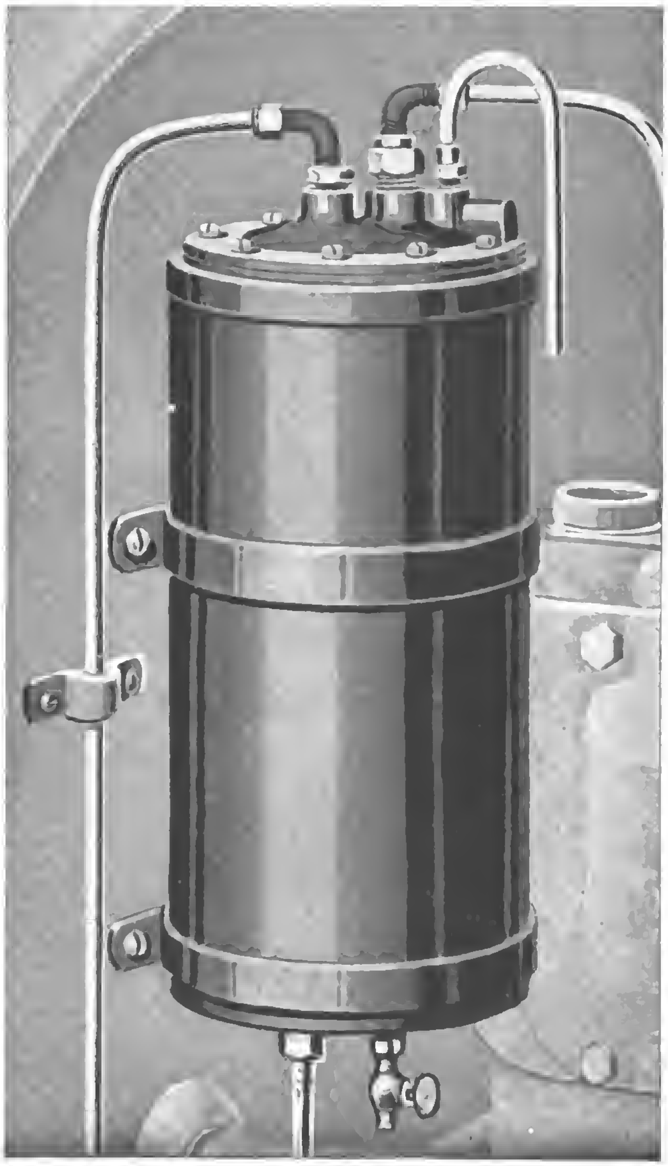
The AUTOMOBILE

Vol. XXXIV,
No. 9

NEW YORK, MARCH 2, 1916

Ten cents a copy
Three dollars a year





VOL. XXXIV NEW YORK—THURSDAY, MARCH 2, 1916—CHICAGO NO. 9

The AUTOMOBILE

New England

World's Greatest Department Store

¶ Her Machines Are Used in All the Factories of the World—Her Aid Is Given in Clothing All Nations—Her Leather Industry Is International—Agriculture and Lumbering Are Factors.

¶ Her Buying Capacity, Always Large, Is To-day at Full Tide—Her Factories Are Working Ceaselessly—Never Was Her Prosperity Greater Nor Her Prospects Brighter.

¶ Her Automobiles Have Gained 27 Per Cent in the Past Year—Her Purchasing Capacity Exceeds a Third of America's Automobile Output—She Has $500,000,000 of Unexpected Wealth.

NEW ENGLAND is the greatest department store of the world. Alone and unaided she can supply almost everything that civilized man desires or needs, and all she asks is the rawest of raw material in return. Feed New England with steel, with cotton and with hides and she will feed, clothe and equip you for any enterprise.

To-day New England boasts a territory roughly 3 per cent of the whole of the United States, but that area contains 7 per cent of the population. The six New England States together cover less ground than is included in each of eight single States in the Union. Texas, two and one-half times as large as all New England, has but a little more than half the population; Oregon, the same size as the six States, has but a tenth the number of people.

The Universal Provider

When first opened up the vast richness of the central and Pacific States dazzled for a time, but the development of the newer lands began around New England, and the pioneer districts looked always to New England to supply the goods of civilization that are the essentials of the creators of new communities. New England has been called the tool room of the world, and not inaptly; but let it not be forgotten that it was also the nucleus, the storehouse and the base for all Northern America; that there is no State in the Union and no country on the globe that does not still depend upon New England for many of the necessaries of life.

Ever Growing Prosperity

Like all other places, New England had its lean years and its fat ones, but through all of these a steady growth in population and a steady increase in individual wealth has been apparent. Does a new manufacturing industry arise, it is New England that exploits it and, though none too favored by climate, New England remains a great farming country.

Were some vast cataclysm of nature to remove these six fertile States, fertile of men and machines as well as crops, and two-thirds of the world would perforce go unshod, while countless thousands would be forced to garb themselves in something nearer the primeval style than cotton fabrics or woolen cloths. Halt the machine tool factories for a year and there is no manufactured thing throughout the world that would not rise in price. Flood the forests of Maine and Vermont and we should see some interference with the wood pulp and the paper trade.

Five Primary Industries

There are in New England five great industries, the primary five they might be called. Firstly comes the bodily equipment of man, textile products, both woolen and cotton. Secondly is the leather trade, which makes a large proportion of the boots and shoes of the world. Thirdly, in normal times, are the tools with which civilized man earns his living, either the actual implements as are used by the mechanic or machines which are an intermediate stage in the fashioning of other tools. Fourthly comes produce of the soil. A little grain, a little fruit, many potatoes, together with much of man's simplest luxury, tobacco. Fifthly is lumber, mostly in the form of wood pulp for paper making.

The five primary products of New England thus might be classified as modern man's four chief necessities, clothes, tools, food and the raw material of intercommunication between man and man.

Numerous Small Industries

New England has a host of smaller products which are important in the aggregate. Marble and building stone come from the quarries of Vermont. From the Atlantic coast the inland gets the fish trawled for on the Grand Banks. Technical and educational books are another important product, even education itself, if you can call education a product of industry. Jewelry, watches, toys and an everlasting list of lesser things make up the vast total of civilization's complex necessities.

This is why New England is the main department store of the world.

Prosperity Grows Steadily

It is agreed that never has New England seen such prosperity as in the past twelve months. Naturally, a place that supplies so large a proportion of the world's necessaries must perforce be prosperous when the world's demand is large, but to turn that obvious prosperity into dollars and cents is not easy.

In 1910 the national census gave some idea as to the relative positions occupied by the different sources of New England wealth. It showed that the textile industry was about twice as productive as the leather trade, that machines and metallic products about tied with boots and shoes; that farming was the third most important activity of the six States. Putting figures of merit against the different sources of new England wealth the census showed somewhat as follows:

Textiles	6.25
Boots and shoes	2.93
Metal products—machines and tools	2.85
Farming	1.41
Lumber (mostly wood pulp)	0.83

Now the figures from which these deductions were made are not collected every year. Actually it is for farming alone that definite government returns are made. It might be thought that in six years there would not have been much development in the oldest art of civilization, yet comparisons show that the value of farm products in New England for 1915 is more than one and a half times as much as it was in 1910. To be exact, in the proportion of 2.17 to 1.41.

This is because both output and price show a rise, the New England farmers are getting more from the land and are obtaining a higher price in the market.

Factories Never Stop

In textile work and in the leather trades we see in 1915 a condition never before equalled. Instead of working on a normal ten-hour-a-day schedule, a majority of the plants have been in practically continuous operation. Doubled and more than doubled outputs are to be found everywhere. There has been no stocktaking; there has been no time for it, but to estimate that the earning power of the industries is double what it was in 1910 is conservative.

Vast Rise in Metal Products

What then of the metal trades? The imagination is almost staggered by the vastness of the increase. Not a plant but is running day and night and Sundays; not a plant but has increased its hourly output; not a plant but is employing more men over and above those needed for the extra shifts. In Rhode Island alone it is agreed by the authorities that $120,000,000 is altogether too small a sum properly to represent the *increase* in the earnings of capital and labor. Massachusetts reckons about an equal sum and Connecticut a larger amount. Say these three States have, by their manufactures alone, earned $400,000,000 more in 1915 than is their normal, and one is still well on the safe side.

The accurate statistics of agriculture in the six States of New England show increased earnings totalling $53,000,000. Lumber has gained a little, while the factories of Maine, Vermont and New Hampshire, smaller in importance though they be, have none the less been swamped with business.

More Than $500,000,000

Five hundred million dollars is altogether too small a sum properly to represent the *extra* money New England has earned from the rest of the world in 1915.

Of course the population of the six States has increased also. Taking the normal rate of increase and adding a little to allow for the influx of workers in the past twelve months, we arrive at a figure of about 7,000,000 men, women and children. The normal per capita wealth of the inhabitants of the United States was just over $1,300 in 1914. Ten years before it was about $1,200, so the normal rate of increase is not more than $10 per annum. Spreading the extra $500,000,000 New England earned last year over her 7,000,000 population and we get a per capita increase of over $70; seven times the normal increase for a year. Furthermore, it may be remembered that this increase is not properly spread over a whole year. Many of the New England factories were rushed with work a year ago, but not all of them by any means, and there was a noticeable increase in the pressure during the summer, so it is fair to estimate that New England has, during 1915, raised her per capita wealth 750 per cent of the normal yearly rise.

High Per Capita Wealth

Take it another way and, regarding the per capita increase as a percentage of the normal per-capita wealth, we see that there has been a very large rise. Of course the New Englander is better off always than the average for the whole country, so let us assume that the per capita wealth of New England was $1,500 in 1914. Add $75 to $1,500 and we get a 5 per cent increase in capital value of each inhabitant, a pretty substantial rise for twelve months.

Prosperity Not Due to War

Ask almost any man, and he will answer that the prosperity of New England is undoubtedly enormous, and, he will add, due to war orders. This popular view is not wholly correct, for although New England is making munitions and supplies of one sort and another for troops; these war orders have not made the immense difference in the state of New England's business which actually exists.

Europe Ceases Exportation

The true way to regard the prosperity of New England's factories is to recall the fact that *Europe has ceased to export.* Thus we find many markets formerly supplied from England, from France or from Germany turning to America for their supplies. It is a very striking fact indeed that so many of the New England factories report the possession of good contracts with various of the South American republics. In a great number of instances the manufacturers report that they have secured very desirable customers in this way, that the present orders from this source are keeping them very busy and that the quality of the goods is being appreciated so greatly that the foreigners will have a very hard struggle to get back in the market again in the future.

America Takes Bulk of Output

Then, too, the demand upon America to generally look after and care for the world while the rest of it fights has brought prosperity to the whole of the United States, so that the domestic trade of New England is booming. In the automobile industry the demand for tools and plant equipment has been unprecedented; building, which has shown immense activity the past few months, demands all sorts of the smaller New England metallic products, and so the argument can be extended. Take away from New England all her munition orders, all her orders for clothes and boots for the armies, and she would still be very busy indeed.

What does this prosperity mean to the automobile trade? It means that the buying capacity of New England is far greater than ever before. Here is 96,000 square miles of territory with 7,000,000 inhabitants and $500,000,000 *extra* to spend or to invest: $500,000,000 unexpected money which will be expended somewhere.

Could Buy a Third of Automobile Output

It is estimated that the value of the automobiles to be made in America this year will be $1,300,000,000, so New England could, if she wished, buy about 38 per cent of the whole with the money already earned to say nothing of the money now being earned at an even faster rate than prevailed throughout 1915. To estimate how much New England actually will spend upon cars is impossible, but if she puts aside 20 per cent, $100,000,000, for this purpose it will take the automobile manufacturers all their time to fill even a part of the demand.

STRATHMORE

AUTOMOBILES

MOTOR VEHICLES MOTOR VEHICLE SUPPLIES

We have as good a motor carriage as is made in the world; strong, well built, easy running, handsome, economical. Orders should be placed at once for prompt delivery.
Catalogue on application.

Strathmore Automobile Company
Albion Bldg., 1 Beacon St.,
BOSTON, MASS., U. S. A.

A limited amount of the Treasury Stock is for sale on terms which may be obtained by addressing as above . . . .

A long ago idea of what the automobile should be.—An advertisement in "The Motor Vehicle Review" of 1899.

New England Registrations Total 185,363 Cars and Trucks

39,331 More in Use in That Territory Than at the Close of 1914—38 People Per Car—20,804 Commercial Vehicles—2812 Dealers, Garages, Etc.

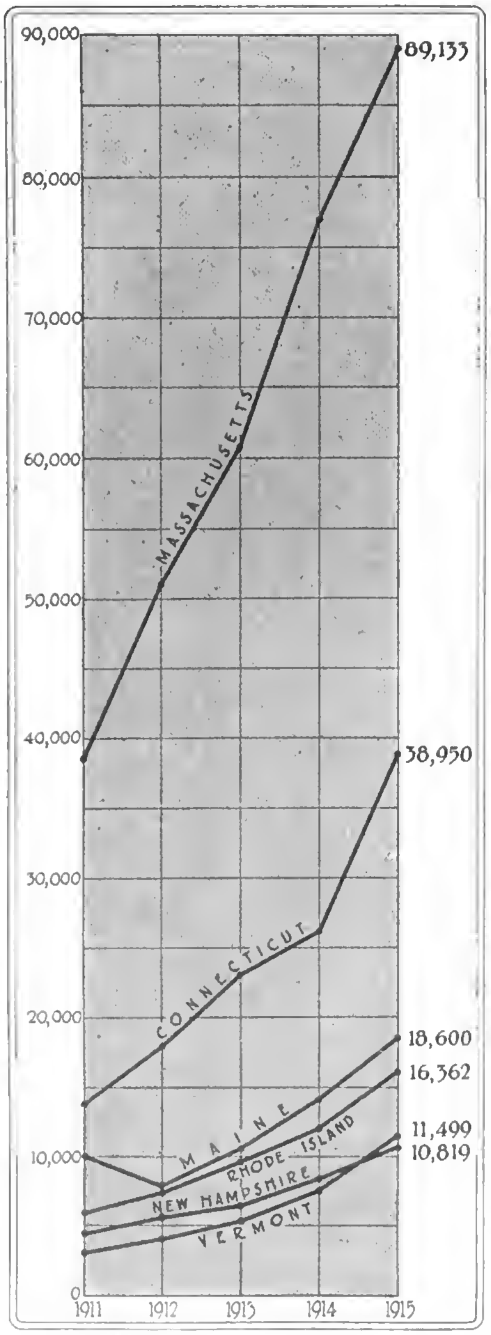
By Donald McLeod Lay

REGISTRATION statistics for the calendar year 1915 indicate that the six New England States, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut, are all still far from the saturation point as regards their capacity to purchase automobiles and motor trucks. The average population-to-car ratio for this group of States is 38 to 1, or slightly higher than the average ratio for the entire country, which is 42 to 1. Of all the States, Iowa holds premier position in population-to-car ratio with a 16 to 1 proportion. The highest New England ratio is 32 to 1, Connecticut and Vermont both attaining this relation and Rhode Island having 37 to 1. Maine, Massachusetts and New Hampshire each have 41 to 1.

A Big Field

It is readily seen that Iowa's ratio is the logical mark at which New England should aim, although her rich agricultural acres enhance the car-buying capacity of this State to a degree that New England, with its large areas of untillable mountain country and unproductive lakes, perhaps can never attain. A comparison of what Iowa and the New England group have accomplished, however, brings out very strongly the latent possibilities in New England as a field for the automobile and motor truck manufacturer and dealer.

If New England, with a population of 7,108,003 on Jan. 1, 1916, had one motor vehicle for every sixteen persons, as is the case in Iowa, she would have a total of 444,250 cars and trucks. In other words, with her total registration of 185,363 at the end of 1915, she has yet to buy 258,887 machines to be on a par with Iowa in respect to population-to-car ratio. Of the total of 185,363 registrations at the end of 1915, there were 20,804 motor trucks of various sizes and types.



Registration in New England since 1911

But, although yet far from the population-to-car ratio of a number of other States, the New England group made very substantial gains in registration during 1915, the number of cars and trucks added to their records during the year being 39,331, or a gain of 26.9 per cent. As compared with the first reliable statistics available, the registration reports for 1911, the latest figures show a gain of 108,875 cars and trucks during the five years, or 142 per cent, since the 1911 total was only 76,488.

Massachusetts, which holds eleventh place in the list of forty-eight States and the District of Columbia, leads the rest of the New England group in total registrations, with 89,133, a gain of 12,301 vehicles, or 16 per cent over 1914.

Connecticut's Increase Large

The remaining five States are much smaller in registration, Connecticut, with 38,950 vehicles, adding 12,732, or more than Massachusetts gained during the year, being 49 per cent over Connecticut's 1914 total.

Maine ranks third with 18,600, a gain of 4300 machines, or 30 per cent.

Rhode Island is fourth with a total of 16,362, an increase of 4031, or 33 per cent over 1914.

Vermont is fifth with 11,499 cars and trucks, a gain of 3886, or 51 per cent, the highest percentage gain of the New England States.

Last, but not far behind, comes New Hampshire with its total of 10,819, representing 2081, or 24 per cent, more cars and trucks than in 1914.

Studying the registration statistics, we find a steady, consistent growth recorded from year to year in the New England States, the total for 1912 being 94,434 cars and trucks in use there as contrasted with the 76,488 reported at the end of 1911. The following year 22,969 more people bought cars or trucks, pushing the registration total up to 117,403, and in 1914 this increased to 146,032, in 1915 reaching an aggregate of 185,363. It will be seen from a comparison of the yearly increases in the number of registrations that these grew larger almost in direct proportion year by year, and it is also evident that the increases of the individual States have been usually in proportion to the total registration in each.

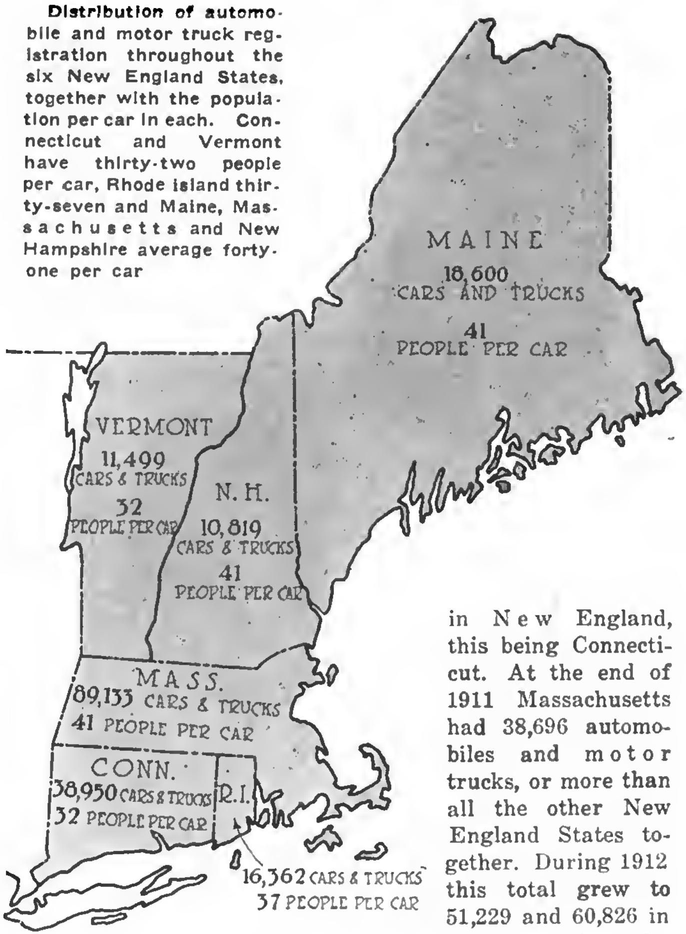
30 Manufacturers

Industrial statistics show that there are thirty manufacturing establishments in three of the New England States, Massachusetts, Connecticut and Rhode Island, which are producing automobiles, commercial vehicles and motors. There are twelve car makers, fifteen truck builders and five motor manufacturers, several of these being included under more than one heading, which explains the apparent discrepancy in the total.

2812 Dealers, Garages, Etc.

Similarly, there are 2812 automobile establishments in New England besides the manufacturing plants mentioned. Of these, dealers are represented to the extent of 1349, garages constitute 1580, repair shops 658, supply dealers 122 and charging stations 133. The same explanation as that given in the preceding paragraph serves to reconcile these figures with the total.

There are nearly 10,000 commercial motor vehicles in the Bay State, which has over twice as many as its nearest rival in New England, this being Connecticut. At the end of 1911 Massachusetts had 38,696 automobiles and motor trucks, or more than all the other New England States together. During 1912 this total grew to 51,229 and 60,826 in 1913, passing the 75,000 mark in 1914, the commonwealth having registered 76,832 motor vehicles. In the five years from 1911 to 1915, when 89,133 represented the total number of cars and trucks in the Bay State, 50,437 machines were added to its records. Illustrating the growing recognition of Massachusetts as a tourists' paradise, there were 13,500 non-resident car owners registered in the State in 1915 as compared with 7150 in 1914, only 920 in 1913 and 858 in 1912. Fees of various kinds paid by automobile and motor truck owners, dealers, chauffeurs, etc., passed the $1,000,000 mark last year, attaining a total of $1,205,420.19, as compared with $925,964.75 in 1914, a gain of $279,455.44.



Distribution of automobile and motor truck registration throughout the six New England States, together with the population per car in each. Connecticut and Vermont have thirty-two people per car, Rhode Island thirty-seven and Maine, Massachusetts and New Hampshire average forty-one per car

CAR AND TRUCK REGISTRATIONS IN THE NEW ENGLAND STATES SINCE 1911 WITH DUPLICATES ELIMINATED

State	1911	1912	1913	1914	1915	Gain in Five-Yr. Period
Connecticut	13,994	17,950	23,263	26,218	38,950	24,956
Maine	10,045	7,743	10,570	14,300	18,600	8,555
Massachusetts	38,696	51,229	60,826	76,832	89,133	50,437
New Hampshire	4,489	5,764	7,420	8,738	10,819	6,330
Rhode Island	6,017	7,565	9,894	12,331	16,362	10,345
Vermont	3,247	4,183	5,430	7,613	11,499	8,252
Total	76,488	94,434	117,403	146,032	185,363	108,875

1914 AND 1915 CAR AND TRUCK REGISTRATION IN NEW ENGLAND WITH INCREASES

State	1915 Reg.	1914 Reg.	Car Increase	Per Cent. Increase
Connecticut	38,950	26,218	12,732	49
Maine	18,600	14,300	4,300	30
Massachusetts	89,133	76,832	12,301	16
New Hampshire	10,819	8,738	2,081	24
Rhode Island	16,362	12,331	4,031	33
Vermont	11,499	7,613	3,886	51
Total	185,363	146,032	39,331	—
Average per cent. increase				26.9

POPULATION PER CAR IN THE NEW ENGLAND STATES

State	Cars Registered	Population Jan. 1,1916	Pop. Per Car
Connecticut	38,950	1,234,031	32
Maine	18,600	770,064	41
Massachusetts	89,133	3,690,748	41
New Hampshire	10,819	441,545	41
Rhode Island	16,362	608,540	37
Vermont	11,499	363,075	32
Total	185,363	7,108,003	—
Average population per car			38.3

CAR, TRUCK AND MOTOR MANUFACTURERS IN NEW ENGLAND

State	Car Makers	Truck Builders	Motor Mfrs.	Total
Connecticut	5	4	2	9
Massachusetts	7	10	2	19
Rhode Island	..	1	1	2
Total	12	15	5	30

NUMBER OF DEALERS, GARAGES, REPAIR SHOPS, SUPPLY DEALERS AND CHARGING STATIONS IN NEW ENGLAND

State	Dealers	Garages	Repair Shops	Supply Dealers	Charging Stations	Total
Connecticut	287	220	120	33	22	527
Maine	115	217	62	5	14	354
Massachusetts	582	724	276	66	74	1,258
New Hampshire	159	184	76	3	11	267
Rhode Island	85	110	70	11	9	209
Vermont	121	125	54	4	3	197
Total	1,349	1,580	658	122	133	2,812

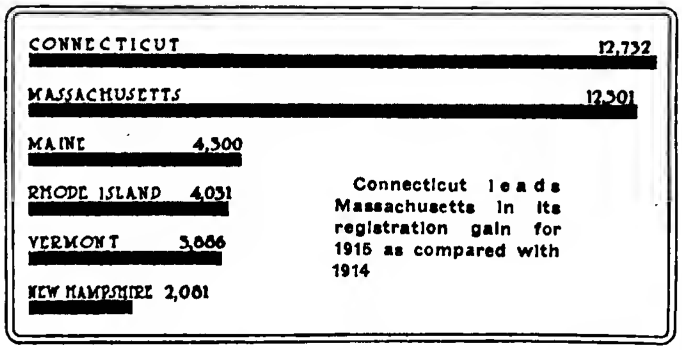
Massachusetts Still Leads

Accepting the latest census bureau estimate of 3,690,748 as the population of Massachusetts at the beginning of 1916, the Bay State has forty-one persons for each car and truck registered, allowing for all duplication.

Of great importance in the pioneer days of the automobile industry as the home of many manufacturing activities, Massachusetts is still a factor, having seven automobile establishments, ten motor truck plants and two motor manufacturers, according to *The Automobile Trade Directory.* In addition, a considerable percentage of the leading accessory manufacturers are located in this State.

Massachusetts has 1258 dealers, garages, repair shops, supply dealers and charging stations, there being 582 dealers' establishments, over twice as many as in Connecticut, which is in turn far ahead of the other New England States. The Bay State's total of 724 garages is nearly as many as all the others combined, while its 267 repair shops, sixty-six supply dealers and seventy-four charging stations are in each instance more than twice as many as any of the other States in the group can boast.

Connecticut registered 38,950 cars and trucks in 1915, or



Connecticut leads Massachusetts in its registration gain for 1915 as compared with 1914

over 20,000 more than any State in this territory with the exception of Massachusetts.

The Nutmeg State's increase in registration during 1915 was 12,732 cars and trucks, or 49 per cent, being 431 more than that of Massachusetts during the same period. In 1911 there were only 13,994 motor vehicles in Connecticut, this number increasing to 17,950 the following year and to 23,263 in 1913. At the end of 1914 the records showed 26,218 machines in use, the increase in registration for 1915 being 508 more than the gains made during the preceding three years combined. As compared with 1911, the 1915 statistics show an increase of 24,956 cars and trucks.

In respect to the number of trucks registered Connecticut is far ahead of all the other New England States except Massachusetts, having nearly 5000 in use.

Has Nine Manufacturers

Crediting Connecticut with 1,234,031 population, there are thirty-two persons to each car or truck in the State, this being the lowest number being shown by any of the New England States, an honor which is shared with Vermont. No statistics are available in regard to non-resident registrations in Connecticut.

There are five automobile manufacturers located in the Nutmeg State, which also has four motor truck builders and two motor manufacturers, although the total for the State is only nine, owing to the fact that some establishments are counted under more than one heading. There are 527 establishments in Connecticut included under the classifications of dealers, garages, repair shops, supply dealers and charging stations. This total is made up of 287 dealers, 220 garages, 120 repair shops, 33 supply dealers and 22 charging stations, many of these being counted under two or more heads so that they apparently do not agree with the total.

Connecticut's fees increased $136,619.85 in 1915, the amount received being $544,625.81, as compared with $408,005.96 in 1914.

Maine in Third Place

Maine's increase of 4300 cars and trucks in 1915 was 269 greater than the gain of 4031 made by Rhode Island. Thus Maine shows a 30 per cent increase in registration as compared with the 1914 total of 14,300, while on its estimated population of 770,064 for Jan. 1, 1916, it has a population-to-car ratio of 41. Of the total registration approximately 1000 are commercial vehicles. Maine's fees for 1915 were $13,865.12 less than those of New Hampshire, amounting to $268,412 as compared with $282,277.12. Yet the gain over the 1914 receipts of Maine's registration office was $112,726, or over 72 per cent.

In 1911 Maine's total registration was 10,045. In 1912 a new law went into effect shortly before the automobile census was made so that there were only a part of the cars in the

1915 Massachusetts Registrations Analyzed by Makes

Ford	25,961
Buick	7,919
Cadillac	5,812
Overland	5,122
Studebaker	3,570
Maxwell	3,386
Hudson	3,119
Packard	3,102
Chalmers	2,495
Metz	2,031
Reo	2,005
Pierce-Arrow	1,794
Stevens	1,596
Oakland	1,209
Jeffery	1,180
White	1,129
Hupp	1,074
Pope	1,061
Stanley	1,009
Peerless	962
Dodge	942
Chevrolet	914
Franklin	862
Autocar	754
E. M. F.	723
Jackson	708
Oldsmobile	700
Regal	695
Winton	683
Knox	653
Mitchell	615
Paige	603
Stearns	584
Dayton	565
Locomobile	546
Velie	491
Saxon	447
Cole	425
International	392
Chandler	378
Premier	345
Kissel	338
National	280
Lozier	276
Marmon	273
G. V.	249
Lenox	248
Haynes	242
R. C. H.	234
Locomobile	219
Mercer	217
Stutz	214
Thomas	213
Elmore	208
Inter-State	194
Selden	194
Columbia	193
American	190
Anderson	182
Fiat	182
King	176
Krit	174
Abbott	171
Chase	169
Kelly	168
G. M. C.	168
Simplex	162
Federal	154
Stewart	141
Warren	132
Baker	123
Garford	123
Little	122
Pullman	117
Speedwell	113
Marion	111
Bailey	109
Imperial	108
Atlas	104
Case	104
Scripps-Booth	98
Renault	97
Moon	96
Apperson	94
Michigan	92
Everitt	92
Trumbull	92
Grout	85
Mack	84
Cartercar	83
Ideal	83
Brush	81
Touraine	81
Waverley	79
R. & L.	77
Crawford	75
Grant	75
Palmer-Singer	72
Sampson	66
Westcott	65
Universal	64
Elec. Veh.	63
Henderson	62
Marathon	61
Berkshire	59
Empire	59
Atterbury	58
Briscoe	58
Lauth-Juergens	55
Corhin	54
Mathewson	54
Royal	53
Auburn	49
Briggs	47
Koehler	47
Herresboff	46
Lexington	46
Marquette	44
Babcock	43
Paterson	43
Bergdoll	42
Ohio	41
S. G. V.	41
Ward	41
Daimler	41
Buckeye	39
Motorcar	39
U. S.	39
Republic	38
Napier	36
Welch	35
Flanders	34
Nyberg	34
Walker	34
Adams	33
Johnson	33
Clark-Carter	32
Cameron	31
Sears	31
Mais	30
McFarlan	30
Allen	29
Eldridge	29
Gramm	29
Penn	29
De Tamble	28
Courier	27
L. P. C.	27
McIntyre	27
Schacht	27
Dart	26
Parry	26
Standard	26
Little Giant	24
Columbus	24
Lancia	24
Lyons	23
Palmer-Moore	23
Acme	22
Voiturette	22
De Dion	22
Westfield	22
Dort	21
Mora	21
Moyer	21
Rapid	21
Fuller	20
Morgan	20
Detroit	19
Commerce	18
Decatur	18
Easton	18
Hotchkiss	18
Amer. Cyclecar	17
Elkbart	17
Lion	17
Pilot	17
Benz	16
Crow	16
Pickard	16
Reliance	16
Commercial	15
Cunningham	15
Cutting	15
Mercury	15
New Eng. Truck	15
Rainier	15
Vulcan	15
Gear	14
Grand Rapids	14
Henry	14
United	14
Victor	14
Alma	13
Herff-Brooks	13
Mercedes	13
Monroe	13
Brown	12
Chadwick	12
Knight	12
Postal Trans. Serv.	12
Royce	12
Teele	12
Flint	11
Kline	11
Maccar	11
Northern	11
Panhard	11
Rochet-Schneider	11
Waltham	11
Wayne	11
Darracq	10
Delauney	10
Havers	10
Lambert	10
Lansden	10
New Departure	10
Norwalk	10
Partin	10
Austin	9
Consolidated	9
Gesellschaft	9
Harrison	9
Isotta	9
Owen	9
Pathfinder	9
Pittsburgh	9
Sanford	9
Staver	9
Words	9
Krebs	8
Milburn	8
Signal	8
Sternberg	8
Tait Bros.	8
Bessemer	7
Buffum	7
Carhartt	7
Grabowsky	7
Lear	7
Saurer	7
Steele	7
Walter	7
Bay State	6
Buffalo	6
C. G. V.	6
Couple Gear	6
Croxton	6
Davis	6
De Luxe	6
Driggs-Seabury	6
Harwood	6
Hercules	6
Imp	6
Keystone	6
Middleby	6
Morse	6
Otto	6
Service	6
St. Louis	6
Whiting	6
York	6
Bayard	5
Blomstrom	5
Brightwood	5
Colum. Buggy	5
Dragon	5
Frayer	5
Howard	5
Midland	5
Sullivan	5
Sultan	5
Vanderwater	5
Miscellaneous	
29 mfrs. each 4	116
31 mfrs. each 3	93
70 mfrs. each 2	140
272 mfrs. each 1	272
Total	101,500*

*Does not tally with other statistics, as it includes non-resident and re-registrations.

NON-RESIDENT REGISTRATION IN NEW ENGLAND STATES SINCE 1912

State	1912*	1913	1914	1915
Connecticut	**	**	**	**
Maine	400	**	700	2,000
Massachusetts	858	920	7,150	13,500
New Hampshire	750	16	1,160	1,466
Rhode Island	1,000	288	**	**
Vermont	100	448	643	**
Total	3,108	1,672	9,653	16,966

*Includes re-registration. These are not included in other years.
**No record.

State on record. The 10,570 machines reported for 1913 seem to credit the State with only a small gain but it must be remembered that the 1911 figures include numerous duplicate registrations, no record of these being available at that time. In 1914 Maine's total had reached 14,300 and by the end of 1915 it was 18,600, a gain of 8555 in five years.

Maine has no manufacturers of automobiles, motor trucks, or motors, but it boasts of 354 dealers, garages, repair shops, supply dealers and charging stations. There are 115 dealers, only a few less than Vermont and a few more than Rhode Island, but the 217 garages rank Maine close behind Connecticut. There are sixty-two repair shops, five supply dealers and fourteen charging stations.

Rhode Island Ranks Fourth

On a population basis of 608,540 Rhode Island, the smallest State in the country, has thirty-seven persons to each motor vehicle. Of the total registration, over 1500 are motor trucks while the fees received by the registration department last year were $208,498, an increase of $51,478 over the $157,020 taken in during 1914.

The number of motor vehicles in Rhode Island has increased almost proportionately each year, varying from 6017 in 1911 and 7565 the following year to 9894 in 1913, growing to 12,331 in 1914 and again to 16,362 last year, the total increase for the five years being 10,345 cars and trucks, or nearly 200 per cent as compared with the 1911 registration total.

Although there are no automobile manufacturers in Rhode Island, this State is the home of one motor truck maker and one motor-manufacturing concern. There are only 209 dealers, garages and similar establishments, this total being smaller than that of any of the other New England States except Vermont which has 197. In so small a territory naturally comparatively few dealers are required, there being eighty-five in the State. Garages number 110, there are seventy repair shops, eleven supply dealers and nine charging stations.

Vermont Stands Fifth

Although New Hampshire had 1242 more cars registered in 1911 than Vermont, in 1915 the latter State managed to forge to the front, its total of 11,499 cars and trucks being 680 in excess of the 10,819 which New Hampshire was able to muster. Vermont's increase over its 1914 total of 7613 was 3886, or 51 per cent, and on a population basis of 363,075 its population-to-car ratio was 32, this State sharing with Connecticut the place of honor in this respect among the New England group. Vermont's increase in motor vehicle registration during the five years from 1911 to 1915 was 8252, or over 200 per cent.

Few Trucks in Vermont

Only about 350 motor trucks are in use in Vermont and the receipts of the State motor vehicle registration department during 1915 amounted to $218,479.85, an increase of $64,212.94 as compared with $154,266.91 collected in the preceding year.

Like that of the other States, Vermont's annual gain in registrations has been fairly constant, the number of cars and trucks recorded each year varying from 3247 in 1911 and 4183 a year later, 5430 in 1913 and 7613 in 1914, to 11,499 last year.

There are no car, truck or motor manufacturing establishments in Vermont but there are 197 dealers, garages, etc., many of whom necessarily are counted more than once since they operate establishments requiring classification under more than one heading. Thus there are 121 dealers, 125 garages, fifty-four repair shops, four supply dealers and three charging stations.

New Hampshire in Sixth Position

Although ranking below Vermont on the basis of car and truck registrations in 1915, New Hampshire is only 680 behind, having 10,819 motor vehicles as compared with 8738 at the close of 1914, a gain of 2081 machines, or 24 per cent. Like Maine and Massachusetts, New Hampshire has forty-one persons for each car and truck registered, its population on Jan. 1, 1916, being estimated at 441,545. There are nearly 1000 commercial vehicles included among the registrations and fees for 1915, covering passenger cars, trucks, dealers, chauffeurs, etc., amounted to $282,277.12, or $82,274.62 over the 1914 total of $200,002.50.

In 1911 New Hampshire had 4489 motor vehicles, increasing to 5764 in 1912, and during the following year to 7420, the 1914 registration amounting to 8738 and the 1915 total to 10,819. Thus the increase for the five years since 1911 was 6330 cars and trucks, or over 100 per cent.

Dealers, garages, repair shops, etc., in New Hampshire number 267, there being 159 dealers, 184 garages, seventy-six repair shops, three supply dealers and eleven charging stations. It will be noted that all of these figures with the exception of the number of supply dealers are considerably in excess of those for Vermont, which has 680 more cars registered than New Hampshire.

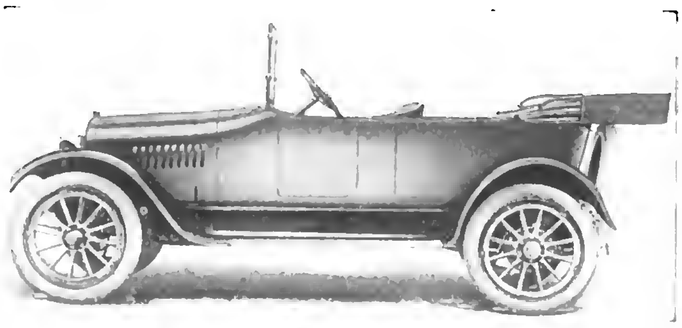
Dixie Flyer Is New Car

THE Louisville Automobile Show marked the first public appearance of the Dixie Flyer, made by the Dixie Motor Car Co. of this city. The new car is to sell for $775.

The Dixie Flyer has a four-cylinder unit power plant with floating rear axle and 112-in. wheelbase, using the Dyneto electric system. The body is a yacht type finished in bottle green, the high crowned fenders and radiators are black enameled and wheels are finished in a light natural wood stain.

The instrument board is covered with buffed leather and outlined with raised aluminum binding, the interior of the doors are covered with the same heavy grade of upholstering material as the cushions, and the floors and toe board are covered with deep piled carpet of a tan-olive shade blending into the general color scheme. It is close fitting and neatly and durably bound around the pedal and lever openings.

The Dixie Flyer is furnished with complete equipment, including one-man top, quick detachable side curtains, etc., and a full complement of tools.



Four-cylinder Dixie Flyer listing at $775

Lest We Forget

New England's Pioneers Did Much to Put the Industry Where It Is Today—Home of Mechanics Who Were Fascinated by Problems of Road Locomotion

IT is but natural that New England, the home of the best mechanics in the world, should have had its share in the development of the automobile industry. New England's entire atmosphere breeds accurate workmanship and mechanical virility which has been an influential factor in the development of more than one of the country's leading manufacturing arts.

The fascinating problems of motion, particularly as applied to self-propelled vehicles proved irresistible to New England's mechanical mind and in many a back yard, men, whose daily pursuits were in other fields, labored after hours and late into the night on vehicles which have left their stamp on the industry as it is to-day. Even at the time of the Civil War the experiments of Roper in and around Boston attracted attention and the story of Roper is the story of many others who helped to solve the big initial problems of the horseless carriage.

Here in the atmosphere of the forge and machine shop where the raw materials of the world are turned into finished products, the mechanical skill of men accustomed to the loom and machines of precision and complicated motion soon began to clear a way through the jungle of difficulties in the way of road locomotion. It was but natural then that steam, the best known motive power, should be first employed and the necessity for a light-weight steam vehicle soon brought to light developments which are important factors in steam plants to-day. For example James H. Bullard, Springfield, Mass., built in 1885 a cylindrical boiler with horizontal fire tubes.

Early Steam Vehicles

Fairly successful steam cars were constructed in New England as far back as 1893, when C. L. Simmonds, Lynn, Mass., had one operating in the streets, and in the years previous to 1898 the steam car of George E. Whitney, the forerunner of the Stanley, was a common sight in Charles River Park, Boston. Then later, when the internal combustion engine was developed to a higher point, men like C. E. Duryea, H. P. Maxim, H. W. Alden and others were not lacking to take up this phase and bring it rapidly to the front.

Automobile activity has shifted to the Middle West with Michigan and Indiana as our leading manufacturing States, and the part that New England played in the development of the motor car is apt to be forgotten. Memory should be refreshed of the giant's part borne by the country of the Pilgrims and the Puritans in building an industry which typifies modern science, because that part is immensely important in that many of the leaders of the industry to-day found their automobile engineering birthplace in New England.

The Electric Vehicle, Pope, Knox, Columbia, Duryea, and Locomobile companies have been the schools in which many of the automobile engineers of world-wide renown to-day received the experience and training which has made them preeminent. Some are still in New England, others have followed the trend toward the Middle West and are now established closer to the heart of the industry to-day, and yet there was a time when the little group of manufacturers in the six New England States included in their ranks a large percentage of the automobile engineers of this country.

Turn back to 1906: Ten years ago, the membership list of the Society of Automobile Engineers included eight New England engineers. These were H. W. Alden, Harry A. Knox, Hiram P. Maxim, W. J. P. Moore, B. Morgan, A. L. Riker, Henry Souther and A. C. Schultz. These pioneers, most of whom have made automobile history both in New England and in other parts of the country, are representative of the spirit of New England, a decade and more ago.

To-day the New England membership of the S. A. E. is 140, and since the society is growing steadily there is no doubt that this will increase annually, but now that the pioneers have cleared the way and put this giant industry in the position it occupies to-day, it is well that in giving honor to New England for the part it rendered in the early days, that credit also should be extended when the automobile had to combat the popular prejudice of the day, not to mention adverse legislature and adverse traction interests.

Beginnings of the Nineties

But far back of the first days of the history of the S. A. E. some of the pioneers mentioned were at work. H. W. Alden and Hiram Percy Maxim were associated in the American Projectile Co., and in the fall of 1894, when Mr. Maxim started experimenting in Lynn, Mass., with his three-cylinder tricycle, Mr. Alden was associated with him, making most of the drawings for the odd vehicle at night. This tricycle was run over the roads of Lynn and vicinity in 1895. Mr. Alden migrated soon afterward to the Pope Mfg. Co., Hartford, following Mr. Maxim, these two being associated with Hayden Eames in the opening of an experimental motor car department under the direction of the Pope Mfg. Co.

Mr. Alden went with the Electric Vehicle Co., Hartford, in 1902 and remained until 1905. This concern was another great developer of automobile engineers, having been the school in which more than one now well-known engineer received his early training in the automobile business. Mr. Alden remained with the Electric Vehicle Co. until June, 1905, and then returned to the Pope Mfg. Co., where he developed the commercial car department, building several trucks with two-cylinder, horizontal, opposed motors. In April, 1906, Mr. Alden left New England, the scene of his early endeavors, and went with the Timken company Detroit, where he has been ever since.

An 1896 Four-Cylinder

A story of New England automobile engineers cannot be told without mentioning Harry A. Knox, who in 1896, while attending the Springfield Industrial Institute, designed and built a four-cylinder-opposed, four-cycle, horizontal engine, and later in connection with A. H. Overman, president of the Overman Bicycle Co., Chicopee Falls, Mass., made arrangements to develop an automobile with this motor. The activities of Mr. Knox also extended to the Duryea Co., Springfield, Mass., as while working at the Springfield Industrial Institute he had been employed on the first ten Duryea cars that were ever built for sale. He remained with the Overman Bicycle Co. until 1908, during which time several vehicles were built. The last car build at the Overman works was the foundation of the afterward famous Knox car. This was a four-wheel runabout weighing about 1000 lb. and having a 90-in. wheelbase. E. A. Cutler, Springfield, Mass., became interested in the car and associated himself with Mr. Knox in 1898, forming the Knox Auto Co.

In 1899, in his engineering capacity for the Knox company, Mr. Knox built about twelve or fifteen cars, and 1900 over 100 of the three-wheel Knox runabouts were sold. Chas. Y. Knight, inventor of the Knight engine, earned the right to be mentioned in a New England engineering story by buying one of the first of these cars. Mr. Knox sold out his interest and resigned as vice-president and general manager of the Knox Automobile Co. in 1904, forming the Knox Motor Truck Co. of Springfield, Mass. The previous Knox company forced him to abandon the name Knox in connection with his manuracturing activities and the company was renamed the Atlas Motor Car Co. with Mr. Knox president and general manager.

Knox Used Worm Drive

The Atlas Co. built several two-cycle, two-cylinder runabouts in 1908 and in 1910 and 1911 a considerable number of two-cylinder two-cycle taxicabs. In 1912 Mr. Knox designed and built a large touring car with worm drive equipped with the Atlas-Knight engine, and in this year plans were made to build a quantity of these cars, but owing to inability to obtain engines the scheme fell through.

The business of the Atlas Motor Car Co. was closed in the Spring of 1913, and at that time Mr. Knox joined the ranks of those who had migrated from New England and located with the Lyons Atlas Co., Indianapolis, Ind.

Hiram Percy Maxim, inventor of the Maxim silencer and president of the company which manufactures this device, is one of the early New England automobile engineers. As has been indicated, Mr. Maxim and Mr. Alden were connected in the development of the three-cylinder tricycle in 1894 and 1895 and under Hayden Eames of the Pope Mfg. Co. this was actively manufactured in Hartford. Col. George Pope, chairman of the New York Show Committee for many years, took his first ride in a Columbia automobile with Mr. Maxim in October, 1895, and in 1896 Mr. Maxim was interested in the building of Columbia electric cars, which were sold abroad and in this country for $3,000 each. In 1898 and 1899 a single-cylinder four-cycle engine was developed by Mr. Maxim for the Columbia Co., and this machine proved to be very successful, making good records in many of the endurance runs such as the Automobile Club of America run from New York to Buffalo, 1903. This machine was the well-known Columbia Mark VIII. In 1903 some of the two-cylinder Columbias were developed. Mr. Maxim still remains a New England engineer, although his activities are now in connection with the silencer and not with the motor vehicle.

Tried Electric Tricycle

Another engineer whose early associations were in and around New York and then in New England and who has remained in that part of the country is A. L. Riker, now a member of the Naval Consulting Board under Secretary Daniels, and chief engineer and vice-president Locomobile Company. Mr. Riker's connection with the automobile industry began with his application of a storage battery to an automobile in 1890. This was a tricycle known as the Coventry rotary. He sold his first electric motor car to J. R. Whiting in 1897. Mr. Riker's activities were with the Riker Motor Vehicle Co. in Elizabethport, N. J., until 1902 when he went with the Locomobile Co., Bridgeport, Conn. His call to the Locomobile Co. in 1902 was for the purpose of developing a gasoline car. Mr. Riker was the first president of the S. A. E.

New England activities in the S. A. E. have never been more strongly represented than by Henry Souther, whose work as chairman of the Standards Committee will long be remembered. Mr. Souther earns the right to be called a New England pioneer due to his connections with the Pope Mfg. Co. in 1895 where he was associated under Hayden Eames with Messrs. Maxim and Alden. Mr. Souther was sent abroad in 1895 by the Pope company, and in 1899 left their employ and took up the work of consulting engineer, during which time he did considerable work for the Locomobile, Knox, Duryea and Columbia companies. Mr. Suther also joined the movement away from the New England States and has now taken up his work as vice-president and general manager of the Ferro Machine & Foundry Co., Cleveland Ohio.

If the development of automobile engineering in New England is to be studied, the Stanley automobile made by the Stanley brothers, F. E. and F. O., must be cited as one of the landmarks. The first Stanley automobile ever put on the road was in the Spring of 1897. The Stanley brothers are from Lewiston, Me., and it was in this town in 1887 that they received their first inspiration to build steam cars. Their experiments were continued for ten years, the first car being built, as stated, in 1897. In 1899 John Brisben Walker, a magazine publisher, entered the ranks of the New England automobile engineers by purchasing the Stanley works in 1899, but afterward sold the plant at Newton to a Mr. Barber. After this, the Stanley brothers bought back the Newton plant and in 1902 again resumed the manufacture of cars which has been continued to date.

Zenith Reached in 1909

The zenith of automobile manufacturing in New England was reached in 1909 and 1910. Big companies like Alco, Pope-Hartford, Stevens-Duryea and others were then actively making cars which possessed national reputations for excellence. In addition, large numbers of concerns building various accessories began to enter the business, and since then this field has been growing rapidly. As a consequence, from 1910 on the ranks of the New England automobile engineers have been steadily augmented, but in the infancy of the automobile business the men connected with the industry were with the automobile manufacturing concerns as indicated by the representative men mentioned together with many others such as H. Vanderbeek, H. S. Baldwin, who were on the engineering staff of the company which was named successively Pope Mfg. Co., motor carriage department, Columbia & Electric Vehicle Co., and Electric Vehicle Co.

Although in numbers the factories that produce automobiles in New England are not as great as a decade ago, it does not mean that the automobile industry has ceased to depend on that part of the country. In fact, the New England engineer is a very influential factor to-day in the automobile industry. His development of tools, machinery, fabrics and other manufactured products makes him a very necessary link in the chain which connects the finished automobile to the raw material. New England's great population of trained mechanics and engineers have every reason for appreciating the automobile, their environment, training and inborn mechanical ability demand it.

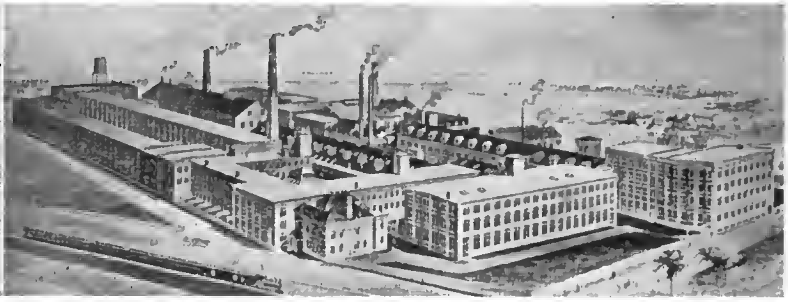
Various causes led to the movement of many of the early New England engineers to other cities, especially the abandonment of the automobile business by some of the concerns such as the American Locomotive Co., when men like B. D. Gray, who was chief engineer for that concern and who is now vice-president and manager of the Hess-Bright Mfg. Co., left for other fields.

The shifting of the industry to the westward has caused the shifting of men, but the effects of the impetus given by the New England engineers will not cease to be felt for a century.

A Few of New England's Factories

The Locomobile Co. of America, Bridgeport, Conn.

The Fafnir Bearing Co., New Britain, Conn.



The Bridgeport Brass Co., Bridgeport, Conn.

The Billings and Spencer Co., Hartford, Conn., as it is today

The Billings and Spencer Factory as it was originally

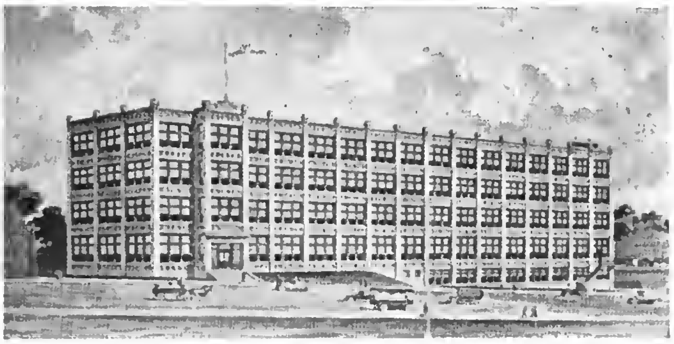
The Bosch Magneto Co., Springfield, Mass.

The Veeder Mfg. Co., Hartford, Conn.

# of Both the Past and the Present

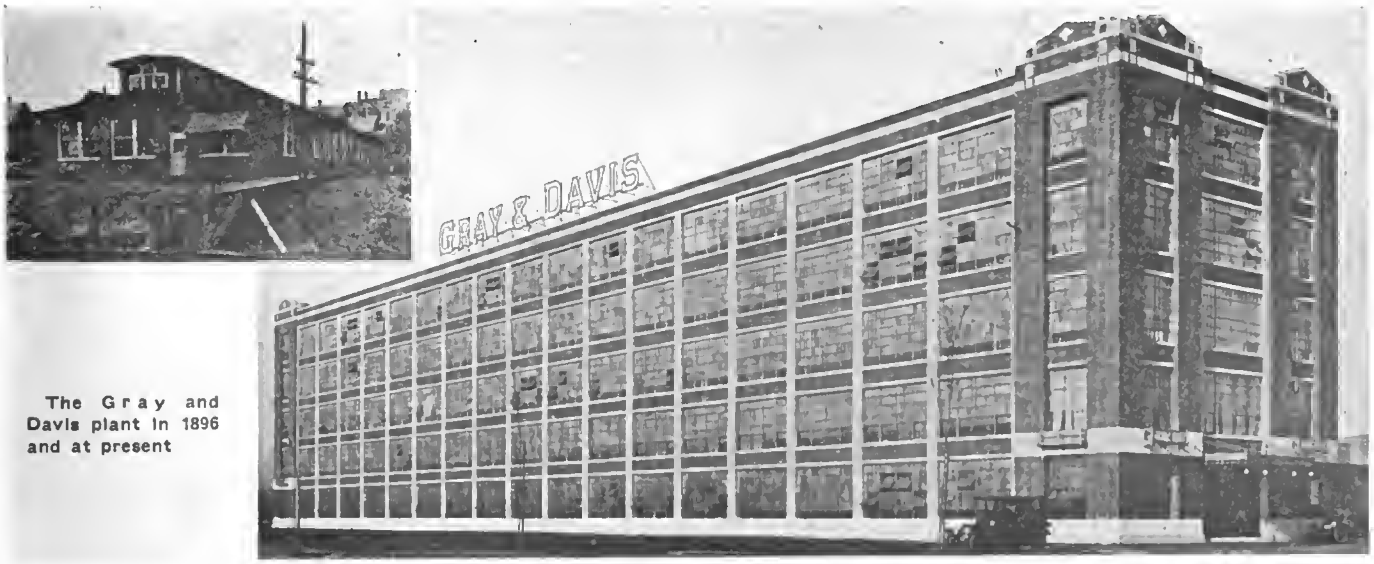
New Departure Mfg. Co., Bristol, Conn.

Left—The Waltham Watch Co., Waltham, Mass., as it is today, and, right—as it was in 1854



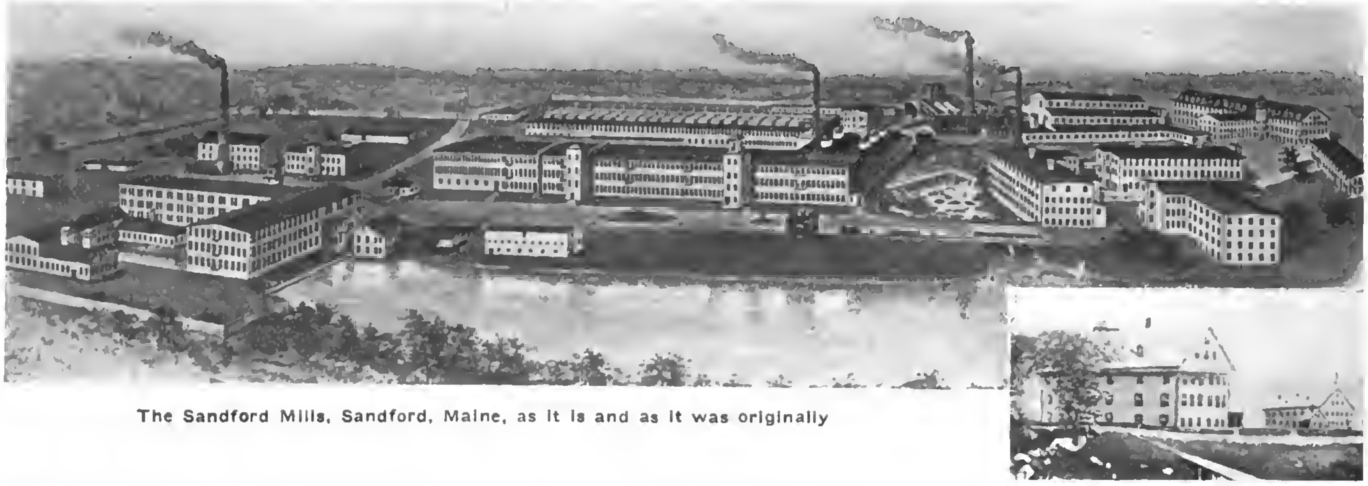
The Randall-Faichney Co., Boston, Mass.

The Chelsea Clock Co., Boston, Mass.

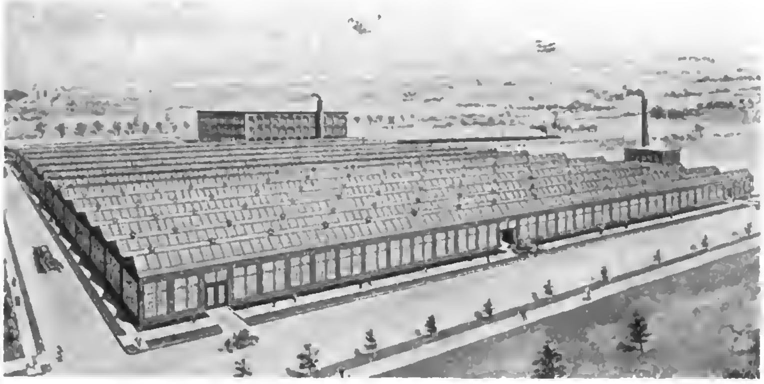


The Gray and Davis plant in 1896 and at present

A Few of New England's Factories

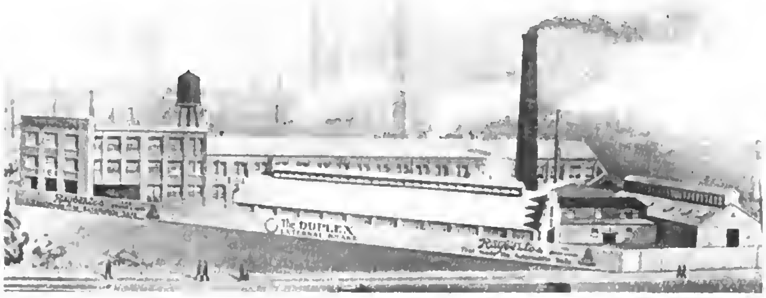


The Sandford Mills, Sandford, Maine, as it is and as it was originally

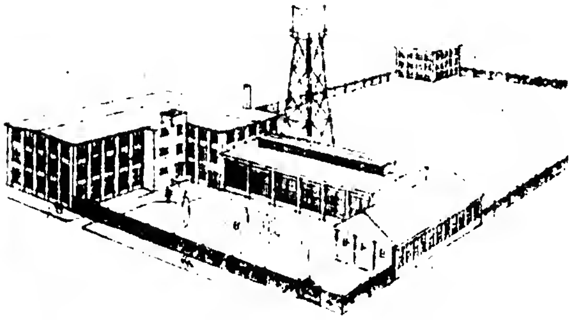


The Metz Co., Governor Gore Plant, Waltham, Mass.

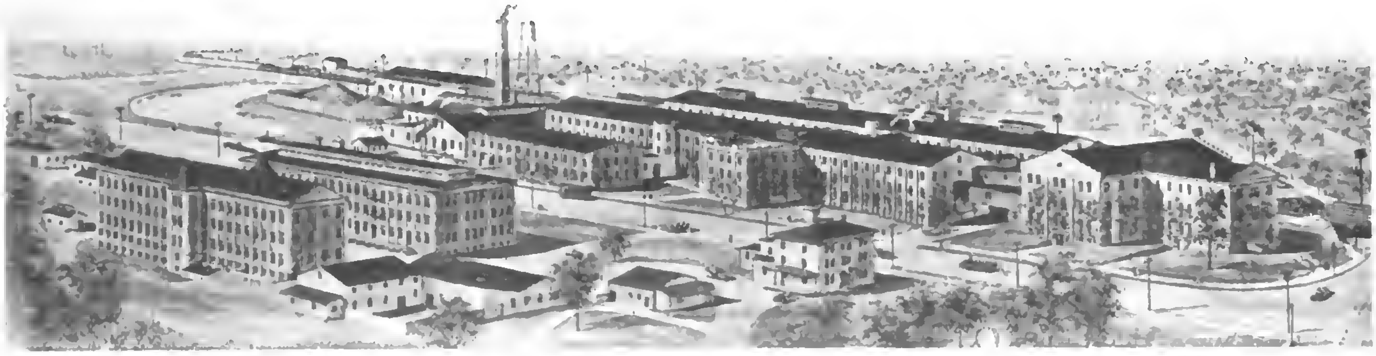
The Baldwin Chain and Mfg. Co., Worcester, Mass.



The Royal Equipment Co., Bridgeport, Conn.

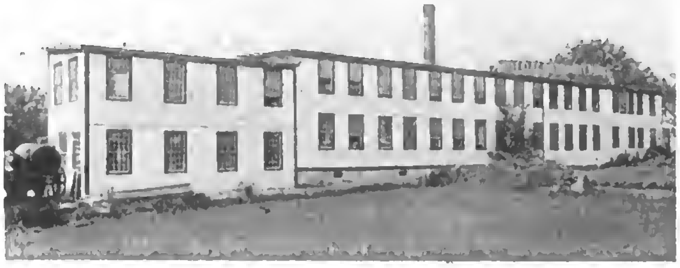


G. W. J. Murphy, Amesbury, Mass.



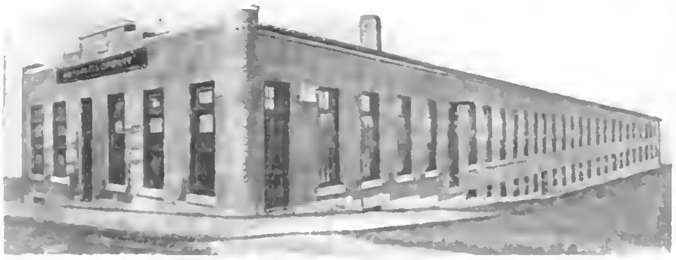
The Hartford Rubber Works (United States Tire Co.), Hartford, Conn.

# of Both the Past and the Present



The Hoyt Electrical Instrument Works, Penacook, N. H.

Above—The Dover Stamping and Mfg. Co., Cambridge, Mass., originally and today. Right—The Whitney Mfg. Co., Hartford, Conn.



The Auto Parts Co., Providence, R. I.

The Standard Thermometer Co., Boston, Mass.

The Heald Machine Co., Worcester, Mass.

Above—The original and present plant of the Brown and Sharpe Mfg. Co., Providence, R. I. Left — The O'Bannon Corporation

New England News of '99

Many Curious Ideas Shown in Paragraphs From "The Motor Vehicle Review" of 1899 and 1900—Liquid Air Automobiles Expected—Mile Record 1.34 4-5—Plans of First Boston Show

The First Doctor Automobilst

SPRINGFIELD, MASS., Nov. 6, 1899—Dr. A. O. Squier, of this city is the first Western Massachusetts physician to discard the horse and buggy for the motor vehicle, and now his fellow-physicians are watching him with not little curiosity, slightly tinged with envy.

Electric Does 25 Miles on One Charge

BOSTON, Sept. 22, 1899—One of the chief difficulties that the manufacturer of electric motor carriages has had to contend against up to the present time is an inability to produce a carriage that will run for any considerable distance without recharging the storage batteries. The extreme limit of distance thus far scored is 25 miles.

Police Use Automobiles

BOSTON, Sept. 22, 1899—Mayor Quincy's experiment in the use of motor vehicles for the chiefs of city departments is proving successful. Only one carriage has been tried as yet, but it has been stated that it does the work of three horses. It is used for many business trips around town for which a horse with wagon was formerly needed. The motor vehicle does not have to rest, as a horse does. Mayor Quincy has ridden in it several times.

Liquid Air Automobile Co. Formed

BOSTON, Sept. 7, 1899—The Liquid Air, Power & Automobile Co., Boston, has purchased a five-story and basement brick factory in Cambridge, to manufacture liquid air for automobiles and other machines run by that power. The patents owned by that company cover processes which are claimed to reduce the cost of manufacture to a minimum, and to enable the practical application of liquid air energy as power for driving all sorts of machinery. The company's automobiles, run by this power, weigh less than 300 lb., and would make a trip of 100 miles at an expense of only a few cents.

Mile Road Record, 1.34 4/5

BROCKTON, MASS., Oct. 17, 1899—The fastest mile ever ridden over a highway in a vehicle was made yesterday afternoon on the State highway at Whitman, by the motor vehicle built and owned by the Marsh brothers of this city. The time for a warming up mile was made in 1 min., 51 and 1/5 sec., thus establishing a new 1-mile motor vehicle record for the world. Mr. Marsh opened the throttle suddenly and the vehicle, with its 350 lb. of weight, the lightest in existence at that, shot up the hill like a bolt of lightning. Immediately after this performance a mile was made in 1 min. 34 and 4/5 sec.

Covered 150 Miles in 12 Hours

WORCESTER, MASS., Aug. 25, 1900—The first two-seated motor vehicle has made its appearance here. It is the property of J. W. Bigelow, and was brought here from the Locomobile factory. A trip of 150 miles was made in 12 hr.

Records Cause Wonder

PROVIDENCE, R. I., Feb. 14, 1900—Motor vehicles are coming into wider use in this city among society people and business men, and are rapidly supplanting the fractious horse. Three years ago, when these vehicles first appeared on the streets on their way to Narragansett Park, where the first big race was to be held, they were a novelty and attracted wide attention. The records made by the electric and gasoline carriages were subjects of wondering comment, and their cost, stated at upward of $1,000 each, seemed prohibitive.

Boston to Have Automobile Show

BOSTON, Dec. 8, 1900—There is a rumor that Boston will witness a motor vehicle exhibition in Mechanics' Building early next spring. The effort to bring about the holding of such an exhibit is being made by a large number of men who are not interested in the motor vehicle for monetary gain, but rather for personal pleasure and comfort.

University Automobile Clubs in 1900

NEW HAVEN, CONN., Nov. 24, 1900—Motor vehicle clubs composed of students of the various universities are now being formed. A meeting of the Yale students to organize will be held in the near future. Harvard motorists have also been asked to organize.

Status of Automobile

WORCESTER, MASS., Nov. 27, 1900—Steps have been taken in court in this city to determine the legality of motor cycles and motor vehicles as vehicles. Efforts will be taken to secure recognition for motor vehicles on a footing with the regular horse carriage. The question of liability for runaway accidents is what is scaring motorists of Worcester and the State. It is well known that the horseless carriage is almost everywhere causing accidents beyond city limits by reckless and fast driving. It is claimed that the users of motor vehicles are liable for all damages caused on the road, inasmuch as the motor vehicle has not legal license to use highways.

Good Roads Closed to Automobiles

BOSTON, Feb. 15, 1900—The motor vehicle has created a storm in this city. These vehicles are prohibited on most of the good roads in and around this city. If you engage an electric cab for a run out to Brookline you will notice that the driver stops on entering Brookline. He gets from his seat and goes to the hack of the cab. There he attaches a black tag with the license number of the cab, printed in white thereon. The figures are large. They are fully 2 in. high.

Must Stay Outside Cemetery

BOSTON, Feb. 15, 1900—A notice has recently been posted at the main entrance to Forest Hills Cemetery, this city, reading "Automobiles are not allowed in this cemetery." As stated by the secretary of the cemetery company, "We cannot afford to run the risk of having automobiles cause trouble in the cemetery. We have agreed with many of the lot owners that we shall take perpetual care of their lots, and make good any damage to them. Some of the protected property includes valuable monuments and other marble work of value, and the risk of having some horse frightened by an automobile is more than we care to take. If an automobile should swoop suddenly down on a funeral procession there might be a regular stampede."

First Accident Suit in Boston

BOSTON, June 6, 1900—The first suit growing out of an accident caused by a motor vehicle came up for trial in the U. S. circuit court to-day. The plaintiff seeks damages of $25,000, alleges that the accident was due to the negligent, careless and unskillful manner in which the vehicle was managed and controlled. The defense is that the plaintiff walked against the machine.

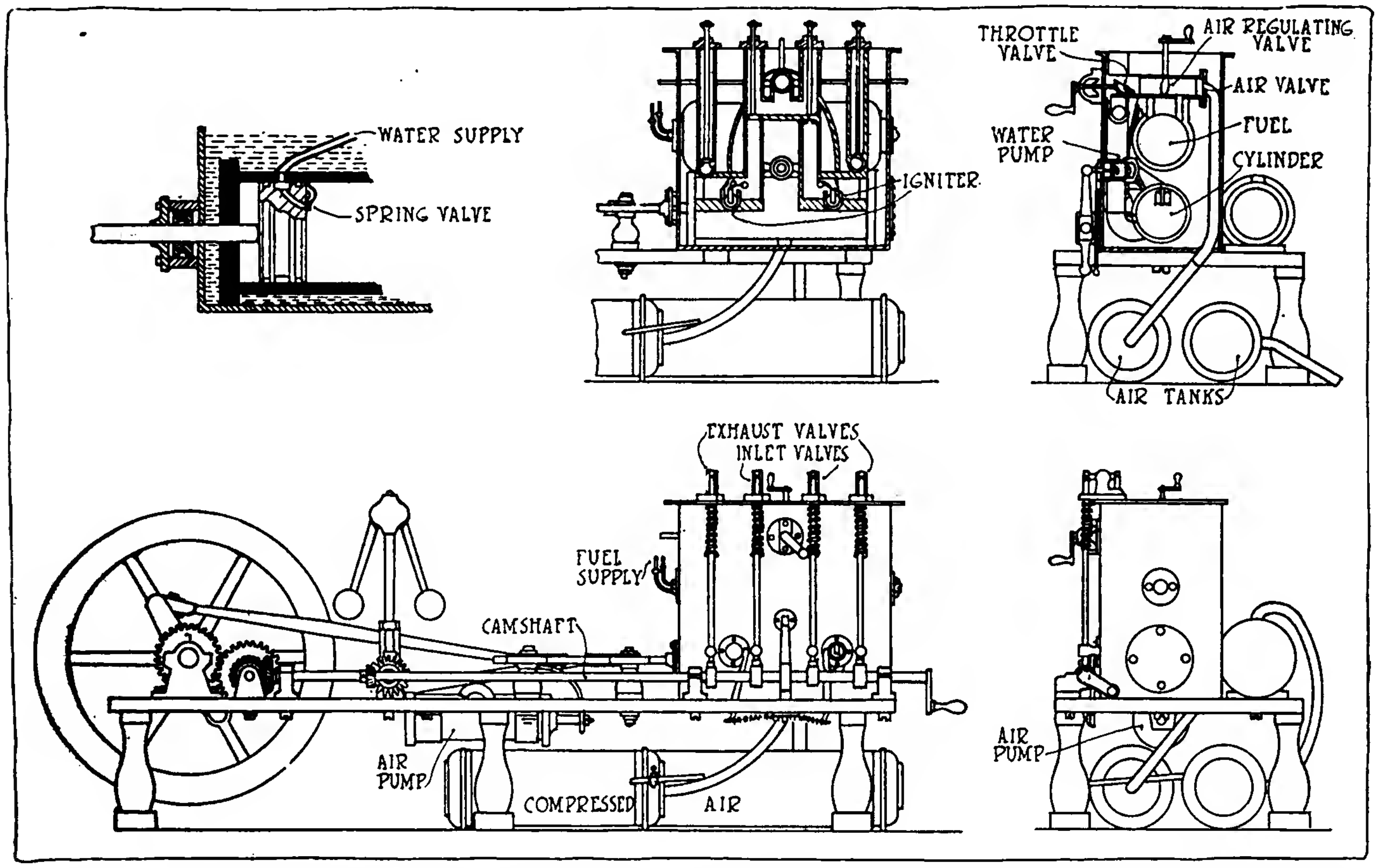
The History of the American Automobile Industry—19

Stuart Perry an Important Man in Early Development—Water Used as Lubricant—Tried Compressed Air Starting System—Grasped All Essentials of the Gasoline Engine

By David Beecroft

IN developing the internal combustion engine too great credit cannot be given to the work of Stuart Perry of New York, whose patents, issued in 1844 and 1846, showed a practical engine. Perry's accomplishments were outlined in last week's issue and we are fortunate in being able to illustrate his motor this week, the illustrations being taken from his patent papers. Unfortunately we cannot show a complete cross-section of the engine, but in the upper left is a section showing one end of the cylinder with a double-acting piston; that is, an explosion taking place at either side of the piston the same as pressure is applied to each side of a piston in a steam engine.

Perry's engine was a vertical type with valves located in the cylinder head, with waterjacket for the cylinder walls, cylinder head and valve parts, but not resembling the present-day engine very much, but rather being fashioned after steam practice of 70 years ago. As stated last week, Perry used an air starter and, in fact, his patent drawings show no effort of attaching a starting crank,



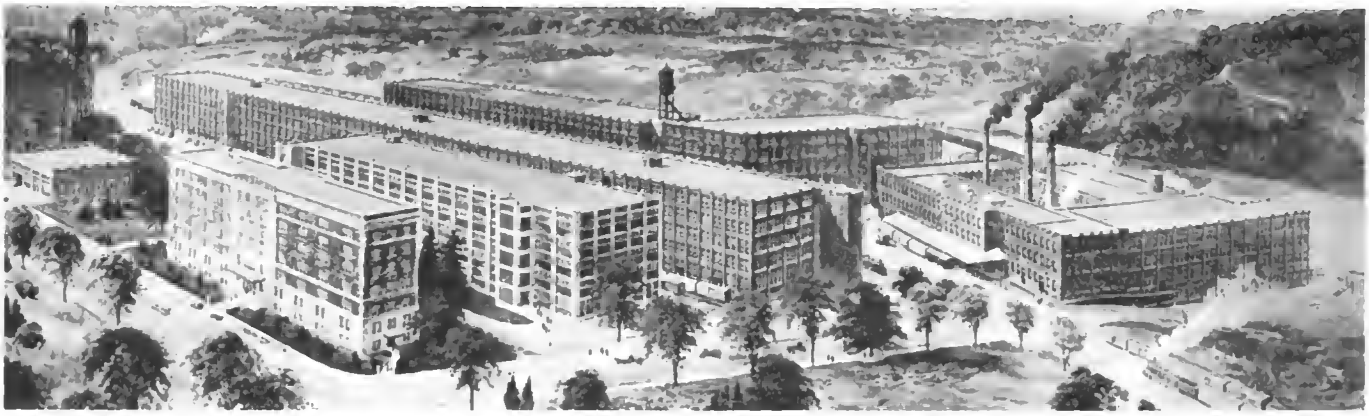
Details of the internal combustion motor of Stuart Perry, New York City. This was invented in 1844 and 1846. The upper left illustration shows how he lubricated the piston and cylinder by water. The other illustrations show his system of air-starting, and the small handle on the external camshaft was set by hand to start. The upper right illustration shows how Perry used a throttle valve to regulate the flow of mixture with the cylinder. He also used a regulating valve to control the flow of air with the object of securing a satisfactory mixture. Perry's motor was a double-acting type; that is, an explosion took place at either side of the piston. It was entirely water-jacketed, used tube ignition and had intake and exhaust valves operated from an external camshaft.

rather there is a miniature crank attached to the external camshaft, which crank was used to put the camshaft in the proper position for starting; that is, to open the intake valve to admit the explosive mixture when it was ready and then to close the valve and revolve the cover on the platinum ignition tube so as to let the heat of the tube explode the mixture.

As several of the illustrations will show, Perry used two large air tanks, one of which was connected with an air pump, either driven by hand or from the motor. The usual valves were employed in the air system for conducting the air into the cylinder for starting purposes.

Perry relied entirely on water to lubricate the cylinder and piston. The upper left illustration showing a section of the piston discloses how there was a water supply pipe leading through the cylinder wall and registering with a water groove in the piston. This water pipe registered with the groove when the piston was at the end of the stroke. There was a double-acting water pump shown in the upper right illustration which was connected with the water supply pipe leading to the piston so that when the piston registered with the pipe as illustrated, a stroke of the pump plunger delivered water into the piston groove. This groove connected with a spring valve in the piston so that the water pressure opening this valve permitted a part of the water supply to be injected into the cylinder. This supply was considered sufficient not only to aid in lubrication, but also to add its expansive force. In addition the piston rod was lubricated by a water packing gland. At either side of the water groove in the piston were packing arrangements to retain the water in the groove.

To start his motor Perry realized the necessity of heat to vaporize the spirits of turpentine used as a fuel and it was doubtless this difficulty of starting that led him to use the compressed air, which assisted the explosive power of the mixture in starting. He did not use a carbureter, as we understand it to-day, but employed a retort into which the spirits of turpentine was fed. This retort was waterjacketed and it was necessary to heat the water by external means to a point where the turpentine was converted into a gas. When the necessary mixture was obtained the camshaft was turned by hand to the proper position to open the intake valve and at the same time closing the exhaust. The mixture then filled the cylinder and a further turn of the camshaft closed the intake valve and uncovered the ignition tube. After the first explosion it was expected that the regular cycles would continue the explosions, the camshaft being driven from the crankshaft after its first setting by hand.



Two New England factories. The Fisk Rubber Co., Chicopee Falls, Mass., and below, the American Chain Co., Bridgeport, Conn.

Floating Bush Bearings in Live Rear Axles for Trucks

A British Opinion on Commercial Vehicle Design

IN a paper presented to the Institution of Automobile Engineers and discussed at a recent meeting of this society, George W. Watson, a member of the council, reviews all construction features in live axles for commercial vehicles with critical comment and illustrations. The usual distinctions between floating, semi-floating and non-floating axles, as well as between "solid forging" and built-up axles, are made the basis for the division of the subject and the cast-steel wheel is the type contemplated as used. Among the statements made by the author, and in the discussion by members of the British society, those of greatest interest to the American industry are quoted in substance in the following. The remarks referring to floating bushes for wheel bearings in heavy vehicles are perhaps specially interesting, as this system was proposed for bicycles many years ago in this country—somewhere about the year 1899—on the plea of reducing friction and equalizing wear of the stationary member of a bearing almost or fully as much as ball bearings, but has not been employed extensively here for motor vehicles.

For vehicles intended for use on paved or good macadam roads the author advocates worm drive for all axles up to six-ton limit of axle weight, but for heavier and slower vehicles he considers the double-reduction type to be the better, particularly if the differential is mounted on the crown wheel shaft and the final drive taken through two pairs of spur gears, as in the construction shown in the accompanying illustration. This construction is on the whole one which he considers very favorably, also in other details.

In some cases, where ample ground clearance is wanted, the worm drive may not be acceptable, he holds, "because it is not practicable to make a worm wheel as small in diameter, for a given gear ratio and load, as may be given to the final gear wheel of a double reduction axle."

It is mentioned as an objection to the spur gear type of differential that there is double the amount of backlash, as compared with the bevel gear type, due to the aggregate clearances between bearings and gear teeth, and this he considers in time liable to become serious.

To make axle shafts and driving flanges in one piece is held to be bad practice, because the flanges are apt to be bent by rough handling in repair shops, and if the flange is subsequently bolted up tightly to the wheel, the shaft is liable to be badly stressed, causing serious fractures.

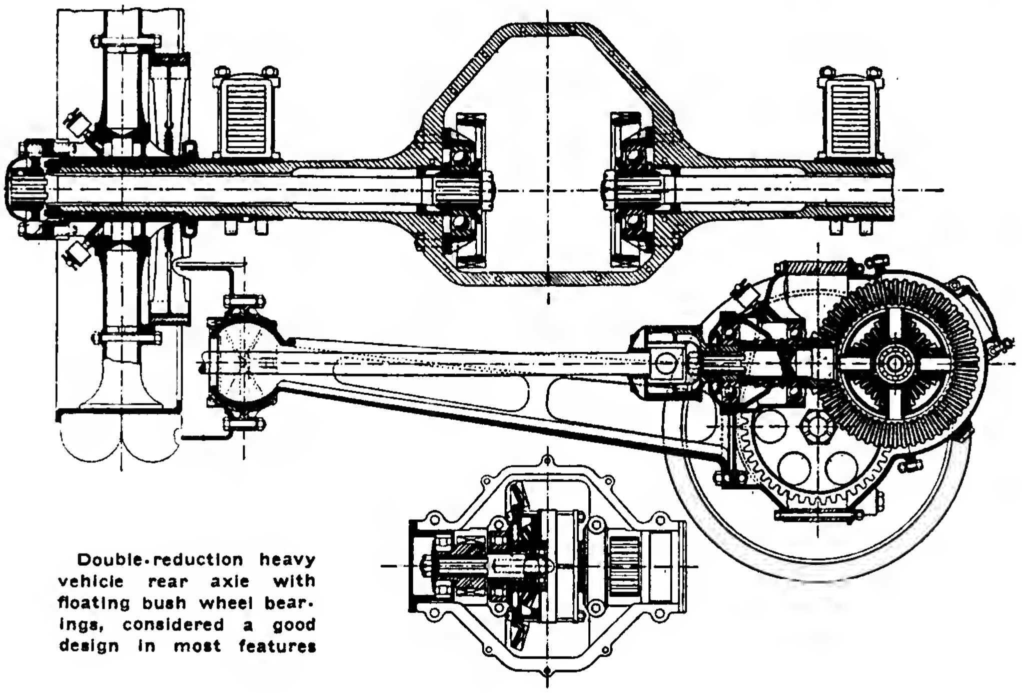
It has been proved that in the hubs of road wheels floating bushes are much better suited to the rough usage of commercial service than any tried form of roller or ball bearing. A wheel with floating bushes is easily and quickly replaced in the event of tire damage, and such a bush properly made and fitted offers very little more friction than a ball bearing hub of equal load capacity, except when starting from rest.

Both the external and the internal clearance should be greater for floating bushes than would be allowed for any ordinary bearing. The army specifications allow between 0.006 and 0.0136 of an inch for both outside and inside fits, and the normal diameters of the bush to which these limits refer are 3.5 and 4 in. With closer fits the lubrication becomes uncertain. The play noticed with the larger clearance, when the axle is jacked up, is more apparent than real, and it makes the removal of the wheel easier.

The distribution holes in floating bushes should be drilled along a helical line and spaced so as to carry grease (or heavy oil) to every bit of the axle and hub surfaces. The rubbing surfaces of both axle and hub should be ground and polished to secure the best results, and, if the hub is a casting, it is therefore advisable to force into it a steel liner by hydraulic pressure, with subsequent grinding of the bore. Care should be taken to remove thoroughly the metal particles that may be left in the oil passages after the grinding.

According to the author's experience it is not necessary to harden the wheel journals of an axle, provided the pressure caused by load and tractive resistance does not exceed 400 lb. per square inch between the axle and the floating bush.

In no part of an axle should end-thrust be left to take care



Double-reduction heavy vehicle rear axle with floating bush wheel bearings, considered a good design in most features of itself. Where it is not possible to fit a single or double thrust ball bearing, a floating washer of phosphor bronze not less than 5/16 in. thick should be provided, and it should be placed between steel surfaces that are ground, though not necessarily hardened. Casehardened thrust washers, particularly when used with floating bushes in wheel hubs, have an unfortunate habit of cracking.

Objects to Truss Bars

The truss rod or tie bar for any axle subject to great variations of the load is a source of weakness, because it cannot be adjusted to balance the stresses which are set up. The careless adjustment of a tie bar, to take all sag out of an axle when it is under full load, may lead to excessive bending stresses in the axle casing in the opposite direction when the load is removed. Generally, in practice, as has been shown with the army trucks in France, it is the tie rod which gives out first, but injury to the axle frequently follows. [No mention is made by the author of the use of suitable rebound checks to prevent the oscillation of the axle and transmit excess loads to the vehicle frame, although this expedient, if properly designed, may save as much material and weight in the axle as the use of a truss bar and is not subject to the objection mentioned against the latter.]

In the matter of lubrication of the axle, the author prefers to allow the free passage of oil from the central casing to the wheel journals, rather than to take constructive measures to prevent such leakage, provided only that steps are taken to drain the leakage away from wheels and brakes. One of the reasons for the preference is that drivers are more likely to give attention to the lubrication of the axle if they are not put to more trouble than that of dropping an occasional pint of oil into the central casing. He has also found it to be good practice to mill a broad flat on the top side of the wheel journals, when plain or floating bushings are fitted, as this flat facilitates the distribution of lubricant over the whole length of the bearing. All thrust washers should be provided with distribution paths, preferably in the form of eccentric grooves, with the throw of the eccentrics on the two sides arranged diametrically opposite; otherwise the washer may be so weakened that it will split along the groove. Cross or radial grooves invariably lead to breakage of the washer.

In the discussion of Mr. Watson's paper it was brought out that several members consider the matter of unsprung axle and wheel weight rather unimportant for trucks; that the forged axle is widely preferred to the cast one but is difficult to obtain in Great Britain—not only under war conditions; that internal-gear drives are considerably lighter than axles with double gear reduction, and that the preference for floating bushes over ball bearings in wheel hubs and for differentials, is not unanimous, as ball bearings have been proved reliable for the heaviest vehicles and their interchangeability is a highly appreciated feature.

Automobiles Save 32 Cents Per Mile in Road Supervision

IN these days of efficient and businesslike methods the government authorities do not intend to be outdone in these respects. An evidence of this is the report of cost data kept on three low-priced automobiles used in supervising work on the Washington-Atlanta Highway by the Office of Public Roads and Rural Engineering. E. W. James, chief of road maintenance in this department, states that, based on records kept since May 24, 1914, when the cars were put into service, through December, 1915, the cost of transportation per mile of road under supervision averages 20 cents per month. The only comparable cost figures for the use of livery horse vehicles for similar work give 52 cents per mile per month for transportation. The economy of the automobile in this work is emphasized by the large possible saving of time, and thereby money, developed by the field men of the office.

42.9 Miles per Day

Of the three cars in use, that having the lowest mileage to date has run an average of 28.4 miles per day, thirty days a month, since going into service. The highest mileage shows 42.9 miles per day for the same period.

As shown in the accompanying tabulation, the average cost per mile of all three cars since put into service was 4.13 cents, including a general overhauling on each.

In the first tabulation is given a summary of the miles run, total cost and cost per mile of each of the three cars during each month of 1915, together with the totals for the year, for the year 1914 and the grand totals including all costs since the cars were put into commission.

The second table gives the average cost of gasoline, oil, tires, storage, etc., on each car for the years 1914 and 1915, with the weighted averages for total operation costs during the entire term of service of the vehicles. In the last column of this tabulation is given the common average for all cars for the whole period.

Summary by Months of 1915 of Cost Data on Three Cars Used in Road Supervision

	Car No. 1			Car No. 2			Car No. 3		
Month	Miles Run	Total Cost	Cost Per Mile	Miles Run	Total Cost	Cost Per Mile	Miles Run	Total Cost	Cost Per Mile
January	563	$43.19	$0.0767	807	$39.75	$0.0493	203	$61.35	$0.1546
February	....	9.60	....	780	45.85	0.0587	583	13.61	0.0234
March	635	62.25	0.0979	1,557	64.42	0.0413	1,169	32.63	0.0278
April	848	20.49	0.0241	1,404	64.37	0.0457	1,391	37.01	0.0265
May	1,023	51.50	0.0504	1,947	64.81	0.0333	1,322	59.33	0.0448
June	865	32.78	0.0376	1,198	61.10	0.0508	1,456	74.99	0.0514
July	838	47.89	0.0570	1,461	37.24	0.0255	1,412	50.89	0.0360
August	1,031	48.19	0.0468	690	15.19	0.0220	1,495	61.75	0.0414
September	1,018	28.02	0.0275	1,249	53.20	0.0426	965	42.65	0.0442
October	1,070	46.78	0.0436	1,366	65.28	0.0478	1,195	34.96	0.0292
November	978	31.40	0.0321	1,485	47.49	0.0319	1,172	46.99	0.0401
December	1,149	53.39	0.0465	1,240	43.49	0.0350	1,156	63.68	0.0550
Totals	10,018	$475.48	$0.0475	15,184	$602.19	$0.0397	13,519	$549.84	$0.0407
1914 totals	6.210			9,308			8,712		
Grand totals	16,228			24,492			22,231		

Averages on Operation Costs of the Three Cars

	Car No. 1			Car No. 2			Car No. 3			
Item	1914	1915	W'ght'd Avgs.	1914	1915	W'ght'd Avgs.	1914	1915	W'ght'd Avgs.	Com. Avg.
Aver. cost of gas per gal. (cts.)	20.01	18.96	19.35	18.96	18.32	18.56	16.77	16.18	16.41	18.10
Miles run per gal. of gas	17.52	16.29	16.74	17.45	15.66	16.29	19.73	19.76	19.75	17.59
Miles run per lb. of grease	282.27	500.90	386.38	340.58	446.59	399.35	458.53	500.70	483.28	423.00
Miles run per qt. of oil	62.73	47.03	52.01	81.65	45.06	54.31	86.26	97.87	92.97	66.43
Cost per mile of:	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
Gasoline	1.14	1.16	1.16	1.09	1.17	1.14	0.85	0.82	0.83	1.04
Grease	0.05	0.04	0.04	0.05	0.04	0.04	0.03	0.03	0.03	0.04
Oil	0.24	0.33	0.30	0.17	0.30	0.25	0.17	0.14	0.15	0.23
Tire casings	1.15	0.55	0.79	0.90	0.49	0.65	0.48	0.55	0.52	0.65
Other tire cost	0.17	0.26	0.22	0.07	0.22	0.16	0.20	0.15	0.17	0.13
Storage charges	0.89	0.60	0.71	0.28	0.22	0.25	0.64	0.59	0.61	0.52
Miscellaneous	0.76	*1.81	1.41	†1.23	1.53	1.42	†1.28	1.79	1.59	1.47
Total	4.40	4.75	4.63	3.79	3.97	3.91	3.65	4.07	3.90	4.13

*Includes general overhauling in March.
†Includes general overhauling at end of November.

What Good Lighting Really Is*

Automobile Lighting Analyzed from the Lighting Viewpoint

By Emerson L. Clark

THE subject of good lighting is about contemporary with that of automobile engineering, both forming the two youngest branches of engineering work. Artificial lighting has been employed by man for many centuries; likewise man has for an equal period used wheeled vehicles to satisfy his transportation requirements. During the last 15 years transportation by wheeled vehicles has undergone a most extraordinary advance in the development of the automobile. During the same period advances have been made in illuminating engineering which are of comparable importance in the annals of lighting. Thus we see that two such diverse subjects as automobile engineering and illuminating engineering have a few points in common.

Notwithstanding the fact that much information of value in obtaining good lighting has been accumulated and classified, very little of this has been used to improve the lighting of the automobile. I have carefully examined the Transactions of the Illuminating Engineering Society for several years back and failed to find a single paper reporting a study of the lighting requirements of the automobile.

Good Light Essential

Automobile lighting is not merely a luxury—it is a necessity and upon its quality, its suitability, the safety of life and limb depend. Proper appreciation of the importance of the right kind of automobile lighting for preventing certain classes of common accidents is not now exhibited by many persons who should possess it. Good lighting in factories and industrial plants is recognized as being a powerful factor in the prevention of accidents. Statistical plots of the occurrence of accidents throughout the year show that the number of accidents varies directly with hours of darkness. As the days become shorter the number of accidents increase. Proper lighting of the automobile is even more important than the lighting of a factory because the automobile moves rapidly in the midst of other rapidly moving vehicles over all sorts of roads in various states of repair, past innumerable crossings which are always a potential source of accidents.

In to-day's *Plain Dealer* (Jan. 27) I read an account of a man who left his lodge meeting the night before and stepped in front of a swiftly moving automobile on West Twenty-fifth Street and was struck by the machine. The man died on the way to the hospital and the automobile made off before anyone got its number; thus the possibility of ascertaining the exact circumstances of the accident are destroyed. However, it is almost certain that no strong dancing beam of light was illuminating the surface of the road in front of the car for the man would never have stepped into such an attention compelling and obvious field of danger. I recall a particularly deadly accident that occurred in Cleveland shortly after the first dimming ordinance was put into effect. An automobile came on to Lake Avenue from one of the private drives and was struck by a swiftly moving machine running down the avenue. Four people, as I remember, were killed in the first machine. This accident never would have happened had either one of the machines been projecting a strong beam of light so as to strongly illuminate a strip of the road surface a sufficient distance ahead of the car. I would weary you if I recited the list of preventable night accidents, the accounts of which I have seen published in the Cleveland newspapers. It is a large one and covers only a very small section of the country; yet this list by no means includes all or even a major portion of the accidents that happen in this section of the country. I know from experience that but a small percentage of accidents which occur go on record.

The ever present sections of torn up streets, and numerous spots on the road in need of repairs, and countless other contingencies that arise in the course of automobile driving require adequate lighting to assist in avoiding accidents which may injure people or at least damage the machine. Every one recognizes the advantages and increased pleasure in night driving which accompany an adequate road illumination in front of the car, and until the country-wide agitation against glaring headlights imposed its check the tendency was toward increasingly powerful headlights. As a result of the above-mentioned agitation the trend in automobile lighting has been toward insufficient and inadequate lighting with its attendant accidents and dissatisfaction.

The time is now ripe for a complete study of the whole lighting problem to ascertain what the various requirements are, how they can be met and how the conflicting demands can best be reconciled. In the following pages I briefly present such a study.

In order that this work may be better understood it may be well to give a brief résumé of the basic principles of good lighting.

In studying the principles of good lighting it is necessary to consider phenomena relating to three things—first, the light source; second, the objects to be illuminated; third, the eye.

First, considering the light source. The three most important qualities of a light source are intensity, color of light and distribution. Distribution involves both intensity and direction. Light sources are both primary and secondary. The former emit light, the latter reflect it. The sun and the moon are examples of such sources. An incandescent lamp filament and its reflector is another pair of examples.

Intensity of Source

The intensity of a light source is a measure of its strength, of its ability to produce illumination at a distance. Intensity is either a statement of the strength of the light in a certain specified direction or the average of the intensity in a number of different directions. When this is the average of a large number of uniformly spaced directions covering the whole angular space about the source the result is a measure of the total quantity of light emitted. The unit of intensity is the candlepower. The unit of quantity or, more properly, flux, is the mean spherical candle. Another more recent unit is the lumen, one mean spherical candle = 4π lumens, about 12.5 lumens.

Intensity of Illumination

It is necessary to distinguish between the intensity of a source and the intensity of the illumination produced by a source. The intensity of a source does not vary as we move

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*Paper read at meeting of Cleveland Section S. A. E., Feb. 18, 1916.

it to different distances, but the illumination produced by a given source diminishes as we measure it farther and farther from the source (if the source is small compared to the distance involved). The intensity of illumination from most sources diminishes as the square of the distance from the source. If the source of illumination is an infinite plane the illumination does not diminish at all at increasing distances from the plane. The nearest practical approach to this in our experience is sky light. The illumination from the sky is the same at the surface of the earth as it is several hundred feet above it. (I shall make use of this point later when I speak of the brightly illuminated surface of the road as a secondary source of light.)

The unit of illumination is the foot-candle; it is the illumination falling on a surface placed perpendicular to the ray at a distance of 1 ft. from a source of one candle. The same surface moved to a distance of 2 ft. would receive an illumination of one-fourth foot-candle.

Another unit of illumination is the lux or meter candle, about 10.7 lux = one foot-candle. Using light flux instead of candlepower the illumination on a surface is equal to lumens falling on the surface divided by area in square feet; this gives the result in foot-candles. If the area is expressed in square meters the result is obtained in lux.

Brightness

The brightness of a surface is not determined solely by the intensity of illumination falling on it, but is also dependent upon the reflecting power of the surface. There are two kinds of reflection, specular, as in the case of a highly polished mirror, and diffuse, as is exemplified in a piece of white blotting paper. The brightness of a diffuse reflecting surface is proportional to the product of the intensity of illumination falling on it and the reflecting coefficient of the surface. The reflecting coefficient of our best white surfaces seldom exceeds 80 per cent, while that of our common black surfaces is seldom less than 5 per cent; most surfaces fall between these limits.

Brightness is measured in candles per square inch. It is also measured in Lamberts, when one square centimeter reflects diffusely one lumen of light its brightness is one Lambert. Candles per square inch multiplied by 0.4868 equals Lamberts.

Color

The next important quality in a light source is color. In some branches of illuminating engineering this has to be considered carefully. In automobile lighting there are so many other important points to consider that the matter of color can be dismissed for the present.

Distribution

If one wished to define illuminating engineering in very few words he would not be far wrong if he called it the scientific distribution of light. The distribution of light intensity in different directions from a light source is a matter of extreme importance. The light from an ordinary headlight bulb is fairly uniform in intensity in different directions where not obstructed by the base. When this bulb is placed in a parabolic reflector the distribution of intensity from the complete unit is profoundly modified. The distribution characteristics of a lamp determine how these lamps should be placed to produce a given lighting result.

Another term used in lighting which really comes under the heading of distribution is diffusion. Diffusion is used with a number of special meanings. "Diffused illumination" is often used to describe an illumination which comes from many different directions as from many small separated sources or from one large, very extended source. Sky light out of doors is perhaps the best example of diffused illumination, and sun light an example of directed or non-diffused illumination. A test of diffusion is the sharpness of shadows cast. Widely scattered light from a comparatively small source is often spoken of as diffused light. This is somewhat confusing. The shadow test will distinguish the two cases.

The second important thing to consider in good lighting, namely, the surfaces illuminated, may for the present be passed with the statement that they are made visible by the light reflected from them or from other surfaces around their borders. They reflect both specularly and diffusely, more often diffusely, and their reflecting coefficients will lie within the range of 5 to 80 per cent.

Characteristics of the Eye

Finally we come to the third and perhaps the most important thing to consider, the eye. The eye is the final judge of illumination. Lighting must be adapted to the peculiarities of the eye. Everyone has eyes, but most people are in the dark regarding some of their important characteristics.

One of the most striking characteristics of the eye is the large range of illumination over which it will operate. The brightest sunlight gives an illumination intensity of about 12,000 ft. candles and bright moonlight about .03 ft. candles, a range of intensity of 400,000 to 1. If one passes suddenly from bright sunlight to surroundings illuminated to the intensity of bright moonlight the latter would appear perfectly dark and it would take considerable time before vision would be good. A very much smaller change than this has a very pronounced effect of the same sort. When the eye attempts to see in a reduced illumination its sensitiveness to light increases. This change in sensitiveness is not wholly due to a change in the opening of the iris of the eye as is sometimes popularly stated. The difference in the opening of the iris can nowhere nearly account for the magnitude of the change in sensitivity which is observed. Other very important changes which require considerable time take place within the eye. This increase in sensitivity when surrounded by very low illumination is often called dark adaptation.

When the eye is suddenly changed to greatly increased illumination it is pained, but in a short time adjusts itself comfortably to its new surroundings. The eye adapts itself to brighter surroundings more rapidly than to darker ones. That is, its increase in sensitivity with a given change in surroundings is slower than its decrease with the same amount of change in the opposite direction.

When two surfaces within the field of view are illuminated to very different intensities the eye cannot see them both clearly at the same time nor can it view the brighter and then immediately see well on the darker. For accurate vision on the darker surface the eye requires time for adaptation. If there is any considerable area of the brighter surface in the field of view the eye cannot adapt itself to see well in an area considerably darker. This peculiarity of the eye calls for uniformity of illumination of the field of view.

Contrast

A bright area adjacent to a dark area where the ratio of brightness of the bright to the dark area is very large, causes discomfort and glare, a condition with which we are all familiar. Precise quantitative figures on just what conditions of contrast cause glare and how much glare is caused under any given conditions are not available, but the general factors which go to make up glare are known.

Contrast, or the difference in brightness of an object and its immediate surroundings is a very important factor, but it alone does not determine glare. We have in addition to consider both the absolute brightness of the bright object and also the areas or visual angle involved. For instance, the contrast between some of the fixed stars, which have a far greater intrinsic brilliancy than the sun, and the dark space around the star represents about as large a contrast as we can obtain, but this combination does not cause glare. The reason is found in the very small visual angle subtended by the star. For the same reason the bare filaments in headlight bulbs of the sizes in common use to-day do not cause glare to an oncoming driver, although they are very much more brilliant than the surface of the reflector viewed from the direction of maximum intensity of beam. But we all know that when the eye is in the projected beam a moderate distance from the car glare is produced when the surroundings are dark. In this case the brightness of the reflecting surface is very much less than the filament, but the visual angle subtended is so very much greater, 1800 to 1, that the actual amount of light entering the eye from the reflector is much larger than that coming directly from the filament. Again, a very dimly lighted surface contiguous to an area absolutely black would give a large contrast ratio, but this combination would not cause glare. This would indicate that absolute brightness is also a factor.

We see from the above that we can do three things to lessen glare:

First—Reduce the contrast between the bright object and its darker surroundings either by dimming the bright object or by brightening the dark surroundings.

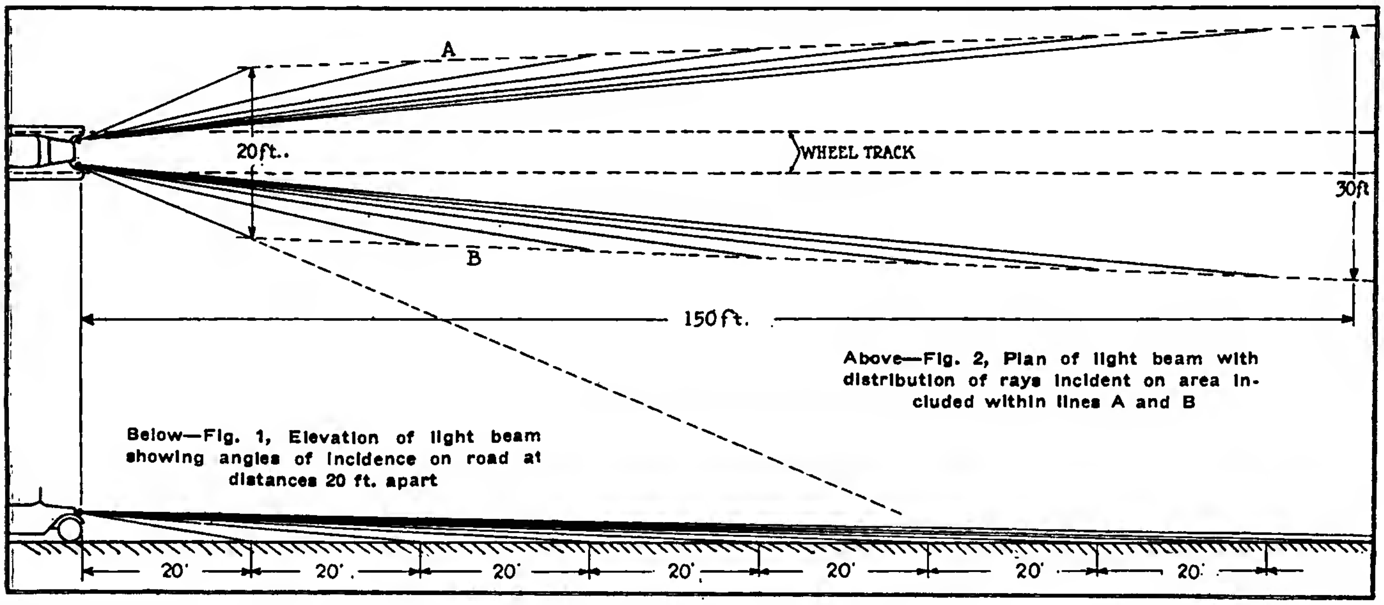
Second—Reduce the angle which the bright object subtends at the eye either by making the object smaller or by getting farther away from it.

Third—By reducing the brightness of the bright object still holding the contrast the same by correspondingly dimming the surroundings.

There is another peculiar characteristic of the eye that has an important bearing on automobile lighting. This is the change in the acuity of vision with the size of the field illuminated. This effect was first announced by Dr. P. W. Cobb of the National Electric Lamp Association and was further studied by Dr. P. G. Nutting of the Eastman Kodak Co. These men have shown by experiment that an illuminated object can be seen much more distinctly when surrounded by a large illuminated area of the same order of brightness, than when surrounded by a dark or dimly-lighted area. Or, putting it in another way, the illuminated object can be seen equally well in a much weaker illumination if the weaker illumination covers a wide area surrounding the object than when the illumination is confined to the immediate neighborhood of the object. This effect is of large magnitude and its importance should not be overlooked in studying the automobile lighting problem. It indicates that for the best results in seeing objects on the road, a large area of the road surface should be uniformly illuminated. The illumination should not be confined merely to a width of the road actually traversed by the car but should extended a considerable distance to both sides of this strip.

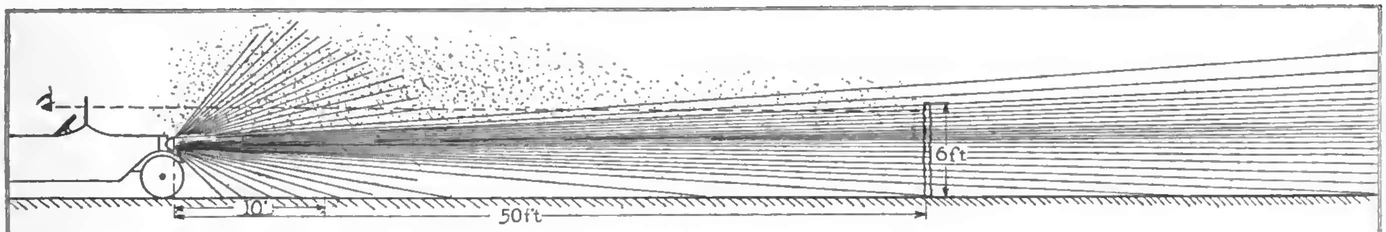
Another advantage of an extended illuminated area is that approaching drivers and pedestrians are much less sensitive to glaring lights when this large illuminated area is in front of them. The brighter the surroundings the more intense must a light be to cause glare. In full sunlight we would barely notice a powerful headlight shining directly in our eyes from a moderate distance.

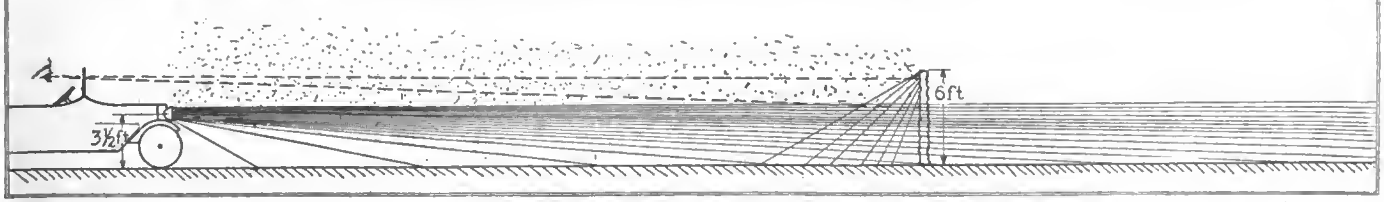
Having now reviewed the important fundamental principles of good lighting we are ready to consider more specifically the requirements of the automobile. We have to consider here first, the requirements of the driver; second, the drivers



Above—Fig. 2, Plan of light beam with distribution of rays incident on area included within lines A and B

Below—Fig. 1, Elevation of light beam showing angles of incidence on road at distances 20 ft. apart





Above—Fig. 3, Form of beam which glares. Below—Fig. 4, Illumination that is non-glaring and occupants of other vehicles, and third, the pedestrians on the road, also some special conditions which the machine is likely to encounter. The merits of any particular installation of automobile lighting cannot be judged solely by the ease and comfort with which a driver can operate the car under some particular conditions. The demands of safety under a wide variety of conditions must also be considered. The tendency in passing judgment is to overlook some important points, just as in figuring costs the tendency is to leave out some important items.

First, considering the requirements of the driver, he would be satisfied if he could have daylight or something closely approaching it. Daylight is characterized by a high intensity of illumination of great uniformity and extent. The intensity of average daylight illumination is a thousand times greater than our best artificial street lighting. Such light as this for the automobile is obviously out of the question. It is equally impractical to suggest that all roads traversed by automobiles be provided with street lighting on the same scale as our best lighted city thoroughfares. Even if this were practical it would fail to meet some of the important safety requirements.

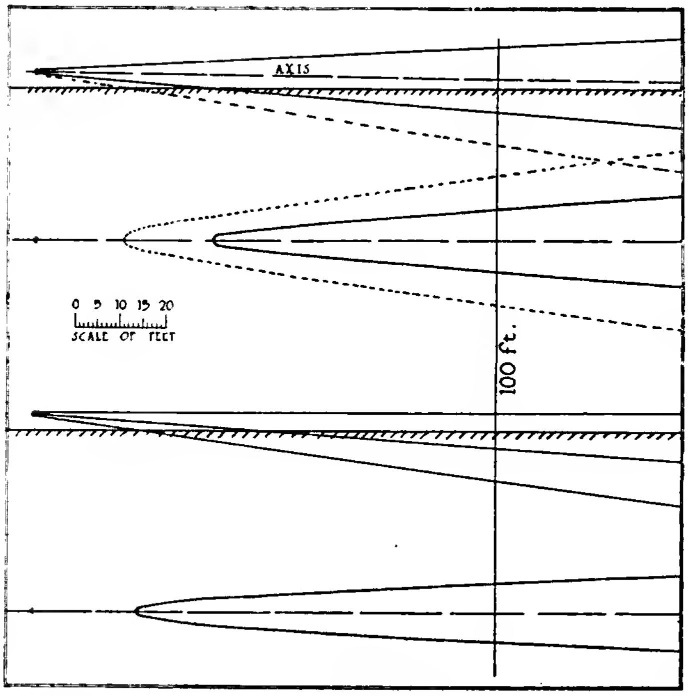
The driver will find it easy to operate the car if the road ahead of him is covered for a considerable distance, say 200 ft., with a strong uniform illumination which enables him clearly to see ruts and stones or any obstacle in his path. This illuminated area should be wide enough to show turns and enable the driver to select the smoothest part of the road. Extra width is also valuable in disclosing landmarks and dangers such as animals wandering along the side of the road which might dash suddenly in front of the car at such close range as to make collision certain. A liberal width of illuminated surface is also advantageous for increasing the efficiency of vision as was mentioned under the characteristics of the eye. Though desirable, we do not have to maintain uniformity over the full width of the illuminated area. The outlying portions will still be very beneficial even if considerably weaker in intensity, but large increase in the illumination in spots and patches over what is necessary to see should be carefully avoided because such spots not only waste light that could be better used elsewhere, but they also cut down the visual efficiency of the eye on the remainder of the illuminated area.

For safety on crossings and rounding curves there is needed a strip of illumination on the surface of the road extending at least 200 ft. in front of the car and with a diminishing intensity extending beyond to 400 or 500 ft. For this purpose the width is not so important but the brightness must be great enough to be easily seen in the presence of ordinary street lighting. This is a particularly important safety measure. Two cars approaching each other at a crossing can see each other's beam of light on the road ahead when the cars themselves are obscured from each other and ample precautions can be taken to avoid a collision. To be plainly visible under various conditions a strength of beam sufficient to give a horizontal illumination of 0.025-ft. candles at 200 ft. should be used. Such a beam will also attract the attention of and warn a pedestrian crossing the street that a car is approaching even when he is not looking toward the car. It will also make the pedestrian visible to the driver if he gets in the path of the car, thus giving a double measure of safety. An illumination on the road such as is described above can in itself harm no user of the road, but will benefit all parties concerned.

The question now arises, How can we secure such an illumination? We cannot space a number of lights along the street as is done in street lighting, for our illuminated area must travel with the car. We cannot even mount units on the car at heights which are customary in good street lighting for we would soon bump into overhead work. We must then produce this illumination from units mounted at some convenient height on the car. (This question of effect of height will be discussed later.) In order that lamps mounted on the car shall produce the illumination mentioned above it is necessary that they direct toward each portion of the surface to be illuminated an appropriate strength of beam, not too strong toward any part or light will be wasted, nor too weak or it will be ineffective. The above specifications call for a very closely controlled distribution of light. In order to show what the general distribution characteristics of the lamps should be in order to furnish the above mentioned illumination, I have drawn Figs. 1 and 2. In Fig. 1 a series of points are laid off every 20 ft. on a line representing the road level and each one of these points is joined to the center of the lamp mounted 3½ ft. high. For uniform illumination it is necessary that equal areas receive an equal amount of light flux. Light flux divided by the solid angle through which it is delivered gives intensity or candlepower. Equal areas more distant from the lamp subtend smaller solid angles, hence the light directed toward the more distant areas must be more concentrated or intense. It will be noticed that the top part of the beam illuminates the more distant sections of the road and therefore must be more intense. The intensity must diminish gradually as we pass to the bottom of the beam.

Referring to Fig. 2, which is a plan view diagram, a strip of road included between the dotted lines A and B is assumed illuminated. Lines are drawn to the lamps from points on the edge of the illuminated area spaced every 20 ft., as in Fig. 1. It will be seen that the lines from the most distant pair of points include the smallest angle, and from the nearest pair the greatest angle. The angle between any pair of these lines represents the sidewise spread which the light directed to the points in question must have to give the desired width of beam. To illuminate the strip shown in Fig. 2, the light must have the least sidewise spread at the top of the beam and the greatest at the bottom and increase gradually from the top to the bottom.

It will be interesting to compute how intense an average illumination can be obtained on the above described area with a size of light source within the limits now in use, when the light is uniformly distributed. The total lumens of light



Above—Figs. 5 and 6, Elevation and plan of beam set to strike road at 250 ft. from lamp

Below—Figs. 7 and 8, Diagrams of beam for same lamp tilted 4 degrees downward available divided by the area in square feet uniformly illuminated gives the intensity of the illumination in foot candles. Taking the strip 20 ft. wide at the car and 34 ft. wide at 200 ft. in front gives an area of 5400 sq. ft. Assuming two light sources each projecting 20 mean spherical candles, gives 4 x 40 = 503 lumens, which divided by 5400 = 0.093 foot candles, or 1 lux strength of horizontal illumination. Bright moonlight is about 0.25 lux, so the intensity of the illumination above calculated is four times that of bright moonlight.

A 1000-candlepower street lamp mounted 20 ft. high gives a horizontal illumination of 0.079 foot candles, or about 15 per cent less than in above calculation at a distance of 60 ft. This intensity of light will show most road surfaces very clearly and when projected from the lamps on a car will show obstructions on the road with great clearness because the vertical illumination which is effective in illuminating projections is many fold stronger than the horizontal illumination.

To allow for the effect of pitching of the car and to make objects visible beyond 200 ft. some light should be projected from the lamps above the beam striking at 200 ft., although it will not be necessary to preserve the uniformity of the road illumination from here on ahead. If less light is available than that assumed above it will be better to keep a narrow strip down the center of the road up to the intensity calculated to serve as a warning at crossings and let the weakening of the illumination be borne by the sides of the strip. However, it would be better to use more light rather than less.

Avoiding Glare

There is a growing tendency to regulate glare by specifying that no strong beams of light shall be projected above a level of 42 in. more than 75 ft. in front of a car, the measurements to be made on a level road. This is decidedly a step in the right direction in regulating lights. The eyes of substantially every user of the road are well above this level, and it is only when a car pitches on a rough road, thus tilting the beam upward, and when rounding the top of a hill that the beam will shine into the eyes of persons facing the car, and the duration of these flashes will be very short and they will very seldom occur except while the approaching car is at a considerable distance, leaving ample time after the flash to pick out a safe course on the road. No possible adjustment of the lighting can avoid the occasional flash just mentioned and preserve lighting that is either safe or satisfying. At the tops of hills the glare could be eliminated by the installation of very brilliant local street lighting. The flashes from pitching could be remedied by smoothing the street surface.

Frosted Glass Wasteful

It has been suggested that glare be reduced by covering the front of the lamp with diffusing glasses which scatter the light. This is very wasteful and unsatisfactory; it gives a distribution of light which is most intense directly in front of the car and which diminishes rapidly as the distance increases, and is ineffective at a distance. In addition this strong scattered light forms an illuminated curtain which blinds the driver in fogs and in snowstorms. This blinding effect is illustrated in Fig. 3. The dotted line represents the line of sight to a 6-ft. high object in front of the car. The long lines represent a strong beam of 8 deg. spread with the center set to strike the road at 200 ft. The short lines from the lamp represent strong scattered light such as would come from a diffusing glass front or other light scattering means. The particles of fog or snow surrounding the line of sight to an object reflect light back into the eye and prevent seeing the object. Fig. 4 represents how this danger is avoided with a distribution of light in which no strong light from the lamp rises above the top of the lamps set at 3½ ft. The portion of the object above the beam of light is illuminated by the diffused light from the surface of the road. This diminishes very slowly in intensity as we go upward because of the large size of the source.

Illumination by Ordinary Parabolic Reflector

Having described what is desired for good automobile lighting, it will be interesting to examine the results obtained by the ordinary parabolic reflector that has been so much used and point out its merits and its defects.

The ordinary parabolic reflector (See Fig. 13) with the light source centered on the focus gives a concentrated beam of light which is most intense along the axis of the reflector, and which diminishes in intensity as we move away from the axis in any direction. At the edge of the beam the intensity is only a small fraction of the intensity in the center. The distribution is symmetrical about the axis. The angle of spread of the beam is approximately equal to the largest angle which the light source subtends from any point on the reflector.

The spread of a beam varies with the size of light source used. A mathematical point would give no spread, that is, it would give parallel rays. But it must not be overlooked that a mathematical point would also give no light.

Focus Affects Beam

Drawing the light source either forward or back of the focus increases the spread of the beam and also greatly reduces the intensity of the center of the beam. If the light source is moved sidewise from the focus, the center of maximum intensity of the beam moves in the opposite direction.

Fig. 5 represents the beam from a parabolic reflector having an 8-deg. spread mounted 3½ ft. high and set with the axis of the beam striking the ground at 250 ft. The full lines in Fig. 6 represent the intersection of this conical beam with the ground, the area inside the full lines is illuminated by the beam. The beam strikes the ground 38 ft. in front of the lamp and does not have a sufficient width to give good results until a distance about 90 ft. in front of the car is reached; beyond this distance the illumination is sufficient. The beam is high enough to glare beyond 30 ft., so this is not "no-glare" lighting.

Light Lost by Tilting Lamp

Fig. 7 represents this same lamp tipped down 4 deg. below the horizontal so that the top of the beam is horizontal. The center of the beam then strikes the ground 50 ft. in front of the lamp, producing a very bright elliptical-shaped spot of small width. The edge of the beam strikes the ground about 22 ft. in front of the lamp. Fig. 8 is a plan view of the intersection of the beam with the road. The intensity of the road illumination diminishes rapidly beyond the 50-ft. point, and its effectiveness dies off even more rapidly because of the presence of the very bright area around the 50-ft. point. This lighting has just one merit—it does not glare. Its defects are: First, too dim at a distance; second, too narrow everywhere; third, too great inequality in intensity.

Spreading the beam to reduce the intensity of the spot requires that the lamp be tipped more to avoid glare, thus bringing the axis nearer the car and still further lessening the effective distance of the illumination already too short. Tipping the ordinary parabolic headlight as a solution of the automobile lighting problem can be dismissed as absolutely unsatisfactory.

To show definitely the distribution of illumination produced on the road by a representative parabolic reflector and the change produced in this illumination by tilting, I have prepared some carefully computed illumination curves based upon the distribution curve of a standard make of 9-in. parabolic reflector of 1¼-in. focal length with a 20-candlepower 6-volt bulb.

These (on the page opposite) represent the distribution of intensity of illumination on the road. The full line curve with the center of the beam pointed to strike the ground at 200 ft., the dashed curve for the beam tilted down 4 deg. from the horizontal or with the center of beam striking at 50 ft.

Curves Show Illumination

Two curves are drawn for each setting of the lamp, one representing the illumination as measured normal to the beam, the upper curve, the other the horizontal illumination to which the brightness of the road surface is proportional. The normal illumination at any point is always greater than the horizontal, when the beam strikes the ground obliquely as is the case in automobile lighting.

Considering first the horizontal illumination with the 200-ft. setting, there is a very dimly lighted space between the 20-ft. and 40-ft. point. Beyond 40 the illumination is good, reaches a maximum of 0.17 foot candles at 80 ft. and falls gradually to 0.023 at 200 ft., which is equivalent to good moonlight; beyond 200 ft. the illumination gradually dies away. It is to be noted that the normal illumination which comes into play in illuminating a projection or obstacle on the road is still high at 200 ft. and for a considerable distance beyond.

Consider now the horizontal illumination curve of this lamp tilted 4 deg., which is necessary to bring it to a "no-glare" position. There is a dim space at 20 ft., but from there on the illumination rises, rapidly reaching a maximum at 40 ft., which is eleven times the maximum of the 200-ft. setting. It falls rapidly from this point, becoming ineffective beyond 80 ft. The normal illumination also falls off rapidly and is ineffective beyond 115 ft. This illumination is very bad because of its great and abrupt variation. The area covered with sufficient intensity is small and the visual efficiency of the eye is much reduced both on account of the small area and because of the enormous and abrupt variations in intensity.

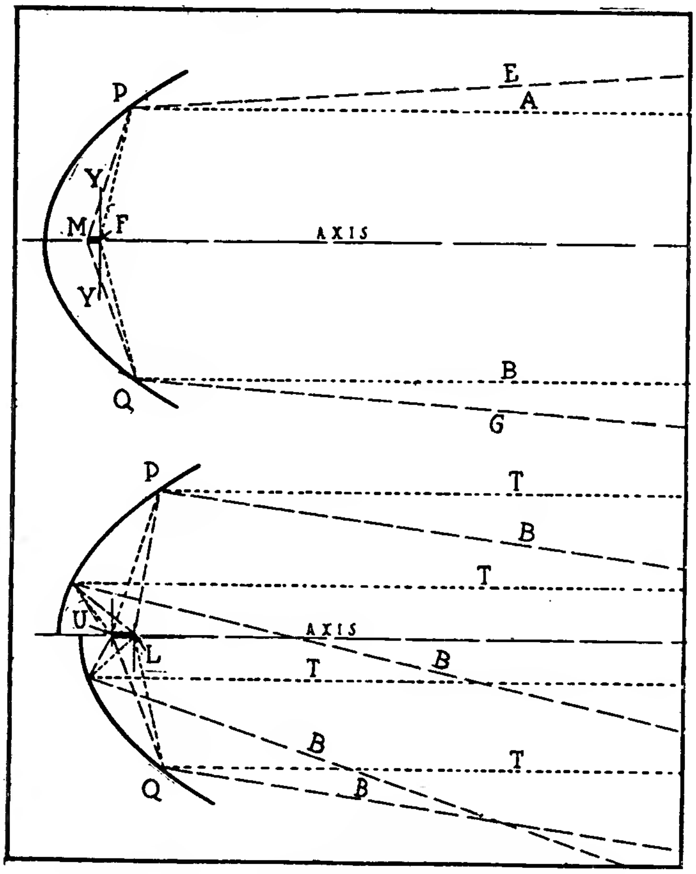
The right hand curves of illumination for the two settings just mentioned, are taken at various distances across the beam. They form a sort of topographical map of the illuminated surface of the road for the two cases.

These curves show that the same enormous increase in variation that existed lengthwise of the beam in the 4-deg. tilt curve also exists across the beam, and the effective width is thereby reduced.

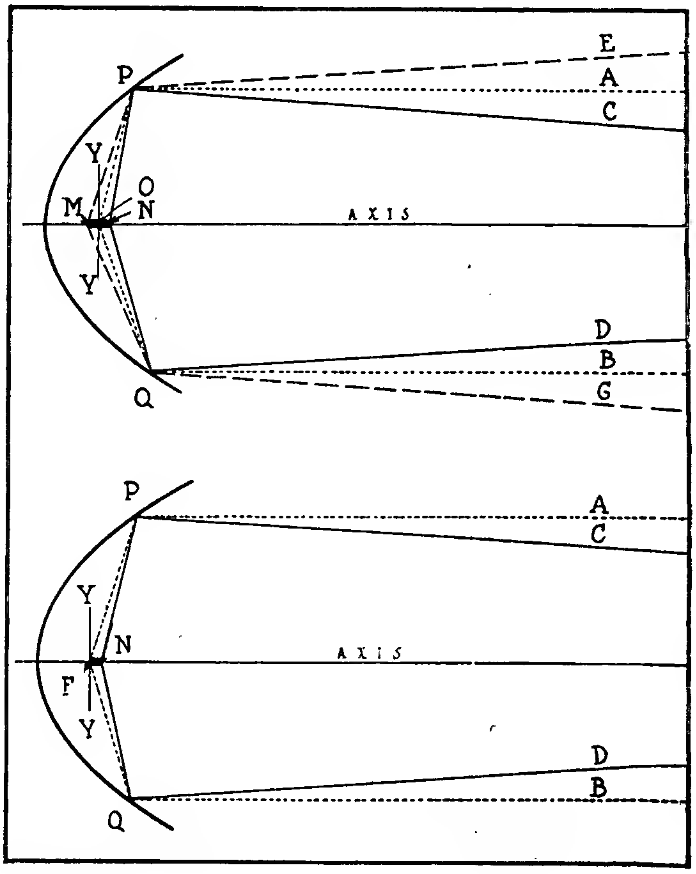
Improved Modifications of Parabolic Reflector

I will now describe how the plain parabolic reflector may be modified to give a more suitable distribution that may at the same time be so directed as to be free from glare. First let us examine more minutely the action of a parabolic reflector. Considering Fig. 11, this represents a section through the axis of a parabolic reflector with a cylindrical filament *MN* centered on the focus *O*. Rays from the focus *O* striking the reflector surface are reflected parallel to the axis, as represented by *OPA* and *OQB*. Rays coming from any other position are reflected at an angle to the parallel ray, which is equal to the angle between the incident ray and the incident ray from the focus to the same point. This follows simply from the law of reflection that the angle of reflection from a mirror surface is equal to the angle of incidence on the mirror.

Thus in the figure the angle *EPA* equals angle *MPO*, also *CPA* = *NPO*, *GQB* = *MQO*, and *DQB* = *NQO*. Similar relations hold for light from any point in the source striking any point on the reflector. It is thus seen that the beam from a reflector is made up of an infinite number of these diverging cones of light coming from all points on the reflector. It will be noticed that light rays coming from points on the filament that are in front of the focus converge toward the axis, and from points behind the focus diverge from the axis. The beam of light from this reflector thrown on a screen will have a distribution of intensity represented in Fig. 13, strongest in the center and diminishing toward the



Figs. 9 and 10, showing effect of dividing reflector

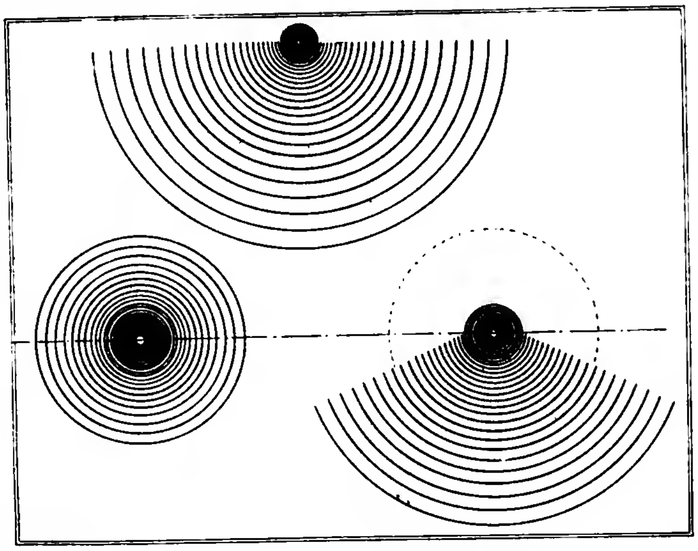


Figs. 11 and 12—Effect of position of filament relative to focal point edge. If the reflector is viewed from a point in this beam not too close to the edge its whole surface will appear brilliant because each point of the surface is sending out a little cone of light which strikes the eye.

If now the half of the filament in front of the focus is removed we have the condition shown in Fig. 9, where all of the little cones of light diverge from the axis, the innermost edges of the cones being parallel to the axis. This beam thrown on the screen would be very similar in light distribution to the beam thrown by the last described adjustment; it has the same spread, that is, covers the same area, but since half the light source has been removed, it is only of one-half the intensity. If we put our eye in this beam a little to one side of the center and view the reflector only one-half of it is bright, and that is the half on the same side of the axis that the eye is placed. The little cones of light all spreading away from the axis do not cross it and strike the eye.

If instead of the front half of the filament we remove the half back of the focus, Fig. 12, all of the little cones of light will converge toward the axis and cross it and diverge from it after crossing. When thrown onto a screen this will give a spot very similar to the one just described, except that it is smaller by the diameter of the reflector (which fact is of small importance in automobile work). The important difference is that when the reflector is viewed as before from a point in the beam a little to one side of the axis, the opposite half of the reflector is bright, and the near half dull. Thus in Fig. 19 the reflector viewed from the point *D* would appear bright on the lower half.

With the filament extending equally on both sides of the focus the cone of light from each point on the reflector spreads equally in all directions from the axis, and if we were to remove any portion of the reflector surface we would simple cut down the intensity of the beam as a whole, but would not change its shape. But with all of the filament to one side or the other of the focus the little cones do not all superpose, but each occupies a definite position in the beam. We can then change the shape of the beam by removing certain of these constituent cones. If, for instance, we take half of the reflector away we have a beam which gives a spot like Fig. 15 without the little hump at the top. This same shape is given with one-half of the reflector with either of the filament adjustments shown in Fig. 9 or Fig. 12. This type of beam has its maximum intensity on the axis and diminishes as we go from the axis outward radially in any direction below the horizontal plane through the axis. Above the plane through the axis the light is nearly all suppressed, since it came from that portion of the reflector that has been removed. It is possible to make the hump that extends upward in Fig. 15 larger by moving the filament toward the focus so that it overlaps the focus more.

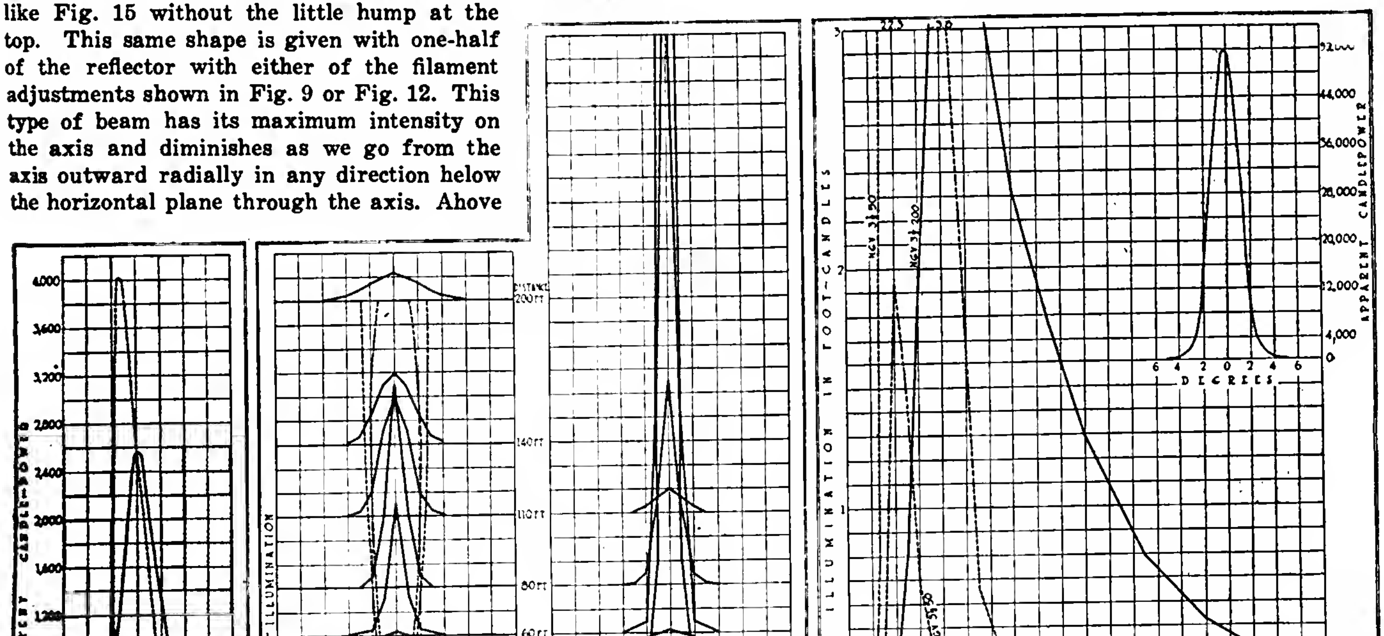


Figs.—Left 13—Right 14—Upper 15

Gives Ideal Illumination

This type of beam gives a closer approach to the ideal distribution desired than any other available. When pointed so that the axis strikes the ground at about 200 ft. and with a center hump large enough to reach up to a 3½-ft. level. The beam gives a broad strip of fairly uniform illumination extending clear back to where direct light from the bulb filament is effective. (This is assuming that the lamp and the filament used are designed to give the proper spread for the mounting height used.) There is no beam light in the glare region above 3½ ft.

(To be concluded)



Illumination curves for horizontal and tilted lamps mentioned on page 414

Anticipating Complaints in Service*

A Scientific Application of Service Experiences to the Prompt Betterment of Production

By F. A. Cornell

INDIANAPOLIS, IND., Feb. 26—How the engineering department of a motor car factory can utilize the complaints which come into the service department to the best advantage in designing new models or making minor changes was explained to the Indiana Section of the Society of Automobile Engineers at the Claypool Hotel last night. This explanation was embodied in a paper presented by F. A. Cornell of the Perfection Spring Service Co., who for a number of years had charge of the service department of the Willys-Overland factory, Toledo, Ohio. Although the title of the paper, "Anticipating Complaints", is the correct one, there undoubtedly would have been a larger number of the engineers in attendance had the author adopted some such title as "How Factory Engineers Can Capitalize on Kicks."

As it was, the service departments of the Indiana car and accessory factories were much better represented than were the engineering departments, a regretable feature inasmuch as both the paper and the lively discussions thereon were full of suggestions and inspirations for the prompt betterment of factory production.

During Mr. Cornell's experience in service and sales work he has developed a plan by which complaints on account of wear and breakage and other difficulties can be charted and segregated by the service department, to convey to the engineering and sales departments exact and immediate information as to the cause and seriousness of any wrong design or materials and show what changes in design, inspection, specifications or factory processes may be needed to correct the fault and thus make sure that the same error is not carried through in later production. The paper (slightly abridged) follows:

The first and easiest step is to build up a complaint system. Through some convenient but invariable path all criticisms should be cleared, analyzed, tabulated, and reported to all interested departments. Grouping of such complaints under several general divisions of car lay-out is too generally used to require further explanation.

But the immediate and vigorous study of these reports is more often from commercial than technical sources. Possibly it seems beyond the reasonable to expect a capable engineer to give ready heed to comments that are so often unfair, and so very seldom thorough. But the fact remains that a Complaint System usually requires the vigorous insistence of a commercial executive before real action is taken.

However, the Complaint System should be retained and supported by another method that introduces mathematical analysis. Possibly all the necessities for replacements might be divided between two general causes: (1) The wear, or (2) the breakage of individual parts. These may be subdivided as falling in one or another of four groups, by the cause of the damage. In further detail these four groups might be adapted to more exact usage along the lines of the following:

Not a single operating engineer might agree exactly with the classifications suggested. They are not offered as a working scheme that should be put into use at once in this form. It is hoped, however, that many such distributions of service damage are now employed. To such executives, this paper will offer a broad opportunity for constructive discussion. To all builders in the world of mechanics this message cannot go far astray: "Get scientifically close to the proofs of your pudding."

Causes for Replacement

Worn (W) or Broken (B).

1. *Inherent Defects.*
    - (*a*) Flaw in Texture.
    - (*b*) Error in Alloy.
    - (*c*) Early Crystallization.
    - (*d*) Wrong Material Specified.
2. *Manufacturing Irregularities.*
    - (*a*) Wrong Material Used.
    - (*b*) Incorrect Treatment.
    - (*c*) Error in Machining, etc.
    - (*d*) Improperly Assembled.
    - (*e*) Lack of Thorough Inspection.
3. *Damaged in Normal Service.*
    - (*a*) Failure of Associated Mechanism.
    - (*b*) Adjusting Assembly not Reasonably Permanent.
    - (*c*) Insufficient Provision for Lubrication.
4. *Damaged in Abnormal Service.*
    - (*a*) Lack of Reasonable Lubrication.
    - (*b*) Lack of Reasonable Adjustment.
    - (*c*) Driving Accident.
    - (*d*) Unusual Driving Damage.

It is true that a tabulation of *all known* replacements offers only an indication of efficiency. Mathematical accuracy could be had only by analysis of *all* replacements. But the repeated contributions of "the kicker" offer opportunities that should be improved as scientifically by the technical departments as they are concluded diplomatically by the selling staff.

The primary point of this paper is to indicate that more attention has been given toward seeing "the kicker" satisfied than in being scientifically certain that each possible cause for complaint is quickly corrected. Let us illustrate how such purposes may be accomplished by sketching the development of a quantity producer's efforts. His scientific scheme was disguised as a game. Even the day laborers became interested in the fluctuation of a "Parts Batting Average."

Developing the System

Each piece returned for replacement or repair was carefully inspected. The cause leading to its condition was reported by the code of our brief (such as W2c, advising the recording and corresponding clerks that the part was worn through an error in machining and therefore in line for free replacement).

It should be noted that those causes that were up to the car owner are listed last as Group 4. It was the plan to exhaust the possible application of any of the rulings under 1, 2 or 3 before refusing credit on the grounds that the factory was not to blame for the damage. It is imperative that fairness be maintained, but that in any case of doubt the customer should be given the benefit and that the manufacturer should carry such doubts as reason for careful watch and study.

This is as far as the ordinary system goes. Now for the "Batting Average." On a proper form, such replacements were tabulated by part numbers. The sub-totals may be taken to show repeti-

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*A paper presented at Indiana Section S. A. E., Feb. 25, 1916.

tions from individual causes. But, better than all, the entire replacements of a part were computed against the total production of that model to the first of a prior month. Should 1200 cars have been delivered up to May 1, and if 12 transmission countershafts, No. 4901, had been replaced up to June 1 of the year, the efficiency of that piece was 99 per cent, and this was shown in the last column of the form.

The Score Board

Such percentage figures make fine information, but more was wanted than to know. A blackboard was placed where the men congregated and the parts leading in non-efficiency were listed thereon in the order of their disfavor. Associated departments soon vied with each other in efforts to excuse the humiliation of leading the list. The jeering remark, "You fellows have a lot of heavy hitters this week," did more to clean out the weaklings than any one other scheme.

Group 1 covered causes within the selection of materials, usually applying to outside suppliers. Group 2 covered errors properly chargeable to a factory department. Group 3 to the engineers and Group 4 to the user. The service department, with sales co-operation, constantly strived to reduce the replacements due to causes within Group 4 by vigorous educational efforts.

But even the "batting averages" and the "score boards" seemed to have limitations. Final and most intensive application of all service experiences was not obtained until the breakage was plotted. This was the effective step *in anticipating complaints*, since the relative efficiency of associated parts was so graphically shown.

The Service Curve

A great many successful enterprises have been developed upon the principle, "the customer is right." While some merchants seem to disagree with so broad a policy there will be a few so stubborn as to deny that many purchasers having a just complaint do not present it to the vendor. Most men want to live agreeably.

It is, therefore, easily possible for some serious faults to go along unchecked unless all the known sources of complaint are tabulated and analyzed. The best trade connections would far rather send in orders than complaints. When they do find fault it is often from just causes that might have been quickly corrected by scientifically cultivating "the kicker."

A careful plotting of a service curve, a broad belief in the fairness of humankind, and a vigorous determination to be sure that we are not at fault before blaming the buyer—all these will go far toward the perfection of car design. The purpose of this paper is to suggest the application of simple and convenient figures as a stimulant to correction before a wide harm is done.

Discussion of Cornell's Paper

Discussion of the paper was opened by E. T. Klee, service manager of the Stutz company who agreed that a system similar to that outlined by Mr. Cornell would be valuable in assuring co-operation between the service and engineering departments, particularly in large organizations where the two departments did not come in contact frequently.

It was the opinion of E. M. Elliot, general manager, Mais Motor Truck Div., Premier Motor Corp., that the chief problem was to make the management of the concern appreciate the truth of the findings of the service department. It was his belief that the service manager ordinarily was made the "fall guy" to placate the owner who complained of mistakes made in other departments.

George A. Weidely of the Weidely engine company, stated that the problem was to get the data in such shape that the management will pay attention to it. He thought that if it was presented in the way outlined in the paper, that it would get attention, and that such a system would go as far as anything to make the American motor car a better car.

Thinks System Good

R. H. Combs, consulting engineer and general traffic manager Prest-O-Lite company and secretary of the section, gave it as his belief that a system such as that outlined would have the desired effect; that this co-operation between the service department and the other departments of the factory was a matter of evolution and will work itself out as the industry grows. The service department was brought into being to relieve the management and the engineering department from complaints, and these departments did not realize the value of the service department from the engineering standpoint.

Service Manager Drew of the Nordyke & Marmon Co., stated the need of appealing to the head of the organization through the expenses of the service department, that it is easier to reach the management through the pocket-book than any other way. He was in favor of a classified accounting system, so as to show the value of the department as a business, distinct from the new car business. He stated that many factories now lump the appropriations to be spent in service work and the accounting is guesswork without any method of knowing the returns from the service department. The expense feature could be worked out showing the cost of each of the various items.

He suggested that a feature that should be taken care of in such a system outlined by Cornell was the analysis of complaints which did not refer to defective parts. This might include such as the construction of the top, or the windshield, or the body design. He quoted Alvin McCauley in the statement that the advertising department has a very close relation to the service department in that the service department must make the car live up to the claims the advertising department has made for it.

Elaboration Suggested

Mr. Cornell suggested an elaboration of the system or rather an extension of its use by which the sales department could tabulate the complaints by territories and thus develop a system for determining what dealers expect too much service attention, such as getting road men to make minor adjustments which the dealers should take care of themselves. This he believes would be of value to the Sales Manager in determining the character of his distributors and dealers.

Commenting on the relation of the advertising and service departments, Mr. Cornell stated that the ideal arrangement was that in force in the Stearns organization when one man was both the advertising manager and service manager. He warned the service men not to rely too much on the dealers' reports, because these were likely to be biased and frequently not made by men of sufficient technical experience to determine whether or not a complaint was just.

He also suggested that it was possible by the system he outlined to put up a danger flag in case there was something radically wrong with a certain part, and thus correct it in a hurry. The service department should take as much pride in getting a complaint as the salesmen do in getting an order.

Asked by Secretary Combs what was done in case broken parts were not returned, the speaker stated that some concerns had a parts auditing service in which traveling auditors examined and passed on defective parts turned in to the dealer and at the same time assisted them in maintaining their parts stock.

Eliminates Mortality

David Landau, consulting engineer of the Sheldon Axle & Spring Co., said that the service department system eliminates the mortality of parts in the new design, and asked upon what basis the efficiency of parts was calculated. That is, what should be the assumed life of a part, or life of a car. In answering this, Mr. Cornell said that the effort was toward making a replacement of parts as nearly constant as possible, that is, in having one part come in for replacement no oftener than others. It is to be assumed from this that Mr. Cornell had as an ideal car one in which no one part wore out quicker than another, and that when it failed, it failed completely like the classic "One-Hoss Shay."

The FORVM

THE QUESTION OF INFLATION—COULD STANDARDIZE BODY DIMENSIONS—GRANT SIX CONFORMS TO AUTOMOBILE'S SUGGESTED PROPORTIONS

Relation of Load Per Wheel to Tire Inflation

By Charles E. Manierre

SINCE the recent publication in The Automobile of my letter advocating the use of oversize tires, a paper by P. W. Litchfield, in the transactions of the Society of Automobile Engineers of 1915, has been called to my attention. Mr. Litchfield, among other things, speaking of the advantages of the oversize tire says:

> "The average car owner never knows what good tire service is until he equips his car with tires one or two sizes larger than those furnished by the manufacturer. Punctures disappear like magic, premature tire wear and carcass failure become things of the past, and riding similar to that of a Pullman car is afforded."

His paper further emphasizes the saving of expense to owners through the use of such tires, and in passing he calls attention to the diminishing liability to puncture as the size of the tire increases.

Incorporated in his paper is a table somewhat similar to that incorporated in the letter of Mr. Parsons, to which I referred in my recent communication. This table gave the proper tire inflation in pounds for tires from 3 to 6 in. in section diameter, and for each section diameter and inflation pressure the corresponding suitable weight to be carried by each rear tire, the rear tire apparently being chosen as having more strain upon it, due to the driving effort, and therefore the inflation suitable for it would be perhaps a trifle more than sufficient for the front wheel.

The table of Mr. Parsons was arranged on the basis of a load per wheel in even hundredweights of 112 lb., for cord tires of various cross-sections, and consequently as to some of the sizes the pressure figured up to odd pounds, e.g. 32, 44, 56, etc. It chanced, however, that for the 3½-in. tire and the 6-in. tire the inflation in pounds increased in multiples of 5, e.g. 30, 35, 40, etc., as in the table of inflation pressures contained in the paper of Mr. Litchfield.

The earlier paper had to do with cord tires, and a comparison of the two shows roughly that allowance in Mr. Litchfield's table, in the smaller sizes, was from 33 to 50 lb., and in one instance nearly 100 lb., less of indicated carrying capacity per wheel, while in the larger sizes, particularly the 5-in., the carrying capacity was as much as 100 and more pounds greater than that indicated in the earlier table. While again, in the 6-in. size the two tables did not differ more than 20-40 lb.

However, these differences rather emphasize the fact that the independent tables had arrived at conclusions not very dissimilar.

The later table indicated the most satisfactory working load and pressure as follows:

In.	Lb. Pressure	Lb. Load Per Wheel
3½	50	515
4	60	750
4½	65	975
5	70	1225
5½	75	1500

It is to be noted that the weight includes both passengers and baggage.

Mr. Litchfield further states that a tire should be reinflated when it has dropped 20 per cent below the recommended pressure. Also that the increase in pressure in a tire on a hot day does not very materially increase the pressure in the tire, but on the contrary that when a tire is pumped up by an engine-driven pump, by which I assume that a spark plug pump is intended, the heat of the air may increase the pressure from 15 to 20 lb. above what would be normal and that with such pumps the pressure ought to be tested an hour after the pumping has been completed.

It is evident that with a touring car, the passengers on the rear seat of which sit directly over the rear axle, a reduction of 10 lb. in pressure might ordinarily be made between the use of the car with the rear seat unoccupied and with the car loaded to its normal capacity, this difference making considerable difference in the comfort of those occupying the front seats on an extended trip. While on the contrary, if all of the seats were to be occupied on some occasion, prudence would suggest a test of the rear tires to make sure that they were properly inflated for the extra load.

Proper Sizes and Inflations

Roughly speaking, it would appear that a 3000-lb., five-passenger touring car should have 4½-in. tires inflated to 60 lb. For a 3600-lb. seven-passenger touring car, the 5-in. tires inflated to 70 lb. For a 4700-lb. seven-passenger touring car, 5½-in. tires inflated to 75 lb., and for a 5500-lb. seven-passenger touring car, 6-in. tires inflated to 75 lb.

No inflation above 75 lb. was recommended, although the carrying capacity of a 6-in. tire inflated to 100 lb. was given as 2280 lb. per wheel.

The Half-Inch Difference

It may be worth while for the reader to consider that when an automobile tire is in place on the machine it carries its share of the gross weight on a flattened section against the ground. This flattened contact with the ground is the shape of an elongated oval, possibly 2 in. wide by 6 in. long, more or less. If the weight sustained by the tire is 800 lb., the oval may have an area of approximately 10 sq. in., and the tire would then be inflated to 80 lb. pressure. In other words, each square inch in contact with the ground would be pressed upon by the earth to the extent of 80 lb., and on the other side, by the weight of the car exerted through the air pressure in the tire to an equal amount. The importance of an additional half inch in tire section is then readily apparent. It will amount to widening the flattened contact substantially the whole additional half inch along the whole of its 6-in. diameter, i.e. 3 full square inches. With 80 lb. pressure this amounts to 240 lb. per wheel, or 960 lb. of added capacity for support for the whole car. The extra ½ in. does not seem much at first thought, but worked out in this way its true importance appears. It also becomes more apparent why a lower air pressure and not a higher air pressure should be used with a larger tire. To produce substantially the same length of flattened oval, the 800 lb. assumed weight on the wheel is to be divided by 13 instead of 10, and the corresponding pressure would be approximately 60 lb.

Using Old Rear Tires in Front

Mr. Litchfield was not specific as to the increased mileage to be obtained by use of oversize tires, but as he speaks of removing from the rear wheels tires which are "almost worn out" and says that they may be run on the front wheels several thousand miles, it is evident that the mileage must be greatly increased. My own very limited experience indicates that it is not less than two or three times that guaranteed by the manufacturer. Of course it is assumed that the driver is reasonable in the use of his brakes and in his speed.

Some years ago it was generally customary for automobile manufacturers to set forth in connection with other details of their cars the weight of the car, but I understand that as there was no standard as to what the word "weight" meant the practice was discontinued, and that the S. A. E. is considering the standardizing of a definition as to weights, which will enable the manufacturers again to state this interesting detail. As a matter of fact, due to additional mechanism and particularly the electric starting systems, the average car for a year or two increased considerably in weight. Attention is again being turned toward the effort to reduce the weight as far as practicable.

Weight Is Important

The weight of the car is, however, as much a matter of interest as the dimensions of the bore and stroke of the engine. It is something which every intelligent purchaser wants to know and which every automobile salesman has at his tongue's end, if asked. A few cars now give prominence to the matter of weight in their advertising. It is to be hoped that this is the beginning of a return to the general stating of that very important item of information, without which it is quite impossible to intelligently consider the matter of the size of tires and the question of the advisability of the use of the oversize.

In conclusion perhaps it should be said that the standard rims admit only the placing of one size of tire and one oversize of tire on the same rim. If the weight of the car is such as to demand anything greater than the oversize, or if it is such that the maker has placed upon it the oversize tire, the only remedy will be the equipping of the wheels with rims suitable to the larger tire. What the diameter of such a tire would be will depend upon the diameter of the tire seat. A 32 by 3½ tire has a rim of 25 in. in diameter. If the oversize 33 by 4 is not sufficiently large then a rim for 34 by 4½ will fit the same seat. A 32 by 4 has a seat diameter of 24 in., which unfortunately cannot be mended. With a 34 by 4 the seat diameter is 26 in., and a change to a larger tire than the oversize will require 36 by 5.

Information respecting these rim sections is given in THE AUTOMOBILE for Nov. 25, 1915.

Loads and Inflations

It seems probable that with the gradual increase of information among automobile drivers as to tire inflation the tire companies will find it practicable to change their method and to issue generally a scale of inflations suitable for various loads. This doubtless would require the action of the S. A. E. in standardizing such a scale, and it will probably be the end of guaranteed tire mileage, for the excellent reason that anyone who cared for the preservation of his tires and adopted the suitable size and inflation would invariably so far exceed the guaranteed mileage as to make the guarantee a matter of entire indifference.

Under this new régime tire troubles and expense would cease to hold the prominent place they now have in the minds of automobile owners.

Gross Carrying Capacity of Goodyear Tires—In Pounds, Per Tire

Infl. Press.		Tire Section Diameter						
Cord	Fabric	3"	3½"	4"	4½"	5"	5½"	6"
27	30	250						
32	35	290	860					
36	40	335	410	500				
41	45	375	460	560	675			
45	50	415	515	625	750	875	1000	1140
50	55	460	565	690	825	960	1100	1255
54	60	500	615	750	900	1050	1200	1370
59	65		670	815	975	1135	1300	1480
63	70		720	875	1050	1225	1400	1595
68	75			940	1125	1310	1500	1710
72	80			1000	1200	1400	1600	1925
77	85				1275	1485	1700	1940
81	90				1350	1570	1800	2050
86	95					1660	1900	2165
90	100						2000	2280

Before pressure drops 20 per cent tire should be reinflated.

This table shows the carrying capacity of Goodyear tires, both cord and fabric, and the proper inflation pressures for any given load. Instead of specifying a certain pressure for different sized tires, the scale provides a pressure adjusted to the load the tire carries.

Standardized Body Design Is Possible

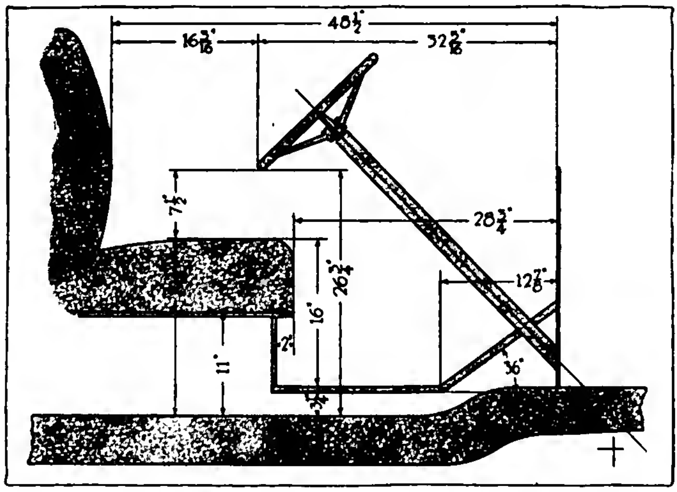
By H. L. Kupel

Bartholomew Co.

THE writer believes that the article in THE AUTOMOBILE for Feb. 3 is very timely as comparatively little attention has been paid to comfort in the past.

The various dimensions as given in the table in this article seem to work out very well after checking them over with our own car, but one dimension which is very important has been omitted, namely, the depth of the front cushion. The writer thinks it is the distance from the front seat back to the pedal that is of prime importance, and we find that for an average person the distance from the front seat back to the edge of the front cushion should be about 17 in. and the distance from the front edge of the seat cushion on a horizontal line to the pedal should be 19 in., as shown in your table. If, however, the front cushion is made of less depth, then the distance from the pedals to the edge of the front cushion should be greater.

I thoroughly agree with Mr. Schipper in the conclusions he has reached in the dimensions that should be maintained, and I think that a front compartment of a body so built will fit almost any ordinary-sized person. The dimensions in the table also are of such a nature that they will permit of slight modifications in order to conform to the peculiarities of certain body designs.



Driver's seat dimensions used for Pierce-Arrow bodies

Good Proportions on Grant

By Jas. M. Howe

Chief Engineer Grant Motor Co.

WE have read Mr. Schipper's article printed in your issue of Feb. 3 with a good deal of interest, and are inclosclosing our corresponding dimensions of the Grant six.

You will see in the main that these dimensions agree fairly close with those recommended. The noticeable variations being that both our front and rear seat heights are carried 13 in. instead of 14 in., using comparatively soft cushions.

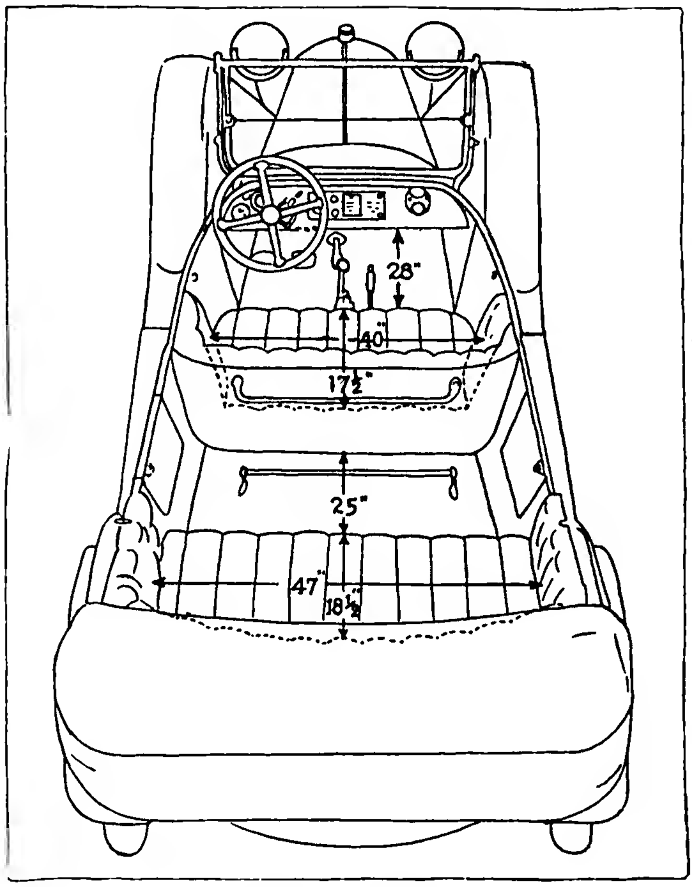
We believe that on a car of our size that 19-in. doors such as we have are ample. With this door we are able to secure a full door without cutting off the rear corner to clear the fenders. With a small six every inch in the length has to be watched very closely so that the space is employed to the best advantage. We have been able to hold our hood length down to 30½ in., which with our bull-nose type of radiator gives us the much-desired long hood appearance as well as a large body with this wheelbase.

In fixing the body dimensions we always set up a dummy and shift the various dimensions until the most comfortable position is obtained, striking a happy medium between the room required by a 6-ft. driver and a small woman. We find we are able to do this very nicely with the exception perhaps of our pedal distance. This is easily taken care of by an extension on the pedal, the other dimensions being comfortable for any size of driver.

There are a number of cars on the market to-day which the writer, who is over 6 ft. tall, is unable to drive with any comfort, the variations in dimensions being very clearly emphasized in the dimensions of the twelve cars that Mr. Schipper has checked up.

It has been our experience that a 21 in. or 22 in. depth of rear seat is too great, as a small person finds such a width uncomfortable. A good deal, of course, depends on exactly how the back is trimmed, but we favor the width of the rear seat not to exceed 19 in. or 20 in. The correct position we believe for the driver is leaning slightly back; the cushion should fit well in the small of his back.

In a number of cars the control levers are altogether too close to the front seat.



Proportions of Grant six

On the whole we feel that your recommendations as to dimensions are well chosen for comfort. With our dimensions we are able to employ the same chassis, with the exception of the rear springs, for our touring car, roadster and cabriolet, the driver's seat in the cabriolet and roadster being at these dimensions, while the seat for the other two occupants are shoved toward the rear 4 in. This works out nicely for three people.

Cast aluminum parts of the new Cadillac coupé body mentioned in The Automobile for Feb. 24

The Rostrum

More About Electrified Chamois Funnels

Editor The Automobile:—Considerable interest has been aroused among motorists by the publication of an article to the effect that the action of straining gasoline through a chamois generated a charge of static electricity sufficient at times to ignite the gasoline and cause disastrous results; and this article has been reprinted and given wide circulation by one of the automobile insurance companies.

In the interest of Marmon owners, the Service Department of Nordyke & Marmon Company have had this situation thoroughly investigated, and eminent authorities seem to agree that there is nothing whatever in the report that passing gasoline through a chamois generates an electrical charge.

In this connection, the report from Arthur L. Foley, head professor of physics at Indiana University, is of interest. Professor Foley writes as follows in answer to the Nordyke & Marmon Company's inquiry:

"Pouring gasoline through a funnel with chamois strainer does not of itself produce a charge, and it makes no difference whether the funnel is supported by a person or by the gas tank. The article is in error in saying that the funnel is grounded when in the tank, and insulated when in the hand. If there is insulation in either case it is more likely when the funnel is in the tank, as the car stands on rubber while the man usually does not.

"As a matter of fact there would be very rare cases, indeed, when both were not grounded for potentials sufficient to produce a spark. But on a day when the atmosphere is very dry as it is unsually on a cold, clear day, a man may become charged by scuffling about on a clean, dry floor, or his clothing may become electrified by friction, as noticed sometimes when combing the hair.

"Under such circumstances pouring gasoline through a funnel, whether or not there is any chamois in it, gives rise to induced charges that are quite too complicated to undertake to explain in a few words. Such charges might fire the gas. Indeed the original friction charge might do so under certain circumstances." P. F.

Indiana University.

Grant Six Dimensions

Part of Car	Key Letter on Chart	Dimension, Ins.
Wheel to front seat vertically	A	8½
Wheel to seat back, horizontally	B	16¼
Front seat, height, vertically	C	13
Shifter to seat, horizontally	D	7
Center of wheel height, vertically	E	27
Pedal to seat, horizontally	F	19½
Shifter level handle height	G	16
Brake lever to seat, horizontally	H	14
Level line of eye and wheel top	J	Over
Must one lean to shift gears	K	No
Must one lean to apply emergency	L	Slightly
Width of front door	M	19
Position of driver in seat	N	Slightly backward
Transverse distance sill to shifter	O	17
Transverse distance sill to brake	P	21
Width of front seat for driver only	Q	20
Entrance space between wheel and side	R	10
Front seat back to rear seat	S	29
Height of rear seat	T	13
Depth of rear seat	U	19
Width of rear seat	V	47
Width of rear door	W	19

Table of Grant six body dimensions which are mentioned in letter from Jas. M. Howe on opposite page

Reboring Cylinders Adds Life to Motor

Editor The Automobile:—I have a 1910 Hudson 20 motor number 1690. It has been thoroughly overhauled, all new bearings in motor with new helical timing gears. What is the make of this motor?

2—I would like your advice on reboring or regrinding cylinders and fitting now pistons.

3—I have never used a self starter but would like electric lights that will stand up while on or in use. Kindly give your advice on generator, etc.

I have used this car several thousand miles with very satisfactory service and I am rather attached to it and do not care to sell or give it away. C. B. F.

Brooklyn, N. Y.

—This motor was made by the Atlas Engine Works, Indianapolis, Ind. Any new parts for it can be secured from the Hudson factory in Detroit.

2—This would no doubt be worth while if the other parts of the car are in good condition.

3—You can install either a storage battery system alone or a generator and battery system. There are a large number of these now on the market which give very good satisfaction and the installation could be made at a moderate expense.

Wheels Gathered for Easy Steering

Editor The Automobile:—Why are the front wheels of an automobile ¼-in. further apart at the rear of the front wheels than at the front?

2—Would it make very much difference on the wear of a tire should this distance vary 1/16-in. either way?

3—If the front wheels are the same distance apart in front and rear, should the tire wear longer? If not so, state why.

4—Should the tire on a wheel that is not cambered give greater mileage than one on a wheel which is?

New York City. J. M. K.

—The slight gather in the wheels is for the purpose of easier steering and for the purpose of keeping the car in a straight course.

2—It would make a noticeable difference.

3—Yes, although the amount of wear due to the normal gather is not enough to be detected.

4—If by camber you mean inclination in the vertical plane, this makes no difference in mileage.

Plugs Must Withstand Heat and Current

Editor The Automobile:—What are the requirements of a first class spark plug, porcelain or stone?

2—How much heat must the insulation stand and how much current should it take to break down same?

Bridgeport, Conn. A. E. W.

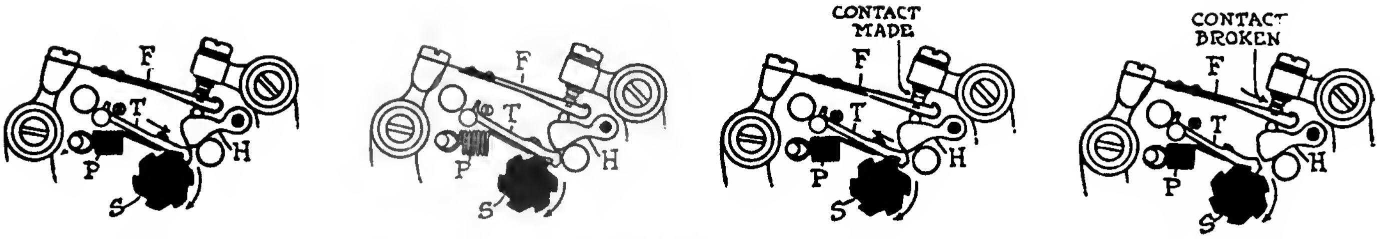


Fig. 1—Diagram showing the phases of operation of the Atwater Kent breaker mechanism and illustrating the open circuit system

—That the insulation does not leak, that the shell is not cracked by tightening the spark plug nut and that the plug does not foul or the points rapidly burn away.

2—The insulation should stand heat up to the temperature of red-hot iron and the dielectric strength must be at least 10 per cent above the possible electric pressure in the high tension system.

Speedster Body on 1915 Franklin Chassis

Editor The Automobile:—Would it be practical to put speedster body on a Franklin chassis 1915 model?

2—Would this outfit operate satisfactorily with a gear ratio of 3 to 1 on high and what speed would this give?

3—Would a Franklin motor be capable of sustaining speeds of 50 m.p.h. or better for any considerable length of time? F. S. W.

Ithaca, N. Y.

—It would be practical to put a speedster body on the 1915 Franklin chassis.

2—The gear ratio of 3 to 1 on high could be used satisfactorily but the speed that the car could make would depend altogether on the condition of the motor.

3—This again is a question of the motor which could no doubt be tuned up to fulfill these requirements.

Operation of the Atwater Kent Timer

Editor The Automobile:—Why is it that the Atwater Kent timer is said to work on the open circuit system; is it because of the way in which the circuit is broken? Kindly explain by diagram.

Philadelphia, Pa. H. R.

—The operation of the Atwater Kent circuit breaker is on the open circuit principle because there is no sustained primary circuit. The contact is made and broken immediately in contra-distinction to the closed circuit in which the contact is remade immediately after breaking.

The operation of the circuit breaker is shown in Fig. 1. The cam wheel *S* has as many notches as there are cylinders and every time one of these notches operates the tripping action an explosion occurs. The notches pull the piece *T* in the direction of rotation of *S*. The piece *T* rides up on the surface of the notch in *S* and finally slips off, being pulled back with a snap by the spring *P*. As it snaps back, the piece *T* strikes the part *H*, which in turn hammers against the spring *F*, making contact for the briefest possible interval. Contact is immediately broken and the circuit is again open.

Piston Displacement per Mile Measures Consumption

Editor The Automobile:—Is it possible to calculate with any degree of accuracy the gas consumption of a car, given the cylinder displacement, geat ratio, and wheel diameter? It seems to me there should be some very definite relation among these factors, yet the results I get from figuring do not tally at all with the actual road tests. What is wrong with my figures?

Thus:

My car, an Oakland, model 50, Northway motor of 346.4 cubic inches displacement, has a gear ratio on direct drive of 4:08 to 1; and 34 x 4½ tires. It is evident that in a mile of 5280 feet, the rear wheels will have to revolve approximately 593.25 times to cover the distance. The gear ratio being 4.08 to 1, the engine turns over approximately 2420 times in the same distance. Each time the engine turns over, one-half of the eight cylinders are fired, from which it appears that its total displacement of gas for this mile is 242.65 cubic feet, or 419,270 cubic inches.

Assuming that the mixture is 1.5 per cent gasoline vapor (the thinnest that can be depended on to explode), this would mean that approximately 3.64 cubic feet of gasoline vapor are required for the mile.

According to Sci. Am. Supp., Dec. 11, 1916, one gallon of gasoline, 70° Baume, gives 25 cubic feet of vapor. If this is true, then the actual miles-per-gallon of this car, figured on a volumetric basis, is less than 7½ miles to the gallon.

As a matter of fact, this car will do 12 miles to the gallon on a fairly level road, in actual practice.

Figuring the same proposition on another basis, that gasoline and air form an explosive mixture at the rate of 1 in 10,000, then 41.927 cubic inches of gasoline would be consumed in one mile. This gives a mileage of approximately 5.5 miles per gallon.

Let us go at the question in still another way: A gasoline engine giving a horsepower-hour on a pint of gasoline is considered an efficient engine. But how does this fit when applied to the case in point? At 2420 r.p.m., according to the above figures, my car travels 60 m.p.h. At 1210 r.p.m., it should travel at 30 m.p.h.

Now, according to the formula $\frac{D^2 N S R}{15,000}$ this motor should develop 35 hp. when running at 30 m.p.h. At a pint for each hp. hour, this would mean 35 pints of gasoline, or 4⅜ gallons, which gives us a mileage of 6.85 miles to the gallon. Again we are away off from road results.

The factors in the first example seem to be fixed, positively; the engine must turn over 4:08 times to each revolution of the rear wheels; and the engine must consume 173.2 cubic inches of gas at each revolution. So it seems. Yet only recently we were told that a Cadillac showed approximately 20 miles per gallon at 15 miles per hour, and only 6 or 7 miles per gallon at 60 miles per hour. Does the gas become richer at high speed? Carburetor engineers tell us they strike to make it thinner. Skin friction and inertia are at the maximum at high speeds. Then why is not volumetric efficiency higher with high speeds? Apparently, from the Cadillac and other tests, it is lower—practically varies in inverse proportion with miles-per-hour.

If this question is sound, I should like to see it discussed in The Automobile by some of your experts. If it is not sound, throw it away. I am one of a large body of your readers who, as automobile owners, without technical education, find in your magazine the final spice necessary to make perfect the joy of owning and operating and keeping their cars in good condition. Therefore, please tell me why my car is more efficient on the road than it is on paper.

New York City. A. I. A.

—In your first test where you have calculated the amount of gasoline drawn into the cylinder in a mile, there are two important factors which you have neglected. First, the amount of air used is far in excess of the theoretical combustion limit and if only the theoretical amount of air were admitted to the cylinder the mixture would be too rich for practical purposes. As all the oxygen in the air is not combined with the fuel in combustion, it has been found necessary to supply a considerable excess of oxygen in order that best results be obtained.

The second point you have omitted in your calculation is the volumetric efficiency of the motor. If this efficiency coefficient is 0.85 or 0.9 it is quite evident that you will get much less actual displacement per mile than you do theoretical.

On your second test you have calculated on a full throttle opening which is not the case always at 30 m.p.h. and certainly not with your car, if it is capable of traveling 30 m.p.h. Normally the amount of gas passed by the engine is between 0.3 and 0.7 the calculated total. The pressure of the atmosphere is insufficient to charge the cylinders fully during the short time the intake valve is open and also the exhaust gas left in the cylinder is a little above atmospheric pressure, so delaying the commencement of intake.

Non-Poppet T-Head Motor

Editor The Automobile:—Is it possible to have a motor of T-head cylinder shape without poppet valves? In order to do this it would be necessary to have sleeve valves on each side of the cylinder and I would like to know if this has ever been done.

New York City. C. G. S.

—The double-rotary valve shown in Fig. 2, is a good example of T-head motor without the poppet valves.

Timing of Model 19 Buick of 1910

Editor The Automobile:—Will you kindly give me a diagram showing the timing of a model 19 Buick? I think this car was built in 1910. F. D.

Warwick, N. Y.

—Model 19 Buick is properly timed when the piston is 1/16-in. past upper dead center and the inlet valve opens when the piston is 3/32-in. past upper dead center. These measurements should be taken with a clearance of 0.005 in. between the ends of the valve stems and rocker arms when both valves are fully closed.

These measurements are taken by removing one of the valve cages and measuring the piston travel in the cylinder with an ordinary scale.

Enger 6-50 Used Salisbury Axle

Editor The Automobile:—What make of rear axle did the Enger model 6-50 use in the 1915 cars?

2—What make clutch?

3—What transmission did they use in the 1912 Enger cars? J. F.

Wilkes-Barre, Pa.

—The Salisbury rear axle was used.

2—Mechanics Machine Co., multiple disk dry plate type.

3—Milwaukee unit power plant.

Velocity Depends on Motor Speed and Ratio

Editor The Automobile:—How can a machine with 4 sq. ft. of head resistance travel faster than one with 6 sq. ft. if the motor speeds are the same, as are also the weight of the machines, horsepower, gear ratios and size of wheels?

2—If the maximum speed of a motor is 4200 r.p.m. with gear ratios and horsepower the same in both instances, would reducing the head resistance increase the speed of the car? L. H. A.

Battle Creek, Mich.

—If the motor speeds are both *the same* and the gear ratios and size of wheels are both *the same* both machines must travel at the same speed regardless of *any* other factors.

2—If *the same* maximum motor speed is obtained the gear ratios being constant, the speeds must be equal, but neither the same maximum car speed nor the same *motor* speed would be obtained in two cars with different head resistance but otherwise identical.

Wear Varies with Pressure and Speed

Editor The Automobile:—Is the wear on a bearing in proportion to the square of the pressure?

2—Is the wear in proportion to the speed?

3—The Diesel engine seems to be an ideal engine judging from what I have read of it. Why are they not used in automobiles?

4—What are the objections to kerosene?

Jersey City, N. J. O. T.

—No, inversely as the square of the diameter.

2—Yes.

3—The satisfactory automobile unit has not been as yet evolved although there are many engineers who believe that the Diesel principle will be incorporated in the eventual automobile power plant.

4—It cannot be handled satisfactorily with the present methods of vaporization as employed in automobile practice. There is no doubt that the kerosene motor is not nearly so far off as its present absence would seem to indicate.

Car Should Travel 350 Miles to Gallon of Oil

Editor The Automobile:—Will you kindly answer the following questions on Studebaker Six, 1914?

1—How many miles should this car get on a gallon of gasoline with a lean mixture?

2—How many miles will this car get on a gallon of lubricating oil?

3—How can I lower the rake of the steering wheel and column, also the front seat, as I would like to sit about 3 or 5 in. lower. F. M.

Philadelphia, Pa.

—You should average in the neighborhood of 10 miles per gallon.

2—The Studebaker Corp. states that owners should get about 350 miles per gallon of oil.

3—It is suggested that you have a thinner front seat cushion made and an extension bracket for the steering post.

Motor Misses at Low Speeds

Editor The Automobile:—I have a 1914 Baby Grand Chevrolet. It misses at low speed whether running idle or pulling the car. The miss is approximately one shot out of

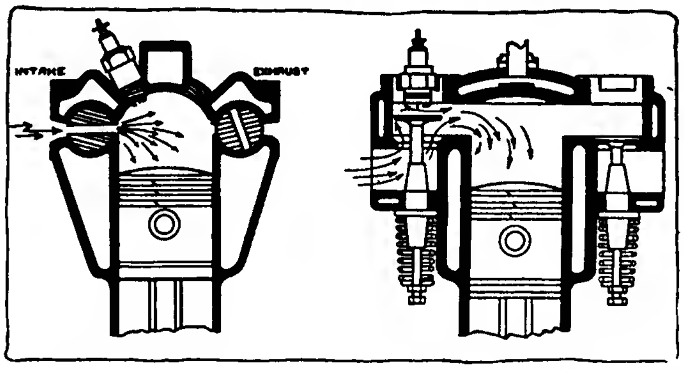


Fig. 2—T-head rotary and poppet motors, left is Mead type

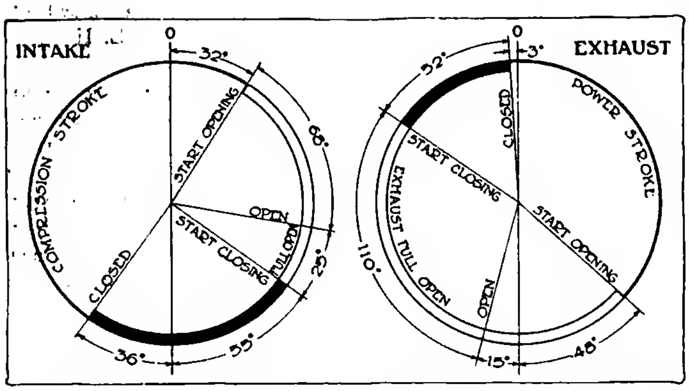


Fig. 3—Timing diagram showing intake opening delayed after exhaust closure

four. Sometimes two miss together, and there is nothing regular about it. After the car is running 20 m.p.h. and faster it runs perfectly and for all speeds higher. This has been acting so for nearly a year. It never refuses to go and starts very easily. I have installed a Schebler carbureter but to no great advantage. I have had it in shops all over central California, San Francisco included. F. H. E.

Woodbridge, Cal.

—It would seem that the ignition system was deranged in some way as to cause a momentary interruption in firing at scattered intervals and it is advised that this be overhauled. Eliminate spark plug considerations by trying a new set of plugs. Then borrow a new timer from another Chevrolet and try this. The same process may be used with each of the ignition units. Sometimes a loose part in a switch will cause uneven firing due to momentary interruption of the current. Faulty insulation or terminal connections give the same indications. Do all the valves close properly? If one should stick or hang up a few thousandths of an inch it would cause the trouble.

Late Intake Creates Vacuum in Cylinder

Editor The Automobile:—Why do some of the manufacturers leave the intake closed for some time after the exhaust valve is closed? Do they not cut down on volumetric efficiency by so doing? M. S.

Ilion, N. Y.

—The reason for the delayed opening of the intake is to create a vacuum in the cylinder which will cause the inlet gases to rush in and fill the cylinder. It takes a noticeable amount of suction to overcome the inertia of the gases and this vacuum is left for the purpose of overcoming this inertia. A diagram showing a late intake opening is illustrated in Fig. 3.

Offset Crankshaft Not Used Extensively

Editor The Automobile:—Has the offset crankshaft been discarded from four and six-cylinder engine design in the auto world?

2—Did not this feature tend to make a more compact motor and also to even up the pressure on the cylinder walls due to a greater connecting rod angularity on the up stroke and less angularity on the down stroke?

3—How does the Cothias process differ from conventional die casting practice?

4—Is the speed in r.p.m. used to designate a high speed motor its maximum speed or the speed at which maximum power is delivered? H. S.

Ann Arbor, Mich.

—Practically entirely, although there are a few still in use.

2—In practice this feature did not seem to give any noticeable advantages.

3—By the use of secret details which allow the use of aluminum, which contracts on cooling, instead of a babbitt, which expands.

4—Generally.

Mixed Fuels Are Generally Undesirable

Editor The Automobile:—Would it be feasible to mix kerosene with gasoline to use in a gasoline motor car providing the fuel is heated and a small jet of steam was let into the intake manifold? If so, about what proportion of gasoline and kerosene? H. C.

Riverton, N. J.

—It is better not to use a mixed fuel but rather one of lower gravity which would give the corresponding fuel. The jet of steam would hardly produce the desired results in automobile practice.

Parents Responsible for Minor's Action in Car

Editor The Automobile:—Please inform me if the owner of a car can collect damages if his car is run into while being driven by his son, who is not quite sixteen years of age, with his father's permission. The car was on the right side of the road when hit and was less than 4 ft. from curb. Road was 24 ft. wide. W. T. L. TB.

Newburgh, N. Y.

—While this is a matter for the courts to decide, it seems right that the father can collect damages. Not long ago, a father was compelled to pay damages for an accident which occurred while his son was driving the car without the father's permission. It seems reasonable that the law should work both ways.

Tire Sizes Used by Studebaker

Editor The Automobile:—Can you tell me the different size tires the different Studebaker cars take, from the first model up to the present ones? Also, the number of cars made by this corporation under the name of Studebaker from the first up to the present time or for the close of the year 1916, etc.? W. M. S.

Detroit, Mich.

—The table herewith gives you the size of tires used by the different model Studebakers from 1907 until the present date. It is impossible to state the annual output of the Studebaker company for all these years.

1907

Model	Tires
40 hp	34 x 4
35 hp	34 x 4
15 hp	34 x 4 and 4½
30 Elec.	30 x 3

1908

No information

1909

Model	Tires
A 27 hp	36 x 4
B 36 hp	34 x 4½
D 36 hp	36 x 4½
D 36 hp	36 x 4½
B 36 hp	34 x 4½

1910

Garford Model or G-7

Front	Rear
36 x 4	36 x 4½

1911

Model	Front	Rear
G 8 36.1	36 x 4	36 x 4½
G 8 36.1	36 x 4	36 x 4½
G 10 28.9	36 x 4	36 x 4
A 25.6	34 x 3	34 x 3½
B 36.1	34 x 3½	36 x 3
C 36.1	34 x 4	36 x 3½

1912

Went under name of Garford

1913

Model	Front	Rear
20 20.30	32 x 3	32 x 3
25 19.60	30 x 3½	30 x 3½
30 25.60	32 x 3½	32 x 3½
35 27.25	34 x 4	34 x 4
Six 29.40	34 x 4	34 x 4

1914

Model	Front	Rear
Four 19.60	32 x 3½	32 x 3½
Six 29.40	34 x 4	34 x 4

1915

Model	Tires
4-SD 19.61	33 x 4
4-SD 19.61	33 x 4
6 29.45	34 x 4
6 29.45	34 x 4

Which Front Tire Wears First

Editor The Automobile:—Which will wear the longest, the right or left front tire under ordinary conditions? C. L. M.

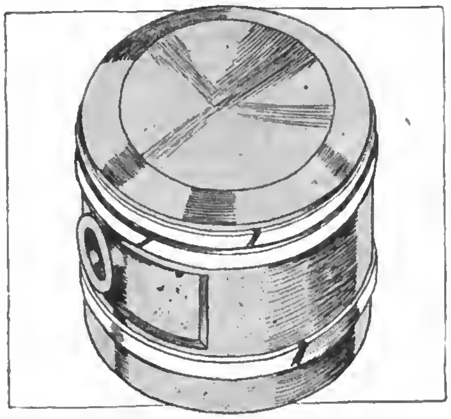
Osco, Ill.

—There will be very little difference in the wear of the two front tires. The fact that the driver usually sits on the left side and frequently is the only extra weight in the car would tend to cause slightly more wear on the left tire. On the other hand, the fact that most of the turns are made to the left, when turning around, would cause the right tire to travel the greatest distance, and, on this basis, it would wear more quickly. Taken all in all, the wear is about equal, in ordinary cases.

ACCESSORIES

Abcilium Alloy Pistons

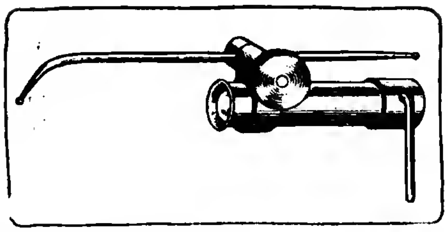
BY the use of the metal abcilium, pistons are obtained which are claimed by the manufacturer to be 70 per cent lighter than cast-iron pistons of the same size. A manufacturing feature of advantage is that the use of expensive dies is said to be unnecessary, the makers recommending sand-cast abcilium pistons, stating that their density is so great that each will withstand an hydraulic pressure of 80 to 100 lb. from within. This feature also eliminates the expense entailed by changing patterns, etc. Abcilium pistons are said to absorb oil under pressure, this oil oozing out again when the pressure is relieved. The maker declares that abcilium pistons have run for from 60,000 to 70,000 miles without showing signs of wear. Other advantages claimed for these pistons are: increased power, acceleration and speed with a corresponding decrease in fuel and upkeep expense; decrease of strain on crankshaft and connecting-rod bearings and bolts; reduction of carbon incrustation; and durability to the extent that none of the parts wear out of shape under severe service and extreme heat.—A. B. C. Castings Co., Cleveland, Ohio.



Abcilium aluminum alloy piston

Kander Test Indicator

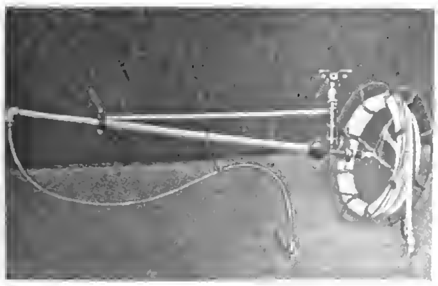
A pointer adjustably clamped on a metal tube containing a flash-light battery and a small bulb comprise this device. The instrument is so mounted, when in use, that the needle can be brought close to the surface of work running in the lathe or other machine tool. If there are high spots the pointer will touch them and thereby ground the lamp, which will flash and indicate the high spot. It sells for $2.50.—J. G. Kander, Reading, Pa.



Kander flashlight test indicator for machine work on lathes, etc.

Gaylord Combination Washers

This consists of a swivel washer, at one end of which is a hose reel carrying from 50 to 100 ft. of hose, which is connected with the water supply, and at the other end, a 10-ft. hose with an automatic spring valve at the nozzle. The water is turned on in the hose on the reel by pulling the hose. By the use of the two outlets, two men can work on a job at the same time; or the reeled hose may be kept for fire purposes, for which it is especially suitable because of the ease with which the water is turned on. A plain revolving washer is also made without the reel and automatic attachment at prices ranging from $12 to $30. Both types may be had with or without electric lights. Prices $25 to $50. —Gaylord Sanitary Mfg. Co., Rochester, N. Y.



Gaylord combination washer

Affinity Cleaner

No water is required in using this compound which is said to effectually clean oil and grease from the clothing and hands. It has a pleasant odor and is not injurious in any way according to the manufacturer.—Affinity Cleaner Co., Omaha, Neb.

Apco Fender Brace for Fords

The Apco fender brace, besides preventing the fenders of a Ford car from rattling, is designed to seal the space between them and the aprons. The brace is a heavy strip of pressed steel which fits well, being held in place by special screws which are easily attached. Besides increasing the rigidity of the fender, the brace prevents water, mud, etc., reaching the running-boards. Four of the braces comprise a set, including the screws, the finish being baked-on black enamel. The braces list at 50 cents.

The new Apco emergency brake handle for Fords is claimed to be an improvement over the ordinary handle in being more positive in action, fitting the hand, and in appearance. Complete with attachments and ready for fitting, it sells for 60 cents.—Auto Parts Co., Providence, R. I.

Pee-Gee Paint for Fords

The outfit consists of 1 qt. of flat black, 1 qt. of top black, 1 pt. of top dressing, coarse and fine sandpaper and a 2-in. brush. It sells for $3.—Peaslee-Gaulbert Co., Louisville, Ky.

Hansen Air Chucks

The Service chuck provides an automatic connection between air hose and valve stem and is fitted with a mushroom valve which is opened by the valve stem and which closes as soon as the chuck is removed from it. It lists at $3.

The Hansen hose connection is designed for smaller garages and use on portable tanks. It grips the valve stem by a soft rubber sleeve which prevents leakage. Price, 80 cents. The same connection may be had with a pressure gage and by pressing down on the gage the exact pressure in the tire may be read. Price, $2.—Hansen Mfg. Co., Cleveland, Ohio.

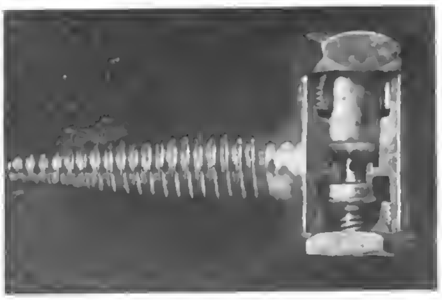
Lewis Nojar Clock

This clock is contained in a rubber case which protects it against road stocks and car vibration. Stem wound and guaranteed for two years, it is made for all makes of cars, the Ford model being attached to the steering wheel and selling for $2.50, while the others are put on the dash and sell for $3 each.—Pennsylvania Rubber Co., Jeannette, Pa.

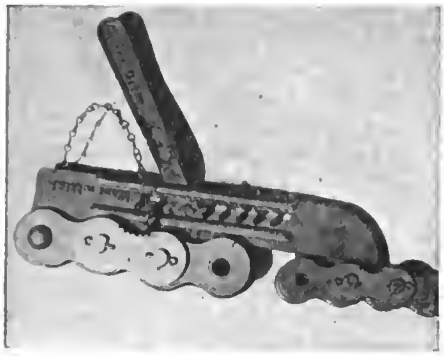
B-G Spark Plug

A spark plug that is unusual not only in outward appearance but in its internal construction is the B-G Non-shortable, recently placed on the market.

Two factors give the plug its outward novelty; it is copper plated for protection and to permit easy unscrewing when tightly set up and the wrench faces are



Hansen Service automatic air chuck



Meyer tool for repairing broken motor truck drive chains

carried high to give the wrench a chance when the plug is inserted in a deep recess.

As for the interior, the central electrode is not an ordinary metal rod, but is composed partly of a carbon compound packed into a recess in the porcelain. The manufacturers claim that this has the effect of greatly enlarging the spark and of so affecting its character that it will not short-circuit through a carbon deposit on the insulation. The porcelain is inclosed in a double bushing designed to overcome breakage at the shoulder. The plug is assembled with the main bushing and porcelain in place and melted metal is poured between the bushing and the porcelain, making a close fit and a firm support for the porcelain. The exposed part of the porcelain is corrugated to increase the surface area. Plugs are packed in a metal can with a ferrule to protect the points which, by the way, are of the highest grade meteor wire. All standard sizes, $1.50 each.—Batchelder-Gallant Co., Boston, Mass.

Queen City Portable Garages

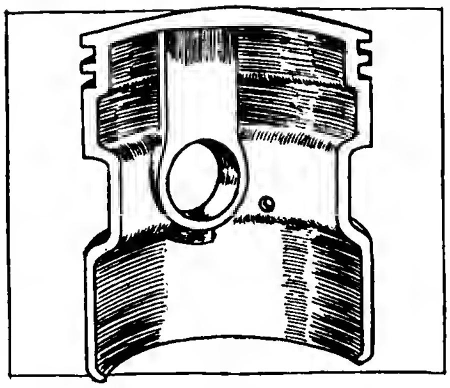
These garages are built of wood in sections and are put together with bolts, a wrench being the only tool required. Studding and rafters are of hemlock, siding of yellow pine and roofing of rubber; trim is white pine, doors glazed and paint may be of any color without extra charge. No floors are included. Price, 10 by 16 ft., $65; 18 by 16, with double door, $120.—Manufacturers Outlet Co., Buffalo, N. Y.

Meyer Chain Connector

It is always a great deal of trouble to bring the ends of a broken motor truck driving chain together, and it is practically impossible to draw the two ends together by hand in order to slip in the link pin. This prompted the invention of the Meyer chain connecting tool illustrated herewith in the act of drawing the ends of a broken chain together. The head of the tool terminates in a hook that is placed behind the first link and there is also a hook on the end of the lever, this catching the other end of the chain. Thus the slack in the chain is drawn up by the lever being moved forward from notch to notch in the main part of the tool, this working on the dog-and-ratchet principle. When the two parts of the chain are brought together, it is an easy matter to slip the pin in place. The device is made for small trucks at $2 and for large trucks at $3.—H. T. C. Meyer, Detroit, Mich.

Green Aluminite Pistons

These pistons are of an aluminum alloy, which, according to the makers, permits fitting with a clearance of 0.0014 per in. of diameter without danger of scoring even under hard conditions. The metal machines freely, has no pin holes and becomes glazed on the surface with a skin which is said to be better than that of cast iron. A feature is the use of stiffening ribs extending from the head to the piston pin bosses, having no connection, however, with the side walls. The effect of this arrangement is to minimize distortion through expansion.—Green Engineering Co., Dayton, Ohio.

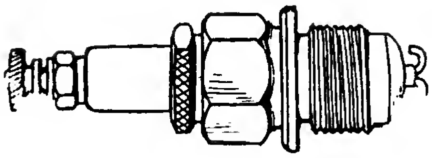


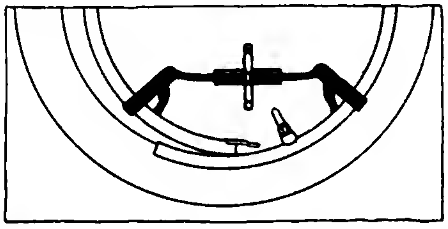
Green Aluminite piston construction

Niswander Rim Remover

This tool for removing demountable rims easily and rapidly contracts and expands the rim by a specially-threaded hand wheel. This gives an even, steady pull, contracting the rim from 1 to 4 in., and the rim hooks and braces are so constructed that the harder the pull, the tighter they grip the rim in either operation. The device folds to a length of 10 in., and although strongly made, it weighs but 2½ lb. and can be easily carried in the coat pocket. The rim hooks are of carbon steel and have sufficient spring to adjust themselves to rims of any width. Nickel-plating and high polish prevent the accumulation of rust. The maker guarantees the tool to work successfully on rims of any size or make. It sells for $3.—Niswander Mfg. Co., Quincy, Ill.

A Queen City portable garage





Above—3-X spark plug. Below—Niswander rim remover

3-X Spark Plugs

The 3-X is a heavy plug with steel shell and packing nut and blue porcelain insulation, the central electrode being split and turned back, forming two sparking points from which the current jumps to the surface at the end of the shell. The opening into the chamber back of the points is a small slot. The terminal at the top is of heavy brass and will take either spring clips or plain terminal tips. All regular and special sizes are made, selling for $1 each.—3-X Spark Plug Co., Chicago, Ill.

Giles Tire Valve

This is a tire valve which will perform all the functions of that part and will also take the place of a pressure gage. The Giles valve shows through a slot in its stem figures indicating the air pressure in the tire.

The valve itself is of the conventional type. The stem, however, is smaller in diameter than usual. A flat, thin-walled tube is coiled about it, the lower end of which is anchored while the upper end is left free with a dial attached.

The upper end of the tube is closed and the lower end communicates with the interior of the valve, thus being under the same pressure as the tire itself. The operation of the gage is the same as that of a steam gage, the pressure tends to uncoil the tube, and the dial is turned according to the pressure. The reading slot is placed at the top in the outer stem. Price, $1.25.—E. M. Giles, Peoria, Ill.

The AUTOMOBILE

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Laying the Foundation

BUILDING an industry, like building a nation, consists in rearing the structure of progress upon the foundations laid by the pioneers. It is to these pioneers and to their early experiments and environment that the heirs to the results of their work must turn from time to time to express gratitude for benefits received. Great sacrifices have always been made in foundation work.

Citizens of the United States have set apart certain days dedicated to those who have by their personal sacrifices, potential personalities and genius furthered the interests of their country. Every school boy is familiar with the names of the thirteen colonies that founded the great union which now spans the continent. Certain men and certain environments are beacon lights in the history of development and it is fitting to render expressions of recognition and gratitude to those patriots and to the scenes of their great activities.

Hardly second in importance to the building of a nation is the building of a gigantic industry which is of benefit to the entire world, constituting a very arc light illuminating the onward path of civilization. Just as the nation has its great founders who with wonderful foresight and determination lay down the lines of progress for the future, so has the industry its great pioneers who often made a life-long sacrifice to attain some little detail of advancement which has proved the key which has opened the gates to triumph in progress. Just as the nation has its hallowed ground upon which great deeds of war or peace were enacted, so has the industry its cherished localities where perhaps the cornerstones of great eras in development were laid.

To-day we turn to New England. Its history is the history of the country. New England, the scene of witchcraft and the whipping post, has had its darker days, but the accomplishments which have originated in that fair country and which are now reflected in its wealth and prosperity, in its wonderful manufacturing activity, are the rewards for the endeavors of the pioneers who have blazed the trail.

Cut the Gas Bill

EVERY experienced automobile man knows that, if they will take the trouble, users of cars can save a large proportion of their gasoline by taking proper precautions. At the present time, with gasoline at almost famine prices, it seems highly desirable that the subject of economy should be brought very forcibly before the user. The user of an automobile is in constant touch with dealers and garagemen, and in fairly close touch with the factories through their sales and service departments. This being the case, there is a great opportunity for the industry to educate the user so that he can reduce the fuel bill for his car.

There is no need to go into the matter in detail. A little skill allows the use of a far leaner mixture than is employed by the average man in ordinary running; keeping the valves, the ignition and the lubrication in proper order makes for efficiency and so saves power waste; care in one way or another is rewarded by the need for less gasoline to do a given mileage.

This is the most vital matter the industry has before it to-day. Never before have the men who act as "guide, philosopher and friend" to the user had to give close study to this economy question, but if they do not strongly buckle to just now, they will be failing in their duty and failing to grasp an opportunity for action which will react upon their own fortunes by giving the industry some very real assistance.

Every salesman and every dealer to-day ought to do all in his power to become an expert on the subject of saving gasoline, so that he can quickly, and accurately, furnish advice when it is sought. The day when the prospect's first question will be "how many miles to the gallon?" is not far distant, and the trade should, nay *must*, be prepared to give an answer that can be substantiated.

Nor should the automobile industry be content to let the matter rest there. Car manufacturers and engineers should redouble their efforts to reduce in every way possible to constructive and designing science the gasoline consumption of their cars. Everyone should realize that the matter is one which vitally concerns the continued success of the industry.

1915—Big Year for New England

Car, Truck and Accessory Factories in This Territory Break All Records

BOSTON, March 1—Taking inventory of the activity of the New England automobile, trucks, parts and accessory factories during the past year, the great increase in the industry and the unprecedented activity of the factories stand out conspicuously. All factories have been busy, and many parts manufacturers have operated on a 24-hr. schedule. Fully 100 per cent of New England manufacturers have increased production from 100 to 500 per cent, and 90 per cent of them have increased the factory facilities. In the vehicle field, Locomobile has had a particularly busy year with its truck work, and its car output has increased. Metz has added 160,000 sq. ft. to its factory at a cost of $300,000. Knox has expended a great deal of effort on its four-wheel tractor business. Stanley has increased its production.

Parts Field Active

In the parts and accessory field equal activity is found. The Connecticut Telephone & Electric Co. has added 40,000 sq. ft. manufacturing space at an expense of $50,000 and has added $25,000 equipment. The Pittsfield Spark Coil Co., formerly located at Dalton, is now located at Pittsfield with increased manufacturing facilities.

The New Departure Mfg. Co. has added a new building during the year and has others in process of erection. Fafnir Bearing Co. has doubled its manufacturing space.

The Waltham Watch Co. has made very great increases in its sale of clocks to the automobile trade.

Bausch Machine Tool Co. is adding a new building for the manufacture of worm drive units. The Heald Machine Co. has added a new building 300 ft. long for its grinding machines. Large increases in factory capacity have been made by the North Grinding Co. The Berkshire Magneto Co., a new organization, is practically ready to market its magneto.

The S. K. F. Ball Bearing Co. is building a new factory in Hartford. Rockwell-Drake Co. is erecting a new ball bearing factory at Plainville, Conn.

The Hartford Auto Parts Co. is erecting a new plant at New Britain. Additions have been made to the plant of the Royal Equipment Co. during the past year.

A new factory has been built during the year by the American Chain Co., in Bridgeport.

The Fisk Rubber Co. has been expanding manufacturing facilities by the erection of new buildings during the entire year.

The Bosch Magneto Co. has increased its manufacturing facilities by 60,000 sq. ft., the new building serving as an annex to the old factory.

The Auto Parts Co., Providence, has erected a complete new factory during the past year. The Mayo Radiator Co. has greatly increased production during the past year. The G & O Mfg. Co. started a new radiator business in New Haven a few months ago. Increased production has been made by the J & B Mfg. Co., Pittsfield, Mass., and also L. S. Starret, manufacturer of fine tools, Athol, Mass.

The Springfield Metal Body Co. has entirely reorganized with greatly increased capital, and is adding to its manufacturing facilities, to take care of factory business.

The Chelsea Clock Co. and the Boston Clock Co. have increased output and production facilities during the year.

Billings & Spencer, during the year, disposed of their old plant in Hartford and have occupied the factory of the Columbia Motor Co. and have added two new buildings.

Whitney Mfg. Co. has added an addition. Wyman & Gordon Co. has added to its forging facilities.

Norwalk Tire Co. has started during the year at Norwalk, Conn.

During the year the Boston Blacking Co., one of the largest manufacturers of shoe blacking, has entered the automobile field with a full line of automobile polishes, top dressings, etc.

The G. W. J. Murphy Co., Merrimac, Mass., maker of the Murphy curtain fastener, has secured a new plant at Amesbury, Mass., for immediate occupation, with ten-fold its present facilities.

L. P. C. Service Sold

RACINE, WIS., Feb. 28—The American Motors Co., Indianapolis, Ind., bid in the service and good will of the L. P. C. Motor Co., Racine, Wis., at the auction sale of the Racine company's assets ordered by the assignee, F. Lee Norton. It was the first parcel offered for sale and brought $3,400. The American Motors Co. will act as service house for all owners of L. P. C. cars in the future and will be in exclusive possession of repair parts.

Warner Gear Not in Merger

MUNCIE, IND., Feb. 25—R. P. Johnson, general manager of the Warner Gear Co., this city, states that the Warner Gear Co. is in no way concerned in the merger which was reported to be undergoing formation among Indiana concerns.

Dealer Wins in Horn Patent Suit

Court of Appeals Reverses Decision of Lower Tribunal in Klaxon vs. Oriental

NEW YORK CITY, Feb. 29—By a decree filed to-day in the U. S. circuit court of appeals for the second circuit, the decision of Judge Chatfield in favor of the Lovell-McConnell Mfg. Co. in its suit against the Oriental Rubber & Supply Co., has been reversed. Judge Chatfield's opinion, handed down last July in the U. S. district court for the southern district of New York, held the Hutchinson patent No. 1,120,057 valid and infringed by electric horns sold by the Oriental concern.

The patent in suit covers a construction having the drive shaft forming the axis of the electric motor at right angles to the plane of the diaphragm and slightly below the center. A face cam is used to vibrate the button at the center of the diaphragm.

Materials Market Unchanged

DETROIT, MICH., Feb. 28—Manufacturers of this city who were interviewed to-day see very little change in the condition of the general materials markets as compared with their status two weeks ago, when a general investigation was made. Most of them express the view that no relief from the current high prices of all raw materials is in sight. The recent German successes and talk of an early ending of the war should Verdun fall into the hands of the Kaiser's troops would not mean any bettering of prices for some months at least, until the producers could get reasonably caught up in their orders. However, such an outcome seems so remote that few if any of the Detroit automobile industry are taking such a long chance and are contracting now for deliveries well into 1917 at current prices. The feeling is quite general that the steel mills are taking as good care of the industry as could be expected under the existing circumstances.

In conversation with one of the largest carbureter makers, this manufacturer said that there seems to be even greater trouble in getting brass, which has heretofore been a necessity to carbureter production. However, his concern will soon be making nothing but malleable instruments, so the brass shortage will not effect him very much. This is a very interesting development of the material situation and indicates that the manufacturers are meeting conditions as they find them. There is no reason why malleable iron could not be used advantageously, but it took unprecedented conditions to force its development.

Wm. T. Jones, general manager of the Edmunds & Jones Mfg. Co., large maker of automobile lamps, whose principal requirements are brass, steel and glass, is one of those who does not see any immediate relief, although his company is in an enviable position due to having contracted as long as eighteen months ago for what materials would be needed this year. He states that the concern now has in stock five times as much material as one year ago, this serving to indicate the foresight displayed in many of the big factories. As a result, current high prices are not felt, but as there does not seem to be any tendency to lower prices, Mr. Jones said that they are now contracting for supplies for delivery during the second quarter of 1917. In normal times it would not be necessary to figure more than sixty days ahead, he explained, but now it is necessary to look twelve months ahead on steel. The conditions are not quite so bad for brass deliveries, however. It is easier to get glass than many other products, according to Mr. Jones.

Everything Going Up

Others of the big parts makers here, as well as the car manufacturers, see no great change, and, as J. E. Ryan, purchasing agent of the Russel Motor Axle Co., put it, everything seems to be on the up grade. He looks for no big drop for some time, at any rate not until the mills get reasonably caught up in their orders. It is next to impossible to contract for brass and copper, because it would not be advisable with the market so high and somewhat subject to fluctuations.

F. C. Gilbert, sales manager of the Timken-Detroit Axle Co., also stated that the steel market is higher and wilder.

It looks as if conditions would become even more strained than they have been, and while the Timken company is protected on steel and has been able to protect its customers. the steel mills are not able to give prices after next July delivery. The mills, he said, will protect on tonnage, but they are unable to say what the price will be.

The fact was also emphasized that car makers, dealers and the general public must fully meet the conditions and realize that prices for motor vehicles must go up, if quality is to be maintained. There is very evidently no way out of it. It is surprising how unanimous well-informed automobile men here are on this point.

Dividends Declared

Packard Motor Car Co.; quarterly of 1¾ per cent on preferred, payable March 15 to stock of record Feb. 29.

Kardo Axle Suit Re-Opened

Ohio Court of Appeals Upholds Corporation's Validity and Orders Rehearing

CLEVELAND, OHIO, Feb. 29—The decision of Judge J. H. Clarke of the United States district court of Ohio in dismissing on April 13, 1915, the patent infringement suit brought by the Kardo Co. against Henry J. Adams, dealing as the Reo Motor Sales Co., this city, has been reversed by Judge Hollister, sitting in the Federal court of appeals. Judge Hollister held that the Kardo Co. is a good corporation under the laws of Ohio and therefore has a right to bring suit for alleged patent infringement. He remanded the case to the lower court for rehearing of the patent claims.

This decision practically re-opens the case which has been in the courts now for over a year, and the higher court instructs that the lower court confine its decision to the merits of the patent in question. The Kardo Co. brought suit against Adams on Jan. 29, 1915, substituting for the American Ball Bearing Co., and charging infringement of patent No. 792,690 issued to Alanson P. Brush of Detroit by the use of a compensating mechanism termed a floating spider in the bevel gear of the rear axle of Reo cars. The Kardo Co. fell heir to the suit against the Reo representative when it took over the patents of the American Ball Bearing Co. The bill of complaint was filed June 25, 1913, and the case was transferred to Kardo on Oct. 3, 1914.

De Palma Becomes a Manufacturer

DETROIT, MICH., Feb. 28—Ralph De Palma is one of the incorporators of the De Palma Mfg. Co., which has been organized here with a capital stock of $100,000. The others interested with the famous race driver are Frank P. Book and J. B. Book, Jr., wealthy Detroiters. While the incorporation papers state that the new company will build aeroplane engines as well as racing cars, the main purpose at the present time is to campaign De Palma's Mercedes which gave such a good account of itself last year. The De Palma company will enter the Mercedes in the big race meets of the year, according to present plans, and Ralph is now busily rebuilding it at the present time here.

The officers of the De Palma company are: F. P. Book, president; Ralph De Palma, vice-president and general manager, and H. V. Book.

Although H. V. Book does not appear in the incorporation papers, he will be the secretary and treasurer when he becomes of legal age two months hence. J. B. Book, Jr., owing to the fact that his brother is not yet of legal age is therefore the third incorporator, although he will have no active interest in the company. All the stock of the concern is subscribed for, and there is none for sale, the incorporators wishing this to be made clear in view of the fact that they have already been approached by parties wishing to become interested.

Scripps-Booth Reorganized—Incorporated with $1,000,000 Capital

DETROIT, MICH., Feb. 28—A reorganization of the Scripps-Booth Co. has been effected, the company having increased its capital stock to $1,000,000 and incorporated under the laws of Delaware.

Clarence H. Booth, who became associated with the concern last December and who has been vice-president and sales director, has been made president; William E. Scripps, vice-president; James S. Booth, secretary, and F. J. Sensenbrenner, treasurer.

Of the new capital stock $750,000 has been subscribed and paid in while the balance of $250,000 is being held in the treasury for future needs.

Need for Testing Argued by Metro. Section S. A. E.

NEW YORK CITY, Feb. 25—At the regular February meeting of the Metropolitan Section, Society of Automobile Engineers, held at the Automobile Club of America last night, Leonard Kebler, president the Ward Leonard Electric Co., was elected chairman; Harry Tipper, advertising manager, Texas Co., secretary, and H. G. McComb, engineer the General Vehicle Co., treasurer.

The program for the evening included a symposium on motor testing and was provocative of a valuable discussion on the real needs of testing commercially. The topic was introduced by Peter Payne Dean, former engineer of the Diehl Mfg. Co., who took the viewpoint that it is not necessary to secure horsepower readings at the rear wheels.

This viewpoint was discussed by C. F. Scott, engineer of the Sprague Electric Wks. and others. The net result of the discussion seemed to be that some form of testing is necessary, but there was evidently a disagreement among the members present as to whether or not the expense of the dynamometer equipment is justified.

In bringing forward his arguments Mr. Dean stated that in his opinion the blower system fits the situation best of all, assuming of course that the accurate horsepower at the rear wheels is not to be measured accurately. The movement of the air in absorbing power does not create heat and furthermore the installation is not expensive. The air can be used to cool the radiator and thus simulate the actual conditions of running the car. In a modern installation, a series of multivane or paddle-wheel blowers are installed either in the test room ceiling or underneath the floor. They can be either driven through friction drums or by belt. This installation is now in use at the Chevrolet plant.

Mr. Dean stated that on comparing costs he finds that the electric dynamometer system to absorb 25 hp. would cost $800 per set, while the blower system for the same power output could be installed for $300 per set.

Knobloch Becomes Cole Motor Car Co. General Manager

INDIANAPOLIS, IND., Feb. 25—A. F. Knobloch has become general manager of the Cole Motor Car Co., this city. Mr. Knobloch was formerly general manager of the Northway Motor & Mfg. Co. He has also brought into the Cole company his brother. W. H. Knobloch, and A. Keller, an efficiency engineer.

Elgin Contest Board Chosen

Chicago, Feb. 28.—W. O. Duntley, recently elected president of the Chicago Automobile Club, has appointed the following members to serve on the contest board, which will direct the promotion of the Elgin road races, the Chicago speedway events and the annual inter-club reliability matches during 1916:

George Ballou, chairman; Joseph Callendar, Tom Hay, A. M. Robbins and E. C. Patterson. This committee will have as its advisors David Beecroft, editor of Motor Age and Automobile, and C. G. Sinsabaugh.

The new contest board promises to be a very active and efficient committee. Chairman Ballou served in the same capacity last year and the other members are experienced in racing matters. Callendar was head of the C. A. C. contest board in 1914, Hay has been starter for the Indianapolis international sweepstakes for the past 3 years, Robbins at one time was a driver on the Abbott-Detroit team and Patterson is the backer of Ralph de Palma.

The C. A. C. contest board has a most strenuous season ahead, as it will be in charge of the Elgin road races, the three meets to be held on the speedway and at least three reliability runs.

Fostoria Price Fixed at $675

FOSTORIA, OHIO, Feb. 28—The price of the new Fostoria light car has been fixed at $675. It has 108-in. wheelbase and the engine is 27 hp. Roadsters, coupes, speedsters and delivery wagons, ranging in price from $495 to $825, are built on the same chassis. These cars are manufactured by the Fostoria Light Car Co., this city.

Studebaker Earns $9,067,425

Sales Amount to $56,539,006, a Net Gain of $13,094,782—46,845 Cars Sold

SOUTH BEND, IND., Feb. 26—The fifth annual report of the Studebaker Corp. for the year ending Dec. 31, 1915, shows net sales of $56,539,006.23, as compared with $4,344,223.41 in 1914, a gain of $13,094,782.82, or 30.1 per cent. An increase of 87.2 per cent was made in net profits, after reserving an increased amount for depreciation and after payment of interest. Net profits for the year amounted to $9,067,425.28 as against $4,844,663.73 in 1914, a gain of $422,761.55. Deducting the payment of the 7 per cent dividends on preferred stock, the net profits remaining for the common stock amounted to 29.5 per cent during 1915 as against 14.2 per cent in 1914 based on a total of $27,931,600 common stock which was outstanding during all of 1914 and for eleven months of 1915.

War order sales amounted to only one-quarter of the total sales made last year, the amount being $13,000,000 as against $2,000,000 in 1914. Sales of cars have increased over 100 per cent since 1911, when only 22,555 automobiles were sold, whereas last year 46,845 were sold, over 90 per cent of which were delivered to regular customers in the United States and the remainder to regular customers in export markets. About 1300 of these were sold to foreign governments for hospital and other purposes.

The number of cars turned out last year year was 32.1 per cent greater than in 1914, but the volume of the automobile sales showed an increase of only 17.5 per cent on account of the reductions in the prices of Studebaker cars made last summer.

The net expenditures for plant and property in 1915 were $740,444 and depreciation credits were $397,991. In addition to these expenditures charged to capital there was spent for repairs and renewals and charged off to operating expenses $1,244,207, compared with $802,458 spent for the same purposes in 1914. The net working capital on Dec. 31 last was $21,276,837, an increase of $6,505,686.

COMPARATIVE BALANCE SHEETS 5 YEARS

Year Ending Dec. 31st	1915	1914	1913	1912	1911
ASSETS					
Cash	$ 5,910,062.05	$ 3,539,163.58	$ 1,957,460.53	$ 865,795.46	$ 1,672,434.45
Investments	1,570,098.69	247,654.15	246,508.72	1,075,692.30	1,431,161.78
Receivables	8,585,199.15	6,698.148.07	5,923,793.36	4,958,120.67	5,688,661.02
Inventories	13,062,041.44	13,470,564.49	16,622,228.55	15,730,840.85	14,391,250.99
Deferred charges	161,445.49	709,489.36	1,191,875.16	1,419,347.58	1,114.585.49
Total quick assets	29,288,846.82	24,665,019.65	25,941,866.32	24,049,796.86	24,298,093.73
% Current liabilities	366%	249%	184%	217%	202%
Plant investment	12,400,493.29	12,058,040.03	11,873,297.47	10,594,807.11	10,302,373.03
Trade name, good will, etc.	19,807,276.64	19,807,276.64	19,807,276.64	19,807,276.64	19,807,276.64
TOTAL	$61,496,616.75	$56,530,336.32	$57,622,440.43	$54,451,880.61	$54,407,743.40
LIABILITIES					
Notes payable	....	$ 1,850,000.00	$ 4,550,000.00	$ 1,400,000.00	$10,050,000.00
Other payables	5,706,510.22	2,493,869.33	2,712,848.31	2,069,728.43	1,953,011.36
5% serial gold notes	*2,305,500.00	5,550,000.00	6,800,000.00	7,600,000.00	....
Current liabilities	8,012,010.22	9,893,869.33	14,062,848.31	11,069,728.43	12,003,011.36
Stock sub. co.'s	....	28,300.00	54,341.29	28,300.00	28,300.00
Preferred stock	10,965,000.00	12,180,000.00	12,650,000.00	13,095,000.00	13,500,000.00
Common stock	30,000,000.00	27,931,600.00	27,931,600.00	27,931,600.00	27,931,600.00
Reserve for future conting'cies	1,500,000.00	....	....	....	....
Special surplus account	2,548,654.17	1,230,747.54	823,724.49	417,008.87	....
Surplus	8,470,952.36	5,265,819.45	2,099,926.34	1,910,243.31	944,832.40
TOTAL	$61,496,616.75	$56,530,336.32	$57,622,440.43	$54,451,880.61	$54,407,743.40

*Called for payment March 1st, 1916.

COMPARATIVE SALES, PROFITS, DIVIDENDS AND SURPLUS

Year Ending December 31st	1915	1914	1913	1912	1911
Number of automobiles sold	46,845	35,460	35,410	28,523	22,555
NET SALES, automobiles, vehicles and harness	$56,539,006.23	$43,444,223.41	$41,464,949.82	$35,440,327.41	$28,487,847.29
Deduct cost of manufacture, selling and general expenses.	47,045,582.77	37,870,999.25	38,834,923.69	32,243,767.19	25,907,499.23
Reserve for depreciation	397,991.01	361,794.01	230,356.84	193,076.34	159,395.70
NET EARNINGS ON SALES	9,095,432.45	5,211,430.15	2,399,669.29	3,003,483.88	2,420,952.36
Add: Other income	152,942.85	133,965.44	83,465.40	122,392.27	85,528.32
TOTAL NET EARNINGS	$ 9,248,375.30	$ 5,345,395.59	$ 2,483,134.69	$ 3,125,876.15	$ 2,506,480.68
Deduct: Net interest paid	49,187.16	414,940.44	484.948.78	444,527.33	456,419.65
Premium on preferred stock	84,234.13	....	....	....	....
Discount and com. serial notes.	47,528.73	85,791.42	93,773.02	83.675.00	....
NET PROFITS FOR YEAR	$ 9,067,425.28	$ 4,844,663.73	$ 1,905,412.89	$ 2,597,673.82	$ 2,050,061.03
7% preferred stock dividends.	830,445.00	869.050.00	901.075.00	930.825.00	708,750.00
Earnings on common stock	8,236,980.28	3,975,613.73	1,004,337.89	1,666,848.82	1,341,311.03
% on amount outstanding	29.5%	14.2%	3.6%	5.9%	4.8%
Transferred to special surplus account	1,317,906.63	407,023.05	406,715.62	417,008.87	....
Less common stock dividends.	1,396,580.00	....	....	....	....
Extraordinary items and adjustments not arising from current operations—charged off.	*817,360.74	402,697.57	406,939.24	284,428.68	396,478.99
Special reserve for future contingencies	1,500,000.00	....	....	....	....
Total	$ 5,031,847.37	$ 809,720.62	$ 813,654.86	$ 701,437.55	$ 396.478.99
ADDED TO SURPLUS	3,205,132.91	3,165,893.11	189,683.03	965,411.27	944,832.04
Previous surplus	5,265,819.45	2,099,926.34	1,910,243.31	944,832.04	....
SURPLUS ACCT. DEC. 31st.	$ 8,470,952.36	$ 5,265,819.45	$ 2,099,926.34	$ 1,910,243.31	$ 944,832.04

*These charges have adjusted all accounts to a clean, conservative basis.

Gasoline Prices Soar in Europe

Sells at 45 Cents Per Gallon in London District—Doubles in 3 Years

PARIS, Feb. 15—Gasoline has taken another leap in both France and England. In London district it is now selling retail at 2s. 6d. per gallon, which at present rate of exchange is equivalent to 45 cents per American gallon. This is the highest price in the history of England, and the highest price in European countries, Germany excepted. The direct result of this increase has been a curtailment of motoring; the use of cars for any other than utilitarian purposes is very small indeed. As, however, the use of automobiles in Great Britain for business and professional purposes is very extensive, the high cost of gasoline has called forth loud-voiced protests. Before the war, and before the government put a tax on gasoline, it was selling in England at 1s. 2d., or 28 cents per gallon; thus the price has more than doubled in a period of three years. There is considerable resentment against the few companies controlling the gasoline situation in England, motorists considering that the increased selling price is altogether out of proportion to the increase in freight and insurance. There is no doubt that when normal conditions are again established there will be a very strong feeling in favor of the use of benzole in place of gasoline. There is not much possibility of the rise of alcohol as an automobile fuel in England.

44 Cents in France

France has also had to stand for a rise in the price of gasoline, the refiners recently having decided to put $1 per 100 liters on gasoline and 60 cents on kerosene. The retail price averages 42.5 to 44 cents per American gallon. This excludes the city of Paris, where there is a special local tax artificially increasing the price of gasoline. For the first time in the history of motordom gasoline is cheaper in France than it is in England. This is partly explained by the fact that in England a government tax has been placed on gasoline, while in France the tax has undergone no change.

A Government Inquiry

The situation in France is considered so serious that a sub-commission of the Ministry of Commerce has been entrusted with an inquiry. This commission met the refiners before the present rise went into effect and was able to arrange that the price of kerosene should only be increased 3 francs (60 cents) instead of 5 francs ($1) per 100 liters. The projected increase in the wholesale price of gasoline was carried through, however, with a provision that in case the retailers' increase was disproportionate to the wholesale increase the refiners would undertake to sell to any municipal authorities at wholesale rates.

Grant-Lees Gear Co.'s Output Increases Over 400 per Cent

CLEVELAND, OHIO, Feb. 26—The output of the Grant-Lees Gear Co., East Sixty-ninth Street, this city, has increased over 400 per cent in the last three years. The capacity of the factory is now 120 complete transmissions per day, and the company is furnishing transmissions for some of the best automobiles in the country. Three years ago the company did largely a jobbing business in gears, but after a study of conditions in the industry experts in gear work were secured and the present flourishing business was started on its way.

Reliance Engineering Extends Scope

LANSING, MICH., Feb. 26—A further extension of the Reliance Engineering Co. has tagen place. The National Engineering Co., Saginaw, Mich., one of the largest grinding and finishing concerns in the country, has been bought out and its entire equipment of machines, tools, etc., also its entire working force of more than 100 men, will locate here in the plant formerly occupied by the Olds Gasoline Engine Co., which belongs to the Reliance interests.

The Reliance company has taken over about half a dozen manufacturing concerns during the past six months, among them the Seager Engine Works, the Michigan Crank Shaft Co. being the biggest. Further extensions of the Reliance company are likely to take place this year.

General Motors Output Statistics

NEW YORK CITY, Feb. 28—The number of cars and trucks built by the General Motors Co. during the six months up to Jan. 31, 1916, was 62,468, compared with 31,608 in the 1915 period, and 76,068 cars for the year ending July 31, 1915.

New York Chalmers to Move

NEW YORK CITY, Feb. 24—The Chalmers Motor Co., Detroit, Mich., has leased for the local branch the Wendel Building on the northwest corner of Broadway and Fiftieth Street, this city. It is a three-story structure. It is stated that two or three more stories will be added.

Name Now Johnson Bronze Co.

NEW CASTLE, PA., March 1—The American Car & Ship Hardware Mfg. Co., this city, has changed its name to the Johnson Bronze Co., with its main office and factory in this city. Its plant is being enlarged.

Porporato Called to Colors

Racing Driver Now in Italian Ambulance Corps—Other Drivers in Service

PARIS, Feb. 28—Jean Porporato, whose Sunbeam took second place at Chicago last year, and who is a well-known figure on American race tracks, has had to obey the martial call and is now wearing the uniform of an Italian soldier. Although Porporato became mechanically interested in automobiles as soon as he left school, and has been race driver and tester for Minerva, Gregoire, Berliet, Sunbeam, F. R. P., and other firms, the military authorities have placed him in the ambulance corps, with which body he is now serving on the Italian front.

After nearly eighteen months' service as an automobile driver on the French front, during which period he has had numerous miraculous escapes, Albert Guyot has just been transferred to the aviation section of the French army. Guyot learned to fly years ago, being one of the first men to mount a Bleriot monoplane, but nevertheless did not find it an easy matter to get a transfer from one branch of the army to another. He is now pilot of a Nieuport scout machine, capable of 120 miles an hour, his dangerous and exciting job being the bringing down of German machines which venture over the French lines.

Kennington to Leave for England Early in April

NEW YORK CITY, March 1—W. O. Kennington, for the past five years assistant chief engineer of the Remy Electric Co., will leave with his family for England the fore part of April. Mr. Kennington is offering his services to the War Office but as yet has not been assigned to any definite post.

He has been in America for about seven and a half years, coming from the English-Simms to the American-Simms and thence to the Remy company, and has been with the latter for about five years.

Mr. Kennington is engaging in business with W. H. Johnson, who is the European agent for the Remy company.

Murray Mfg. Gets Kemiweld Plant

DETROIT, MICH., Feb. 26—The J. W. Murray Mfg. Co., which makes sheet metal parts for automobiles, and which is now located on Clay Avenue, has acquired the Kemiweld plant of the Detroit Can Co., and will locate there shortly. It will provide much larger manufacturing space, and the Murray company intends to add a large force of men.

Louisville Show Success Spells Splendid Sales Season in South for 1916

Hundreds of Optimistic Dealers from All Parts of Kentucky and Southern Indiana Visit Show—30% Business Gain Over 1915 and 30,000-Car Registration Predicted

LOUISVILLE, KY., Feb. 26—Optimism is in evidence everywhere at the ninth annual exhibition of the Louisville Automobile Dealers' Assn., which opened last Monday evening and closes to-night. Indications point to a splendid season following the show. It is the largest motor exposition to hold attention south of the Ohio river, and, as usual, is staged in the First Regiment Armory, which covers 54,000 sq. ft. of floorspace. The big military building is one of the leading show places of its kind in the country, there being no pillars to obstruct the view. It presents a most attractive appearance.

43 Exhibitors

Forty-three exhibitors are showing forty-one different makes of gasoline passenger cars, twenty-eight more than last year, four electrics and nine commercial vehicles. The Old Hickory truck, built by the Kentucky Wagon Mfg. Co., a local concern, and the Dixie passenger car, made by the Dixie Motor Car Co., at the plant of the Kentucky Wagon Mfg. Co., are displayed for the first time at a show this season.

Many Dealers at Show

Factory representatives from all of the big automobile centers are in attendance. Hundreds of dealers from all parts of Kentucky and Southern Indiana also are daily visitors at the show. While the local exhibition, in the main, is a retail proposition, the Louisville distributors and factory representatives have closed many new contracts with sub-agents and dealers for the coming year.

One of the features of the Louisville Show is the great interest being manifested in the commercial vehicle by Kentucky merchants and manufacturers who are buying more trucks than ever before.

30% Gain Over 1915

Business is much better than it was at this time last year. A conservative estimate, based on interviews with dealers, points to an increase of about 30 per cent so far this year over the same period in 1915. A few dealers say business is 50 per cent better, but this is the exception rather than the rule.

Owing to the tendency of some of the dealers to keep their sales secret, it is impossible to give any figures as to the number of cars sold during the show, but all of them agree with the prediction of an official of the Commissioner of Motor Vehicles' office that 10,000 new cars will be sold in Kentucky during 1916. Some say that 15,000 automobiles will be sold in the State this year.

THE STANDING OF KENTUCKY AMONG THE FOLLOWING SOUTHERN STATES IN FIELD CROPS AND LIVE STOCK

Kentucky, Tennessee, Virginia, South Carolina, North Carolina, Florida, Alabama, Arkansas and Louisiana

Horses and mules, number head, 672,000	First
Poultry, $16,072,767	First
Bees, colonies, 152,991	First
(Seventh in United States)	
Sheep, number head, 1,267,000	First
Hogs, number head, 1,507,000	First
(Tenth in United States)	
Apple production, bushels, 7,368,499	First
(Fifth in United States)	
Corn, bushels, 74,825,000	First
(Eighth in United States)	
Tobacco, pounds, 281,200,000	First
(First in United States)	
Cabbage, acres, 3028	Second
Onions, acres, 1959	Second
(Ninth in United States)	
Wheat, bushels, 9,860,000	Second
Potatoes, bushels, 2,450,000	Second
Cattle, number head, 909,000	Third
Apple trees, 5,538,267	Third
Milch cows, 382,000	Third
Hay and forage, tons, 674,000	Third

In Louisville, sixty-three different makes of cars are handled by forty-two dealers and distributors. There are approximately 620 dealers and agents in the Bluegrass State, including about 180 Ford agents, 100 Overland agents and seventy-five Buick agents.

A Wide Territory

Louisville's show is the greatest motor event of the year in Kentucky and marks the opening of the selling season in this section of the country. The district embraced by the local agents, factory representatives and branches, as a rule, covers Southern Indiana, the entire State of Kentucky, and in some instances Tennessee, the western portions of West Virginia and Virginia.

Louisville is an automobile city, not in the producing sense, but from the standpoint of use and distribution. As a distributing point, with its excellent railroad facilities, it ranks with the leaders. A number of the largest factories and tire concerns in the United States maintain branches here.

The majority of dealers have a larger list of live prospects, who have promised to sign up in the spring, than ever before. The lack of deliveries has cost several dealers good sales. As a rule, the Southerner is slow to make up his mind upon the question of buying a car, but, once settled, he wants the machine immediately. When he can't get a certain make he wants, he visits another garage and finds another car in the same class that will satisfy him.

Trucks Sales Increase

There is one feature that stands out more prominently than any other in connection with the industry in Louisville, that is, the rapid strides which the commercial vehicles have made in popularity and usefulness. The number of horse-drawn vehicles on the streets is fast diminishing.

It is outside of the cities where local distributors are doing the bulk of their business. The farmers—the majority of them—and the people living the small towns, want a car selling in the neighborhood of $1,000, and they prefer a touring car, though there is a demand for the runabout. The car listed for $800 and under finds a ready market South of the Ohio River, provided it has a well-known company behind it.

50% Gain Predicted

The automobile in Kentucky has experienced its most prosperous year. During the year 1915, and to date in 1916, there has been a greater percentage of increase in automobile registrations than ever before. Five years ago an increase of 100 per cent meant about 2500 cars; to-day it means 20,000. The prediction is made from the Commissioner of Motor Vehicles' office that the Bluegrass State will absorb 50 per cent more cars during 1916 than in 1915.

The prospects are that 30,000 motor vehicles will be registered in Kentucky by Jan. 1, 1917. There is not a county in the State that does not register automobiles to-day, although 1915 is the first year to show this. Better roads throughout the State, and the Dixie and Jackson Highway movements are believed to be responsible in a large measure for the sale of thousands of cars.

The total State registration for the year 1915 was 19,500 automobiles and trucks, the fees collected amounting to $114,184.07.

10,000 New Cars

Hugh Ramsey, Deputy Commissioner of Motor Vehicles, who is an authority on the Kentucky automobile situation, says:

"About 10,000 new cars were registered during 1915, which paid only the proportional part of the fee to Jan. 1, 1916. These cars will pay the full fee, averaging $7.50, making a total of $150,000 for 1916. Over 1500 cars have been registered for 1916 to date, and a sale of 10,000 cars is anticipated for the year, which will contribute $50,000 in license fees, making an estimated total of $200,000 for the year on automobiles alone. This is more than one-third of the money derived from the so-called '5-cent tax.' There has been more money collected in one week in 1916 than the entire year of 1910. The total receipts for the month of January were $90,384, against $36,000 for the same period in 1915. If this proportionate increase is maintained through the year the estimate of $200,000 will be largely exceeded."

The increase in numbers in the State is largely due to the purchase of small cars in the rural communities. The year saw the advent of the jitney bus, and probably a few hundred registrations were due to that, but they have not had the effect predicted. There seems to be some cause for alarm by the railroad systems over the inroads on their passenger business by the automobile. Instructions have been issued by the larger systems to gather all information possible bearing on the question, in an effort to determine to what extent it menaces, and to work out, if possible, a remedy.

Louisville's Importance

The estimated population of Louisville proper to-day is 305,000; within a 10-mile radius, 416,000. The city is admittedly the largest exporting center in the world for tobaccos and whiskies. It is the largest grain market in the country outside of Chicago—especially for bona fide transactions—as well as the largest live stock market, especially in the matter of sheep and lambs, while in the matter of Southern fruit distribution, including pineapples, watermelons and the like, it is the most important in the United States. This city also is the principal mahogany market and manufacturing center in America.

With possibly one exception, Louisville is the largest exporter of agricultural implements in the world. Other great industries here are: porcelain-lined bath tubs, chewing gum, cotton seed oil, cotton seed products, organs, window shades, loose leaf ledger supplies, boxes, barrels, millinery, stoves, hardware, cement, paints and varnishes.

Record Clearing Reports

Total exchanges through the Louisville Clearing-house for 1915 established a new high record. The total for the year was $742,390,281, as compared with $667,947,515 in 1914, an increase of $74,442,766. Clearings for the closing month of the year amounted to $78,535,342, the highest record for a month in the history of the clearing-house, and a gain of $26,000,000 as compared with the corresponding month in 1914. For the last quarter of the year clearings aggregated $218,230,782, as compared with $146,858,562 for the same quarter of 1914.

Some Kentucky Statistics

Kentucky, with a gross area of 40,598 square miles, had a population in 1910 of 2,289,905. It ranked fourteenth among the forty-nine states and territories. According to the latest estimate of the census bureau, for Jan. 1, 1916, the State now has 2,372,412 inhabitants.

In 1909, from the last government figures available, the total value of the manufactures of the State, exclusive of the products of the neighborhood and hand industries, amounted to $223,754,000.

Kentucky, because of immense whisky production, pays Uncle Sam the fourth largest revenue in the United States. Of the total of $33,653,848 paid by this State in 1915, according to the Internal Revenue Commissioner's report, the biggest item was $28,642,911 from distilled spirits, this being about one-fifth of the amount collected from this source for the whole country. In addition to this, fermented liquor paid nearly $1,000,000 to the Internal Revenue Department in 1915.

$125,000,000 in Distilleries

These figures to some extent give an idea of the importance of liquor-making in a State famous from its earliest days for this industry. It is estimated that over $60,000,000 has been spent in distillery and brewery property in this State. It is further estimated that the operating capital of Kentucky distilleries aggregates something like $125,000,000.

The report of the United States Department of Agriculture estimated the 1915 tobacco crop in Kentucky at $27,899,200. Tobacco to-day is selling from 1 to 4 cents higher than it was a year ago.

This means prosperity in Kentucky, for tobacco is one of the State's chief products, and there is no question but what a big tobacco business influences the sale of automobiles and results in a greater demand for cars.

Texas Dealers Confer on New Law

DALLAS, TEX., Feb. 26—Future contracts of automobile general agents and subdealers over the State will eliminate territorial specifications and price stipulations. This it is said is the result of a conference at Austin last week with the attorney general for Texas and Dallas automobile dealers.

J. W. Atwood of the Buick company, who headed the aggregation of automobile dealers, said that the matter with the attorney general was amicably settled. Heretofore the contracts, some of them specified the territory an agent should sell in and the price he should receive for the car. These objections were raised by the attorney general.

This conference at Austin resulted in the filing of a number of suits against automobile concerns in which it was alleged the anti-trust laws of Texas were being violated. As a result of these suits it is declared the automobile industry in Texas has been hurt.

Syracuse Show Sells Many Cars

Prosperity in Central New York Section—30,000 Cars for 1916

SYRACUSE, N. Y., Feb. 26.—Some measure of the prosperity which is sweeping through Central New York was revealed at the show held in this city during the week ending to-day. Without exception, dealers and distributors expect to far exceed in 1916 their sales for 1915. Their optimism is based on the fact that during the year gone by manufacturing industries in the principal cities in this section has shown a consistent increase, that farmers are well out of debt, crops have been good, bank balances are heavy and there is promise of an early spring with early touring weather.

During 1915, the five counties which are contiguous to Syracuse, and from which Syracuse dealers draw their trade, absorbed 20,467 cars, according to figures supplied by the Secretary of State. These counties, with the number of cars registered are: Onandaga, 7270; Jefferson, 2943; Oswego, 1552; Cortland, 1368; Cayuga, 2326; Madison, 1106; Oneida, 3802. It is confidently expected that the average gain for 1916 will be between 25 and 30 per cent and that the territory should absorb nearly 30,000 cars. The combined population of these counties is 635,145, and of Syracuse itself, 149,000.

The show was the eighth annual affair and was staged by the Syracuse Automobile Dealers Association. Despite inclement weather during the latter part of the week, attendance was good, the average being nearly 5000 per day. The show was held in the State armory.

Portland Mfg. Co. Restarts

FLINT, MICH., Feb. 21—The Portland Mfg. Co., originally located in Portland, Mich., where it was burned out in May, 1915, has restarted in business here. The company which is capitalized at $12,000, will make besides electric and springless-gearless types of washers, a number of special accessories for the Chevrolet and Dort cars. The officers of the company are Arthur G. Lodewyck, president; Frank D. Lockwood, vice-president and Harry C. Shute, secretary-treasurer. Manufacturing quarters have been secured at 859 Patterson Street.

Cannot Revoke License

LANSING, MICH., Feb. 28—Attorney-General Fellows has ruled that the Secretary of State has no right or authority to revoke a chauffeur's automobile license for violations of the automobile law.

E.V.A.A. May Merge with N.E.L.A.

Work of Electric Vehicle Assn. To be Continued Under Auspices of National Body

New York City, Feb. 28—The Electric Vehicle Assn. of America has been invited by the National Electric Light Assn. to affiliate with it as a section, to be known as the Electric Vehicle Section, and that in the event that favorable action is taken by the E. V. A. A., its members will become members of the National Electric Light Assn., and the E. V. A. A. will be legally dissolved. A special meeting has been called to consider the invitation at the office of the association on March 10.

It is the present intention to discontinue any further meetings of the E. V. A. A. body, the members attending the regular monthly meetings of the N. E. L. A. The latter association expects to hold an exhibition May 22 to 26 at its convention in Chicago, and arrangements will probably be made for parking space either in Grant Park opposite the hotel, or some other nearby location for the display and demonstration of electric vehicles.

The Electric Vehicle Assn. of America was organized six years ago and now has a membership of 1150. The N. E. L. A. has a membership of 15,000 and has been in existence for forty years.

Bay State to Fight for Lower Gasoline Prices

Boston, Mass., Feb. 24—Massachusetts motorists have taken up the cudgels in the fight to reduce the price of gasoline in New England. At the request of the Bay State A. A. of Boston, Representative Thomas J. Giblin of the Massachusetts Legislature, has put in a resolution requesting that action be taken. He has asked the Legislature to pass the following:

> Resolved, That the motor industry has given such steady employment to so many thousands of our citizens, men and women; has increased the tax values of the State by many thousands; and has in other ways done so much to add to our prosperity, be it
>
> Resolved, That the Massachusetts Legislature send a resolution to its Senators and Representatives at Washington requesting them to take such action as will result in lowering the price of gasoline in the East, where its high price now jeopardizes the motor business of Massachusetts and gives Western States an unfair competitive advantage over our motor business firms and individuals.

50 Cents per Gallon

At the annual banquet of the Automobile Club of Springfield, Mass., which was attended by 750 members and friends, Thos. L. Hisgen, former independent party candidate for the presidency, who was the principal speaker, asserted that if action is not taken the price of gasoline will go to 50 cents in a year. Hisgen is an independent oil operator. He stated that the percentage of gasoline taken from crude is higher now than ever before; that figures based on facts prove that there is no oil shortage; that the trusts aim to stifle competition and maintain high prices after the war; that the company of which he is president refused an offer from an agent of the Allies to sell all the gasoline they could get at a profit of 4 cents per gallon; that he believes the committee appointed by the Bureau of Commerce to investigate gasoline prices is incompetent, and that the Bureau of Commerce refuses to divulge the names of the members.

Timken New Seamless Tube Plant Working Full Time

Canton, Ohio, Feb. 26—The new seamless steel tube plant of the Timken Roller Bearing Co., recently completed at an expenditure of about $500,000, is now in full operation, 24 hr. a day. It is an all-steel structure of the standard mill type. The piercing and rolling mills with their accessories are of the latest design, embodying a number of patented features which make for greatly improved hot finished tubes. The cold working department includes pickle house, annealing furnaces, pointers, draw benches, straighteners, cutting-off machines, and many other things which make the plant one of the most complete in the world.

Wardell Detroit Steel Products Sales Manager

Detroit, Mich., Feb. 26—H. F. Wardell has been appointed general sales manager of the Detroit Steel Products Co. in place of P. A. Smith, who resigned. Mr. Wardell was formerly office manager of the company. Previously he was with Albert Kahn, the architect, also with the United States Gypsum Co.

Hupp Makes Output Record

Detroit, Mich., Feb. 24—The biggest day of the winter season at the Hupp Motor Car Co., was on Thursday, Feb. 17, when 101 Hupmobiles were made. Although the plants here and in Jackson are working to capacity, the company is still over 700 orders behind the immediate demand.

Struggle for Race Selection

Elgin and Santa Monica Contend for Vanderbilt and Grand Prize

Chicago, Feb. 29.—The battle for the honor of promoting the Vanderbilt cup and grand prize road races for 1916 is on. At the annual meeting of the Elgin association, held last week, the directors and stockholders voted to apply for the sanctions for the two classics and directed Joseph Callendar a member of the contest board of the Chicago Automobile Club, to open negotiations immediately with the Motor Cups Holding Corporation, which controls the two trophies.

Santa Monica already is in the market for the two blue ribbon events.

According to the plans of the Elgin promoters, the Watch City meet will be of 8 days' duration this year, with 4 days of racing. The speed carnival will open Saturday, Aug. 12, with the Vanderbilt cup, and close the following Saturday, Aug. 19, with the grand prize. The C. A. C. cup event will be run on Tuesday, Aug. 15, and the Elgin National trophy contest on Thursday, Aug. 17.

At the annual meeting, which was one of the most enthusiastic sessions ever held by the association, no decision was reached regarding the distance of [illegible] four events or the piston displacement limit to be placed on the entries. These are matters that fall under the jurisdiction of the contest board of the Chicago Automobile Club.

The Elgin promoters have agreed to raise $10,000 of the $24,000 to be offered in purses by the sale of 1,000 season tickets at $10 apiece. Chicago race enthusiasts also have promised to sell the same number of tickets in advance.

The Elgin course has weathered the ravages of winter in splendid shape and very little work will have to be done on the roads to put them in condition for fast driving.

Business Good at Newark Show

Newark, N. J., Feb. 28—Newark's show ran true to 1916 form; it was the biggest and best it ever had, which is the experience that every other show-city has had this year. Paid admissions were double what they were a year ago despite an uninterrupted spell of intense cold alternated with driving rain.

The interest was greater, sales were more frequent, and there was a business-like air that was not so pronounced at previous shows.

The opening was Saturday, Feb. 19, and from the moment the doors were unlocked until the lights were turned out the building was a solid mass of enthusiasts. Many were car buyers but more probably were there out of curiosity, because the majority of the attendance on the opening night is complimentary.

The large attendance through the following week was no doubt due in large measure to the wholesale purchase of tickets by the various exhibitors for distribution among owners and prospects. The regular price of admission was 50 cents, but exhibitors could purchase blocks of 100 for $25. Many dealers bought 500 or more.

Interest in the show was stimulated by making every night except the last a special night. Opening night Gov. James F. Fielder was scheduled to make an address, and his failure to put in an appearance was not the fault of the management. Monday night the Mayor was there to act as host. Tuesday was Washington's birthday and a special musical program was arranged for the night. Wednesday was society, military and naval night—no extra admission was charged. Thursday was club night, the New Jersey Automobile and Motor Club acting as hosts to the 10,000 members of affiliated clubs of New Jersey. Friday was commercial vehicle night and the Motor Truck Club of New Jersey was host to the owners of motor trucks.

Chandler Profits $933,217

New York City, Feb. 24—The Chandler Motor Car Co., the old company, reports to the New York Stock exchange for the year ended Dec. 31, 1915, net profits of $933,217 as against $321,821 in 1914 and $42,232 in 1913. The new company up to Jan. 1, 1916 had $1,613,515 cash in the bank and on hand and a surplus of $173,450.

A comparison of the earnings of the old company for 1913, 1914 and 1915 is given in the following tabulation:

	1915	1914	1913
Gross profits ...	$1,507,360	$706,123	$154,461
Other income...	101,125	43,233	13,034
Total income.	$1,608,485	$749,406	$167,495
Expenses	641,733	428,585	123,363
Depreciation of plant	33,534	4,000	1,900
Net profits...	$933,217	$321,321	$42,232

The balance sheet of the Chandler Motor Car Co., new company, as of Jan. 1, 1916, follows:

Assets	
Real estate, buildings and equipment	$223,928
Good will and organization.......	5,000,000
Investments	43,240
Cash in banks and on hand.......	1,613,515
Accounts and notes receivable....	138,823
Inventories, at cost..............	622,644
Prepaid expenses	14,318
Total	$7,661,475
Liabilities	
Capital stock	$7,000,000
Accounts payable	410,152
Deposits from dealers on contracts	63,725
Reserve for taxes and contingencies	14,146
Surplus	173,450
Total	$7,661,475

Five Firms Have Credit Systems

Banks Support Schemes for Selling Cars on Installment Plan to Approved Buyers

Detroit, Mich., Feb. 28—Selling automobiles on installments or deferred payments has now become a standard part of the business of dealers selling at least five makes of automobiles. Doubtless other makers will be added to the list from time to time, but the five so far in line on the proposition are Overland, Studebaker, Chalmers, Maxwell and Paige, all large producers, and their announcements of arrangements on behalf of their dealers came out in about the order named. In every case the car maker has no financial interest in the credit company that buys the notes taken in by the dealers, but the maker has simply made the proper arrangements so that the dealer may do this class of business on a proper and logical basis.

In every case so far made public, an old and firm banking house is back of the arrangements, and while the plans differ considerably in their details, they follow about the same general idea of having one-half to one-third of the price of the car paid down and the balance in eight monthly payments. The banking firm then buys these notes from the dealer. Hence the dealer has a ready outlet for this paper and does not have to use his local credit for the purpose. Undoubtedly the installment idea will increase the sales of cars, for it opens up that field in which there are many who have enough to buy a car but cannot pay it all out at once.

Credit Houses Back Scheme

Following are the credit houses back of the time sales of the five cars mentioned:

Overland—Guaranty Securities Co., Toledo, Ohio.

Chalmers—Agricultural Credit Co., Chicago.

Studebaker—Commercial Investment Trust, New York and St. Louis.

Maxwell—American Commercial Co., Cleveland.

Paige—Bankers' Commercial Corporation, New York.

Up to a short time ago it was generally thought that automobiles could not be marketed successfully on the installment plan basis, because it was believed there was too much risk of damage and depreciation to the vehicle between the time of first payment and final payment. However, the new arrangements seem to overcome this difficulty.

However, with the wider use of cars by the general public and the need of an adequate method of doing such business so as to save the dealer from haphazard methods that might lose him much money or even wreck his business have decided some of the big producers of cars to make arrangements with banking interests to finance such transactions. Doubtless the great earnings of the automobile companies during the past year and the constantly increasing market for cars were big factors in bringing to the attention of big banking houses the matter of financing time sales, just as these factors have induced many moneyed interests to invest heavily in the expanding motor car factories themselves.

Arrangements Differ Slightly

Although the arrangements differ in details, the general scheme of these deferred payment plans is the same. Usually the dealer is required to take one-third or one-half of the list price of the car down, and the balance in eight monthly payments. The cost of insuring the car against fire, theft and transportation loss is added, as well as 6 per cent interest on the notes which the buyer gives. This is a cash sum that must be paid at the time the initial payment is made. Then the dealer indorses the notes and sends them to the banking house, which buys them from him less a brokerage charge that ranges from 2 to 3 per cent in most cases. In one or two instances the banking firm sends immediately the entire amount of the notes less brokerage, and in others an amount of $100 to $200 is withheld and the dealer given a deferred certificate for this. He can cash this certificate through the banking house when the customer has paid the last note, or if he wishes he can use it immediately by sending it to the car manufacturer, who will accept it on the purchase of more cars, less a discount of 5 per cent.

Buyer Specified

For this kind of business the plan laid down usually specifies the kind of person whom the dealer can sell on this deferred payment basis, and since he indorses the notes he is reasonably sure to satisfy himself that the party is able to pay for the car as agreed. Certain investigation procedure is given the dealer and usually all the necessary forms and notes are furnished him, so that the sales are made in a strictly uniform manner and in accordance with the rules the dealer is instructed to follow. He will, of course, follow them, as he wants the notes to be taken by the credit firm.

In most instances the plan does not interfere with the dealer's local banking arrangements, and there are no restrictions if he wishes to finance the installment sales through his local bank he is at liberty to do so. Usually the dealer needs all of his local credit for taking in the shipments of cars as they come from the factory, and the new scheme is a method whereby the dealer can take care of a much larger volume of credit sales than he would be able to do were he entirely dependent upon his local credit. Some of the car makers, however, do not favor the dealer financing any of their time sales through local banks.

Many will wonder why the banking firm will not remit them the entire face value of the notes less the brokerage, instead of paying all but about 10 per cent and giving a deferred certificate for that, paying it when the car is fully paid for. This is because it is held that the dealer must have some interest in the transaction after he has made the sale and taken the notes. Knowing that the balance of his money is dependent upon the payment of the last note, he will keep in touch with the customer and see that the latter keeps up his payments.

Pennsylvania Rubber Has $4,000,000 Business

CONSHOHOCKEN, PA., Feb. 24—The stockholders of the Pennsylvania Rubber Co., at the annual meeting elected the following officers for the ensuing year: Chairman of board, Herbert DuPuy; general manager, S. G. Lewis; secretary, G. W. Shively; and assistant treasurer, C. G. Morrill. The directors are Herbert DuPuy, H. W. DuPuy, C. M. DuPuy, S. C. Lewis, and G. W. Shively.

The company's report for the season of 1915, shows approximately a $4,000,000 business. Additions will be made to the factory facilities to take care of a production of not less than 2000 casings a day.

157 Chalmers Shipped Feb. 23

DETROIT, Feb. 23—All former shipping records were broken by the Chalmers Motor Co. to-day, when 157 Chalmers were shipped. The daily shipping schedule calls for 125 cars, but it is better than that most of the time.

Army Truck Bids Opened

Full Specifications Issued for Eight Trucks Needed by U. S. War Department

WASHINGTON, D. C., Feb. 26—Bids for supplying the U. S. Army with eight gasoline trucks will be opened in the office of the Chief of Ordnance, U. S. A., War Department, this city, on March 2. These trucks are to be four-wheel-driven with locking differentials whose normal capacity shall be 5000 lb., whose weight with body shall be about 6500 lb., whose speed shall be 15 m.p.h. maximum and whose power shall be 30 hp.

In the specifications of these vehicles, they are required to be capable of negotiating surfaces off the roads and to climb grades of as much as 15 per cent. Axles must be forgings and live axles should be of the floating type. There must be brakes in each wheel and also on the transmission, capable of holding the truck on a 25-per cent grade. Load distribution must be so that not less than 30 per cent or more than 45 per cent falls on the front wheels. The safety factor must permit 20 per cent overloads. The carbureter must be water-jacketed and fitted with a hot air connection. The tread must be 56 in. and the clearance 15 in., 8 in. under the brake drums.

Spark and throttle levers are required to be separate from the steering column. An accelerator, if used, must be to the right of the pedals. The radiator must be mounted on springs and preference will be given to the vertical tube type. It must be at the front and fitted with a drain. Circulation should be by pump, so arranged as not to interfere with thermo-syphoning. The engine should be supported on three points.

The engine is required to be under the hood, of four-cylinders, vertical and with inclosed valve mechanisms. The horsepower formula used is $HP. = .28N (b - 1.18) (s + b)$, in which N is the number of cylinders, b, the bore in inches and s the stroke in inches and must equal 30 by this formula. Towing hooks, after the Ordnance Department's specifications, spring-mounted, must be fitted fore and aft. A spur- or bevel-gear type of differential is required.

Shaft drive is required, worm drive being preferred. Universals may not be exposed. Thirty gallons of gasoline must be carried, 25 in a main tank and 5 in a reserve tank. A selective gearset is required with a total low reduction of from 30 to 40 to 1.

If magneto ignition is used, there must be a battery reserve. If an electric starting system is used, a separate storage battery shall be provided for ignition. Electric lighting is required, fed from a storage battery and in addition to the usual lamps, there must be a dash lamp and swinging searchlight on the dash. Torsion and propulsion through springs is considered undesirable. There must be three forward speeds and a governor set at 15 m.p.h.. A speedometer must be provided. No bright metal parts will be permitted. Four-wheel steering is preferred, but not insisted upon. Single tires, 36 by 6 are desired, mounted on cast steel wheels. Deliveries will be made f.o.b. train at Fort Sill, Okla.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.57	.57	.57	.57	.59	.60	+ .03
Antimony	.44	.44	.43¾	.43¾	.43¾	.43¾	— .00¼
Beams and Channels, 100 lb	2.17	2.17	2.42	2.42	2.42	2.42	+ .25
Bessemer Steel, ton	34.00	34.00	35.00	35.00	35.00	35.00	+1.00
Copper, Elec., lb	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl	9.70	9.55	9.85	9.70	9.65	9.80	+ .10
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl	.23	.23	.23	.23	.23	.23	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb	6.30	6.30	6.37½	6.37½	6.37½	6.50	+ .20
Linseed Oil	.76	.76	.76	.77	.77	.77	+ .01
Open-Hearth Steel, ton	35.00	35.00	35.00	35.00	35.00	35.00	...
Petroleum, bbl., Kans., crude	1.30	1.30	1.30	1.30	1.30	1.30	...
Petroleum, bbl., Kan., crude	2.40	2.40	2.40	2.40	2.40	2.40	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.76	.76	.75	.76	.78	.78	+ .02
Rubber, Ceylon, First Latex, Crepe	.90	.89	.88	.91	.97	.97	+ .07
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	42.25	42.63	43.25	43.75	43.75	50.00	+7.75
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Automobile Club Tests Tankii

NEW YORK CITY, Feb. 28—Results of a certified test on Tankii, a fuel preparation made by the Tankii Chemical Sales Co., Cleveland, Ohio, have just been announced by the Automobile Club of America, under whose auspices the test was made. The report of the technical committee indicates that no increase in miles per gallon resulted from its use. The test was made on the roads in Central Park, the car first being run with gasoline and then with the mixed fuel, the Tankii being in the form of white tablets. One tablet was added to each gallon of fuel.

A run with the mixed fuel showed 13.1 m.p.g., and with the plain gasoline under the same circumstances, 13.4 m.p.g.

Metal Prices Higher

NEW YORK CITY, Feb. 29—A contraction in the supplies of a few of the metals last week caused prices to soar. Tin advanced over $6 per 100 lb. in one day, reaching a new high mark of $50 per 100 lb. Lead reached $6.50 per 100 lb. yesterday, making a gain of 20 cents for the week. Aluminum kept up its rise, reaching 60 cents per lb. Bessemer steel went up $1.00 per ton to $35.

Pennsylvania crude oil went up to $2.40 a barrel on Tuesday. Reports reaching the oil refiners showed that during January there was a falling off of about 6000 barrels a day in normal runs and shipments, and the advance was made in the hope of making up this deficiency. Competent authorities, however, believe that the immense amount of crude oil now held in storage will not find the market until the price has reached $2.50 a barrel.

Crude rubber prices were a little higher with a steady market and a fair demand. Manufacturers did not show much disposition to anticipate to any extent, but the demand for moderate lots was on a fair scale.

Gasoline prices remained unchanged, with higher prices, however, expected. A number of curb brokers in Wall Street are hedging on gasoline. They are buying some oil stocks to cover any rise in gasoline. If gasoline goes up, they figure, oil stocks would also go up, and the profits would reimburse them for the high prices of gasoline. If gasoline went down, on the other hand, they figured they would take their compensation by buying cheaper gasoline, even though their oil stocks dropped a little.

Indianapolis Plant Sold

INDIANAPOLIS, IND., Feb. 24—The American Motor Realty Co., owner of the site and plant formerly occupied by the American Motors Co., at South Meridan Street and the right-of-way of the Indianapolis Union Railway Co., has sold the property for $70,000 to the Indianapolis Cordage and Implement Co.

Jeffery Cuts Hours—Raises Wages

KENOSHA, WIS., Feb. 24—The Thomas B. Jeffery Co., this city, has increased the wages of 2000 employees 10 per cent and reduced the working hours to fifty a week for day work and fifty-five for night work.

Maxwell Man in Orient

DETROIT, MICH., Feb. 24—Walter T. Langwell, of the sales department of the Maxwell Motor Co., sails for Japan and China, April 22, and will make an investigation of the automobile business in the Orient and the possibilities of further extending the Maxwell export trade in that part of the world.

Security Prices Lower

General Reduction Sets in with Little Activity—New Stocks Issued

NEW YORK CITY, Feb. 28.—Securities prices on Saturday were much lower, failing to hold their advantage of the previous week. In fact, a few of the leading stocks on the New York Exchange have gone under their low marks for 1916. Maxwell common at the present time is a little under its lowest mark this year, which was 63½. The first preferred is now quoting at the lowest price this year, that of 85. The second preferred at 48 is ½ point under its low mark for the year. Studebaker at 140 on Saturday was 1⅞ points below its former low mark while its preferred at 109 was just 1 point lower. General Motors and Willys-Overland have managed to quote above their lowest marks. General Motors, common, especially, is considerably ahead of its 1916 rock bottom price of 415 made on Jan. 7. Its present price is around 476. Its highest quotation was 495, made on Jan. 3. The highest point reached by this stock was 558 in 1915, having risen from 82 the same year. Willys-Overland, common, though considerably under its highest mark made this year, is at the present time about 10 points above the rock bottom price of 199¼. Its preferred has been very steady this year, there being very little difference between its high and low marks.

With the exception of a 5-point rise in Firestone common, the rest of the tire issues last week were lower. Miller Rubber common featured the decline with a 50-point drop. This stock has been subject to large fluctuations. U. S. Rubber common went down 1¼ points to 50½. The new Kelly-Springfield common also showed a decline of 1 point. This company has made a formal application for the listing of its shares on the New York Exchange. It is understood that trading in the issue on the big board will start March 9. In accordance with the provisions of the certificate of incorporation there has been set aside in the special surplus account $75,246, which will be expended in purchasing for retirement and cancellation the 6 per cent preferred stock. There will be $3,758,200 preferred and $5,877,200 common issued.

Another company to have its stock listed on the exchange is the Chandler Motor Car Co. This stock was taken from the curb market and placed on the Exchange board last Saturday. The company is listing $7,000,000 common.

There was a brisk demand for the new shares of the Continental Motor Co. on the Detroit Exchange. This stock is now $10 instead of $100. The bid on Saturday was 27 and it is next expected that a further rise will occur. On the last day the old stock was quoted, it went up to 505 bid, which was a gain of 55 points since Feb. 19.

Winton Co. Reverses Color System on Its Cars

CLEVELAND, OHIO, Feb. 26—The Winton Co. has reversed the usual procedure, where both light and dark colors are used on closed car bodies and is now putting the light shades above the seat line and the dark shades below. This plan of coloring is believed to make the cars look more cheerful, since the human vision has a tendency to take in the upper half of everything before the lower portion is noted.

Johnston President of Dealers' Assn.

NEW YORK CITY, Feb. 24—R. H. Johnston, manager of the New York branch of the White Co., was re-elected president of the Automobile Dealers' Assn. of New York. W. C. Poertner of the Poertner Motor Car Co. was elected vice-president, and C. M. Brown was re-elected secretary and treasurer.

Automobile Securities Quotations on the New York Exchange

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	71	82	..
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	75	80	84	86	—1
Chalmers Motor Co. com	..	90	130	150	..
Chalmers Motor Co. pfd	91	93½	99	101	..
Chevrolet Motor Co	..	..	136½	137	+2½
Electric Storage Battery Co	47½	48½	..	..	..
Firestone Tire & Rubber Co. com	375	380	740	750	+5
Firestone Tire & Rubber Co. pfd	108	109½	113	..	+1
General Motors Co. com	88	90	476	480	—1
General Motors Co. pfd	92⅞	95	113	115	—1
B. F. Goodrich Co. com	31¼	31½	69	71	—3⅛
B. F. Goodrich Co. pfd	96⅝	98½	113½	114½	+ ½
Goodyear Tire & Rubber Co. com	188	191	342	347	..
Goodyear Tire & Rubber Co pfd	101	102½	116	117½	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	20	25	—2
International Motor Co. pfd	..	..	32	38	—3
Kelly-Springfield Tire Co. com	104	105	..	..	..
Kelly-Springfield Tire Co. com. (new)	..	..	70	71	—1
Kelly-Springfield Tire Co. 1st pfd	82	83	95	97	..
Kelly-Springfield Tire Co. 2d pfd	122	127	..	..	..
Maxwell Motor Co. com	24¼	24½	63	64½	—2¼
Maxwell Motor Co. 1st pfd	62	62¾	85	86	—1
Maxwell Motor Co. 2d pfd	25	25¼	48	50	+1¼
Miller Rubber Co. com	158	160	225	240	—50
Miller Rubber Co. pfd	101	103	113½	116	..
New Departure Mfg. Co. com	122½	127	173	176	—1
New Departure Mfg. Co. pfd	105½	108	110	..	—1
Packard Motor Car Co. com	..	99	165	175	—5
Packard Motor Car Co. pfd	95	..	102	†104	..
Paige-Detroit Motor Car	..	..	665	700	..
Peerless Motor & Truck Corp	..	..	26	27	..
Portage Rubber Co. com	34	36	68	71	+3
Portage Rubber Co. pfd	85	95	106	108	—1
Regal Motor Co. pfd	..	..	13	16	..
*Reo Motor Truck Co	11	12	26½	28	— ¼
*Reo Motor Car Co	25¾	26¼	33½	34¾	— ½
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	48	50	86	87	— ½
Stewart-Warner Speed. Corp. pfd	101	104	108	..	..
Studebaker Corp. com	44⅝	45	140	142	—6
Studebaker Corp. pfd	92	94¾	109	111	..
Swinehart Tire & Rubber Co	73	75	88	89	+ ½
Texas Co.	126½	127½	202	204	—5½
U. S. Rubber Co. com	54	54½	50½	51½	—1¼
U. S. Rubber Co. pfd	100½	102	107	107½	+1
Vacuum Oil Co	184	186	227	232	—1
White Motor Co. (new)	..	..	49	49½	— ¼
Willya-Overland Co. com	93	95	209	211	+1
Willys-Overland Co. pfd	95	96	104	106	..

*Par value $10. †And accrued dividend.

Factory Miscellany

Oakes to Add—The Oakes Co., manufacturer of automobile parts, will enlarge its plant at Indianapolis, Ind.

Hamilton Carbureter to Add—The Hamilton Carbureter Co., 535 Queen Street, East Toronto, Ont., will build an addition to its factory at Toronto.

Ford Plant in Pocatello—The Ford Automobile Co., Detroit, Mich., it is stated, is contemplating the construction of an assembling plant at Pocatello, Idaho.

Carhart to Build—The Carhart Motor Co., 218 West First Street, Oklahoma, Okla., contemplates the construction of a plant at an estimated cost of $50,000.

Glidden Varnish to Add—The Glidden Varnish Co. will erect a $20,000 steel, four-story manufacturing and storage building at 11,020 Madison Avenue, Cleveland, Ohio.

Hamilton Watch to Make Speedometers—The Hamilton Watch Co., Lancaster, Pa., will construct an addition to its plant for the manufacture of speedometers. C. F. Miller is president.

Canton Automobile Co. to Add—The Canton Motor Car Co., Canton, Ohio, has placed contracts for the erection of a new plant. It will be a two-story brick and steel structure, 66 by 200 ft.

Steel Products to Add—The Steel Products Co. has purchased a tract of land adjoining its plant at 2206 Clarkwood Road, Cleveland, Ohio. The land will be used for an addition.

North American Co. Gets Foreign Order—The North American Motor Co., Pottstown, Pa., has made an initial shipment of its motor trucks to Manchester, England. This company has been recently established.

Prudden to Add—Plans have been prepared for the construction of a two-story, 70 by 540-ft. addition to the plant of W. K. Prudden & Co., manufacturer of automobile wheels at Lansing, Mich.

Belknap to Enlarge—Belknap Wagon Co. will practically double its plant on Front Avenue, Grand Rapids, Mich. The company makes automobile bodies especially for delivery purposes. It now has orders on the books for more than 250 special bodies.

Auto Devices Move—The Auto Devices Co., manufacturer of Pamco shock absorbers and several other automobile specialties, has removed from 3027 Locust Street to a larger building at 3214 Locust Street, St. Louis, Mo., and with enlarged manufacturing facilities will largely increase its output.

Bettendorf Trailer Co. Formed—The Bettendorf Trailer Co., Bettendorf, Iowa, has been incorporated with a capital of $100,000. The company has been manufacturing automobile trailers at Bettendorf for several months, and in the spring will erect a shop building, 300 by 300 ft. J. W. Bettendorf is president.

R & R Shock Absorber Adds—The R & R Shock Absorber Co., Elgin, Ill., has been compelled to increase the force of employees by twenty-five men to take care of an order for 25,000 sets of its product of 100,000 single absorbers. As soon as the material can be secured the company can turn out 2500 sets per week. An addition to the plant is contemplated.

First Rock Island Tractor—The first tractor completed since the Heider Company of Carroll, Iowa, consolidated with the Rock Island Plow Co., Rock Island, Ill., was turned out this week. For several years the Rock Island company has been marketing the Heider product, and when the demand became so great that additional facilities were required it was decided to consolidate, shipping facilities being improved by the change, together with many other advantages. It is hoped to turn out several thousand of the machines this year.

The Automobile Calendar

Feb. 28-March 3..	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Feb. 28-March 4..	Utica, N. Y., Show, Utica, Automobile Bldg., Utica Automobile Trade Assn.
Feb. 28-March 4..	Cedar Rapids, Ia., Show, Cedar Rapids Automobile Dealers' Assn.
Feb. 28-March 4..	Paterson, N. J., Fifth Annual Show, Auditorium.
Feb. 28-March 4..	Shamokin, Pa., Show, Shamokin Automobile Show Assn.
Feb. 29-March 2..	Dallas, Tex., Second Annual Show, Dallas Automobile Accessory Dealers' Assn.
Feb. 29-March 4..	Ft. Dodge, Iowa, Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
March..........	Danville, Ill., Show.
March 5.........	Los Angeles, Cal., Speedway Race, Ascot Speedway Assn.
March 4-11......	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11.......	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
March 8-11.......	Mason City, Iowa, Show, Armory.
March 8-15.......	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11.......	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 11-18......	Boston Automobile Show. Mechanics Bldg.
March 14-17......	Springfield, Ill., Show.
March 15-18......	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 18-25......	Pittsburgh, Pa., Twelfth Annual Show, Automobile Dealers' Assn., Motor Square Garden.
March 20-25......	Twin Falls, Ida., Show, Oliver Tabernacle.
March 21-25......	Deadwood, S. D., Show, Auditorium. Deadwood Business Club.
March 22-25......	Lexington, Ky., Show, Woodland Auditorium.
March 25-Apr. 1..	Wheeling, W. Va., Show, Market Auditorium.
March 27-Apr. 1..	Danville, Ill., Show, Eastern Illinois Dealers.
March 27-Apr. 1..	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3.	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 1-8.........	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 8...........	Corona, Cal., Race.
April 10-15.......	Seattle, Wash., Show, Arena.
April 15..........	Altoona, Pa., Pennsylvania State Motor Federation.
Apr. 26-May 6....	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show. Automobile Industries Assn.
May.............	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6...........	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13..........	New York City, Sheepshead Bay Speedway Race.
May 26-27.......	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30..........	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30..........	Indianapolis Speedway Race.
May 31..........	Minneapolis, Minn., Speedway Race.
June 10..........	Chicago Speedway Race.
June 28..........	Des Moines, Iowa, Speedway Race.
July 2-6.........	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4...........	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4...........	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4...........	Minneapolis 300-Mile Speedway Race.
July 4...........	Sioux City Speedway Race.
July 15..........	Omaha, Neb., Speedway Race.
Aug. 5...........	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 18-19.......	Elgin Road Race.
Sept. 4..........	Des Moines Speedway Race.
Sept. 4...........	Indianapolis Speedway Race.
Sept. 16..........	Providence Speedway Race.
Sept. 30..........	New York City Sheepshead Bay Race.
Oct. 7............	Omaha Speedway Race.
Oct. 14...........	Chicago Speedway Race.
Oct. 19...........	Indianapolis, Ind., Race, Indianapolis Motor Speedway.

The Week in the Industry

Harris Gray & Davis Sales Manager—R. W. Harris has recently been appointed sales manager of Gray & Davis, Inc., Boston, Mass. Mr. Harris was formerly in charge of the Ford system department of the company.

Stone Makes Remy Change—G. B. Stone has been placed in charge of the Ohio-Indiana territory of the Remy Electric Co., Anderson, Ind. For a number of years Mr. Stone has been a member of the engineering department of the Remy company, doing specialized sales work in connection with engineering.

Farrington Joins Gibson Co.—Richard Farrington has been appointed assistant to H. R. Williams, manager of sales of the Gibson Co., Indianapolis, and will have charge of advertising. Mr. Farrington comes to his new position well equipped, as in addition to having been editor of the Automoble Department of the *Indianapolis Star* for sometime past, he was previously connected with an advertising agency, and also with newspapers in other cities.

Dealers

Ahlberg Opens Atlanta Branch—The Ahlberg Bearing Co. has opened a branch in Atlanta, Ga., at 323 Peachtree Street. This branch will be in charge of H. A. Fisher.

Cleveland Co. Builds—The Hudson-Stuyvesant Motor Co., Cleveland, Ohio, is building a $55,000 salesroom and service station. The building is on automobile row on Euclid Avenue and Twenty-first Street. The building, 50 ft. wide by 179 ft. deep, serves two purposes. The front section, 51 ft. deep, is an artistic commercial building, four stories high, of strictly fireproof construction.

Louisville Items—The Louisville Automobile Exchange, 544 South Third Street, agents for the Mitchell, Hollier and Partin-Palmer, have been appointed Chevrolet distributor in this territory.

The Standard Auto Co., 212 East Broadway, Louisville, agent for the Cole and Reo, is the new distributor for the Paige in this vicinity.

G. M. Cheschier of this city, who for two years has been Southern district manager of the Waverly Electric Co., with headquarters at Washington, D. C., has resigned to become district manager of Northwestern territory for the Milburn Wagon Co., Toledo, Ohio. He will make Minneapolis his new headquarters. For several years he was connected with the Southern Motors Co., Louisville.

Motor Men in New Roles

Collins Resigns—B. J. Collins, sales manager of the American Top Co., Jackson, Mich., has resigned.

Ryan Leaves Hupp—John Ryan, traveling representative of the Hupp Motor Car Co., Detroit, has resigned.

Pietsch Packard Mgr.—F. H. Pietsch has been appointed manager of the truck department of the Packard Motor Car Co., Chicago, Ill.

Suhr Promoted—F. W. Suhr has been appointed manager of the New York City motor tire department of the Firestone and Rubber Co.

Durie with Chase Truck—C. A. Durie has been made factory production manager by the Chase Motor Truck Co., Syracuse, N. Y. He succeeds J. E. Gramlich.

Kromer Transferred to Atlanta—P. W. Kromer has been transferred to the Atlanta, Ga., office of the Prest-O-Lite Co., Indianapolis, Ind. He was formerly with the Buffalo office.

Replogle Marathon Middle West Mgr.—H. H. Replogle is Middle West division manager of the Marathon Tire & Rubber Co., Cuyahoga Falls, Ohio. His headquarters are in Omaha, Neb.

Moore Cleveland Velie Sales Mgr.—R. L. Moore, who has for a number of years been intimately connected with the motor car business in Cleveland, Ohio, has become sales manager of the Cleveland Velie Co.

Kerr Joins Overland Forces—Melvin Kerr, formerly assistant branch manager of the King Motor Car Co., New York City, has been appointed western New York representative of the Willys-Overland Co. His headquarters will be in Rochester.

Redman Joins Chicago Michelin—J. E. Redman has been made assistant sales manager of the Chicago territory by the Michelin Tire Co., Milltown, N. J. R. B. Tracy, who was appointed factory representative recently, will continue to supervise the Middle West branches of the company.

Langmaid Resigns—Chase Langmaid, manager of the New England branch of the Federal Tire Co. for some years, resigned last week to become sales manager of the Needham Tire Co. He is succeeded by W. H. Piggott, who was sent on from the factory at Milwaukee. H. L. Diechert has been sent on also as New England traveling representative.

Crumley Detroiter Ssles Representative—A. A. Crumley has been appointed traveling sales representative of the Detroiter Motor Car Co., located in Detroit, Mich.

Ross Joins Dodge—Frank Ross, for the past five years superintendent of the Cleveland Foundry Co., Cleveland, Ohio, has accepted the position of superintendent of the compressed steel division of the Dodge Bros. factory located at Detroit.

Richards Goes to Pittsburgh—G. A. Richards, who has been manager of the Columbus branch of the Firestone Tire & Rubber Co., for three years, has been promoted to manager of the Pittsburgh branch of the company.

Hanson Joins Service Truck—A. B. Hanson, formerly manager of the service department of the Chalmers Motor Co., Detroit, has become general manager of the Service Motor Truck Co., Wabash, Ind.

Wellman Olds Advertising Manager—Fred Wellman has been appointed advertising manager of the Olds Motor Works, Lansing, Mich. He was formerly confidential assistant and advertising counsel to Carl G. Fisher in the Indianapolis and other enterprises. C. V. McGuire, former advertising manager of the Olds, has joined the Cheltenham Advertising Agency.

Dealers

New Dayton Rubber Dealers—The Alling Rubber Co., Albany, N. Y., and the Dayton Tire Co., Boston, Mass., have been appointed dealers for the tires of the Dayton Rubber Mfg. Co., Dayton, Ohio.

Cleveland Items—The Ris Motor Co., Cleveland, has taken on the Kissel-Kar in addition to the Dort, which was its original line.

W. J. Newcomb, Cleveland, Ohio, has purchased the business and stock of the Windermere-Euclid Garage Co. and taken over the lease of the building at 13,560 Euclid Avenue. Mr. Newcomb was formerly connected with the Baker-R & L Co., but will now devote his entire time to the new business.

The Coate Motor Car Co., Cleveland, distributor of the Paige and Pullman, is remodeling and enlarging its salesroom. A service station has been established at Euclid Avenue and East 66th Street, in order to give more room for the sales department.

Columbus Items—The Capital Motor Car Co., 168 North Fourth Street, Columbus, has decided to move to South Fourth Street, where a two-story garage and sales rooms will be erected by the concern. The new structure will be erected during the summer.

The Winders Motor Sales Co., Columbus and central Ohio representatives of the Chevrolet, Velie and Monroe, has decided to erect a modern sales room on East Long Street, near Fourth Street, which will cost approximately $25,000.

Wis. News Items—O. F. Fischedick, who, with J. D. Babcock established the first exclusive motor supply and accessory store in Milwaukee by organizing the Auto Supply Co. in 1910, has disposed of his interest to Mr. Babcock, who becomes president and general manager. Mr. Fischedick will engage in another department of the industry. The Auto Supply Co.'s main store is located at 134-136 Second Street, Milwaukee.

The Diener-Nelson Co., Milwaukee, State distributor of the Haynes and Grant, has moved from 809 Grand Avenue to new and larger quarters at 188-192 Eighth Street, Milwaukee.

The American Tire & Rubber Co., 252 Fifth Street, Milwaukee, has been appointed State distributer of Batavia tires.

The Jeffery Motor Service Co., Fond du Lac, has leased the entire first and part of the second floor of the Longdin-Bruegger Block and is converting it into a modern garage and service station. It will be ready May 1.

E. A. Glab and J. J. Glab of Milwaukee have organized the Pathfinder Sales Co., to act as distributer of the Pathfinder in Wisconsin and upper Michigan. Headquarters have been established at 163-165 Eleventh Street, Milwaukee.

The Motor Car Sales Co. of Milwaukee has been organized to act as Wisconsin distributer of Marmon cars. Temporary headquarters have been established at 136 Mason Street, pending the completion of the company's own garage, which will be located in the downtown district. The concern also is Milwaukee agent for the Oakland line. F. P. Lynch and P. B. Hustis are in charge of sales and George Kerner manager of the service department.

The Universal Auto Supply Co., organized recently as a corporation in Milwaukee, has opened a store and service station at 468 Jefferson Street.

The Anderson Electric Car Co., Detroit, Mich., has established a direct factory branch at Milwaukee, in charge of J. A. Crandall. Headquarters have been opened at 604 Downer Avenue. Mr. Crandall was formerly associated with the Detroit electric branch in Chicago.

San Francisco News Items—The Latham Davis Co., San Francisco, has been appointed Northern California agent of the Case Car, which it will handle in addition to its Stutz and Fiat lines.

M. M. Hartmann of the Hartmann Motor Sales Co., who was recently appointed Pacific Coast distributor of the Lozier car has named William Sealey as manager of his San Francisco office.

G. K. Arnold and J. H. Stelling, formerly of New York, have been appointed Pacific Coast agents of the Simplex-Crane. Mr. Arnold was formerly connected with the Packard and S. G. V. agencies in New York City and Stelling was identified with the De Dion Bouton Co. In addition to the Simplex-Crane car the new firm will handle the Lancia in this territory.

With the arrival in San Francisco of Eli White, chief construction engineer of the Hood Co. of Detroit, last week the first step in the building of the million-dollar Chevrolet assembling plant in Oakland was started. The new plant will furnish close to 150,000 ft. of floorspace and will be so built as to allow the putting together of 8000 Chevrolet cars a year. It is anticipated the factory will be in working order by July 1. The location of the plant is right on the Lincoln Highway in Oakland.

Many Agencies Being Closed at Boston—The activity in Boston motor circles is evident from the way agencies are being placed without waiting for the motor show. J. W. Bowman has closed up to represent the Daniels Eight. He also has the Velie. W. B. Dorr and A. J. Griffen have formed the Dorr-Griffen Co. to handle the Crow-Elkart, with salesrooms on Commonwealth Avenue. F. L. Brown, New England distributor of the Apperson, has formed a new company to handle the line at retail in Boston, with R. W. Shank and J. G. MacMurray, two former Buick salesmen, as partners and they have leased the old Dodge Bros. quarters on Boylston Street. B. W. Krogman and E. J. Sullivan have formed the S. J. R. Motor Sales Co. to handle the new S. J. R. Boulevard roadster being made at Boston, they having taken Maine, New Hampshire and Vermont. G. D. Rathburn of Malden has taken the agency for the Elcar, and he will open salesrooms in Boston shortly. And A. C. White, Jr., resigned recently to take on the Vim truck for New England. W. L. Burgess, sales manager for the Dorris, was in Boston last week and he expects to close an agency shortly and J. W. Moon has plans developing to have his car represented. V. A. Charles, New England distributor for the Briscoe, has given up the retail sales, and it is to be taken over by the Porter Motor Sales Co., handling the Pathfinder.

Gardner Machine to Add—The Gardner Machine Co., Beloit, Wis., manufacturing disc grinders widely used in automobile factories, garages and other shops, has made plans for an addition of the same size as the one now being completed. Both buildings will be 60 by 60 ft. The company's business has increased enormously in the last 8 months, making enlargement imperative. The establishment of many garages and repairshops throughout the country has created a heavy demand for small grinders. The C. H. Besly Co., Chicago, which has works at Beloit, is also enlarging the new shop recently completed.

Tower Truck Co. Formed—The R. J. Tower Motor Truck Co. has been formed at Greenville, Mich., with a capital stock of $50,000. A truck with several new features and a novel system of traction will be manufactured. R. J. Tower is president of the company, Francis Tower, vice-president, and C. V. Coats, secretary and treasurer. Besides the officers T. B. Winter and H. L. Baker are stockholders. Factory buildings have been secured and the manufacture of trucks will start at once.

Parish & Bingham to Add—The Parish & Bingham Co., Cleveland, Ohio, has secured a permit to erect a fireproof addition to its factory building at 10,601 West Madison Avenue. The building will be 900 ft. by 100 ft., with a height varying from 20 to 30 ft. At the same time it asked permission to build an addition to its boiler room. The two will cost about $130,000. Several other modern buildings have been planned by the company.

Kissel to Build Again—Plans for the proposed new factory building to be erected by the Kissel Motor Car Co., Hartford, Wis., on the 17-acre tract recently acquired for future extensions, are being drawn. It is said that work will be undertaken before June 1. The company is completing a large shop addition at this time.

Highway Tire Protectors' Separate Plant—John J. Bukolt, who has been manufacturing Highway tire protectors in connection with his other business, the Automatic Cradle Mfg. Co., at Stevens Point, Wis., will separate the two industries. A $100,000 corporation will be formed to take over the tire appliance and accessory business, and a new fireproof factory affording 15,000 ft. of floorspace will be erected. The present combined works are employing nearly 200 men on two 10-hr. shifts, and more than $3,500 worth of new machinery and tools has been contracted for to relieve the high tension caused by the extraordinary demand.

Steel Clad Auto Bow Co. to Start—The Steel Clad Auto Bow Co., Holland, Mich., has been organized here, its capital stock being $50,000. H. R. Schnarr is president, Henry Winter secretary, and Dick Jellema vice-president and treasurer. The old Holland Mfg. Co.'s plant will be occupied by the new concern.

The AUTOMOBILE

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No. 10

NEW YORK, MARCH 9, 1916

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**Without Adding Size
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SUPER
SIX
TRADE NAME REG.

$1375
at Detroit

Patented by Hudson
December 28, 1915
Patent No. 1165861

Hudson Super-Six

Wasted Power Now Reserve Power

THE Super-Six motor has identical size with the former Hudson Light Six.

But the former type, at its best, delivered about 42 horsepower. The Super-Six delivers 76 h.p.

No more power is created, no more fuel is consumed. All that added power—that extra 80 per cent—is power that was lost in friction. And that friction was due to vibration.

THE IDEA IS NEW

The Super-Six motor follows standard practice in all respects save one. But that one new feature, by eliminating vibration, gives us 70 per cent more efficiency.

The idea is new—a basic invention—as proved by the fact of our patent. It is also proved by performance. The Super-Six has broken all the stock car records.

It has outrivaled every former type — Sixes, Eights and Twelves.

And this new motor is a Hudson invention, controlled by Hudson patents. So it gives to the Hudson unquestioned supremacy.

Reason for 76 H. P.

In the light-weight Hudson this 76 horsepower means a vast reserve power.

It means effortless performance on any road or hill. It means quick acceleration, matchless flexibility.

It means economy, for the motor rarely runs at more than half its capacity.

It is not added power, remember. It is power that we save by saving vibration—power that was heretofore wasted.

LITTLE ENGINE WEAR

All this extra power—this 80 per cent—means that much lessened friction. Engine wear has been almost eliminated.

In our speedway tests a Super-Six stock motor was run for 1350 miles at speed exceeding 70 miles per hour. It was the hardest test a stock car ever stood. But not a part or bearing showed any discoverable wear.

The motor's endurance has been almost doubled by this Super-Six invention.

Take a ride in the Super-Six. Put it through its paces. Then you will realize that fine-car buyers are bound to demand this efficiency.

All Other Cars Outrivaled

At Sheepshead Bay, under A. A. A. supervision, a 7-passenger Super-Six stock car excelled all former stock cars in these tests.

100 miles in 80 min. 21.4 sec., averaging ***74.67 miles per hour***, with driver and passenger.

75.69 miles in one hour, with driver and passenger.

Standing start to 50 miles an hour in 16.2 sec.

During these tests the car was driven 1350 miles at top capacity, at speed exceeding 70 miles per hour without discoverable wear on any part.

7-Passenger Phaeton,
$1375 at Detroit.

Five Other Styles
of Bodies

HUDSON MOTOR
CAR COMPANY
Detroit, Michigan

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MAGNETIC TYPE
0 0 5
MILES PER HOUR
0754
SEASON MILEAGE
069
TRIP

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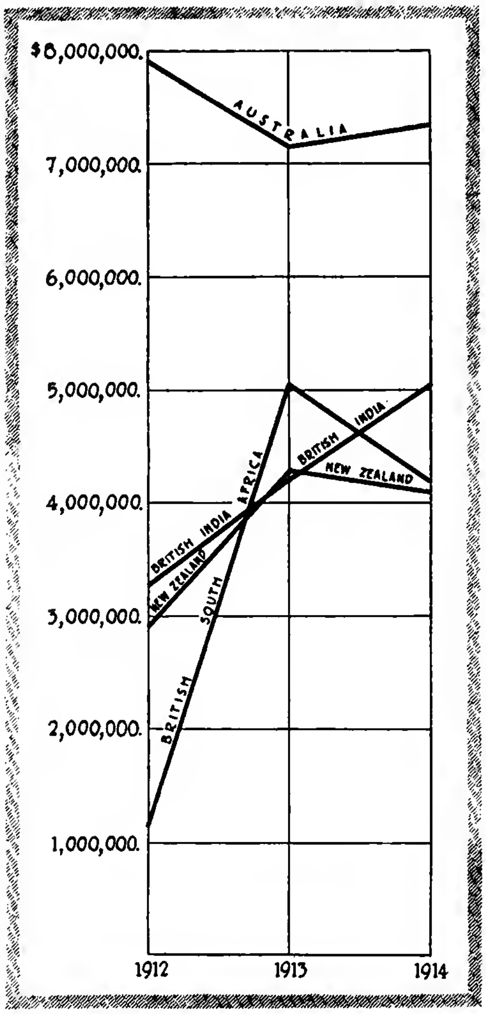
The Automobile

Wanted, $100,000,000 Worth

The British Empire Needs Vast Numbers of Cars and Trucks Which Can Come Only from America

By A. Ludlow Clayden



Automobile import trends in the British Empire

FOR the past several years American made cars and trucks have been exported in increasing numbers to the outlying parts of the British Empire. Australia, New Zealand, South Africa, India and the lesser portions of that vast territory, have looked to England for the major portion of their vehicles, but the eminent suitability of the American car to countries constituted much like America, has earned for it a growing popularity.

Canada is outside the argument, for Canada is a market which the American manufacturer enters without thinking about it; so in the following analysis of British Empire markets, Canada is left entirely out of the calculations.

The immediate conclusion, born of a close study of the import statistics of the major British colonies, is that Australia, New Zealand and South Africa, together with India, will want to buy $100,000,000 worth of automobiles during the next two years. These colonies are not feeling any pinch of war; on the contrary they are supplying many needs of the mother country and being paid for them in hard cash; the modern or reawakened patriotism of the Briton is a distinctly profitable thing to the Empire as a whole. Thus the colonies not merely want American cars, but have ample ready cash to pay for them.

It has been generally understood that many American manufacturers have been doing a good trade with British colonies these past twelve months, but it needs figures to show how great is the actual opportunity for immediate sales and future business.

Take Australia first, as being about the largest buyer of automobiles among the newer countries of the world. Unfortunately it is not possible to give statistics for 1915, as there has not yet been time for the compilation of the figures and their transmission to America, but sufficient is shown by study of the returns for previous years to indicate the trend of affairs. Taking the graph on this page, we see the automobile imports of the four major British colonies for 1912, 1913 and 1914 have shown a steady and substantial increase; moreover it shows that the American imports have risen very considerably in value.

However, it is not so much the value of the imports from the different countries that matters so much as the total values. Studying the curves of total importation, although we have only three points on each, it is yet self-evident that each of these four countries is absorbing automobiles at a rapidly increasing rate. It is safe to assume that the demand for cars in Australia, in New Zealand, in South Africa and in India is progressing in a normal way. None of these countries is pinched by war, and the extent to which taxation has risen is offset by the increase in the demand from Europe for their products.

Thus if we carry on the curves for another couple of years through 1915 and 1916 up into 1917 it is obvious at once that there will be a very large market indeed for cars and trucks and a very strong demand.

In 1914 the British colonies imported a total value of automobiles of roughly $30,000,000. Of this total the United States supplied only between $7,000,000 and $8,000,000. The balance of very well over $20,000,000 came mainly from England and France, with a fair amount from Italy, Belgium and Germany.

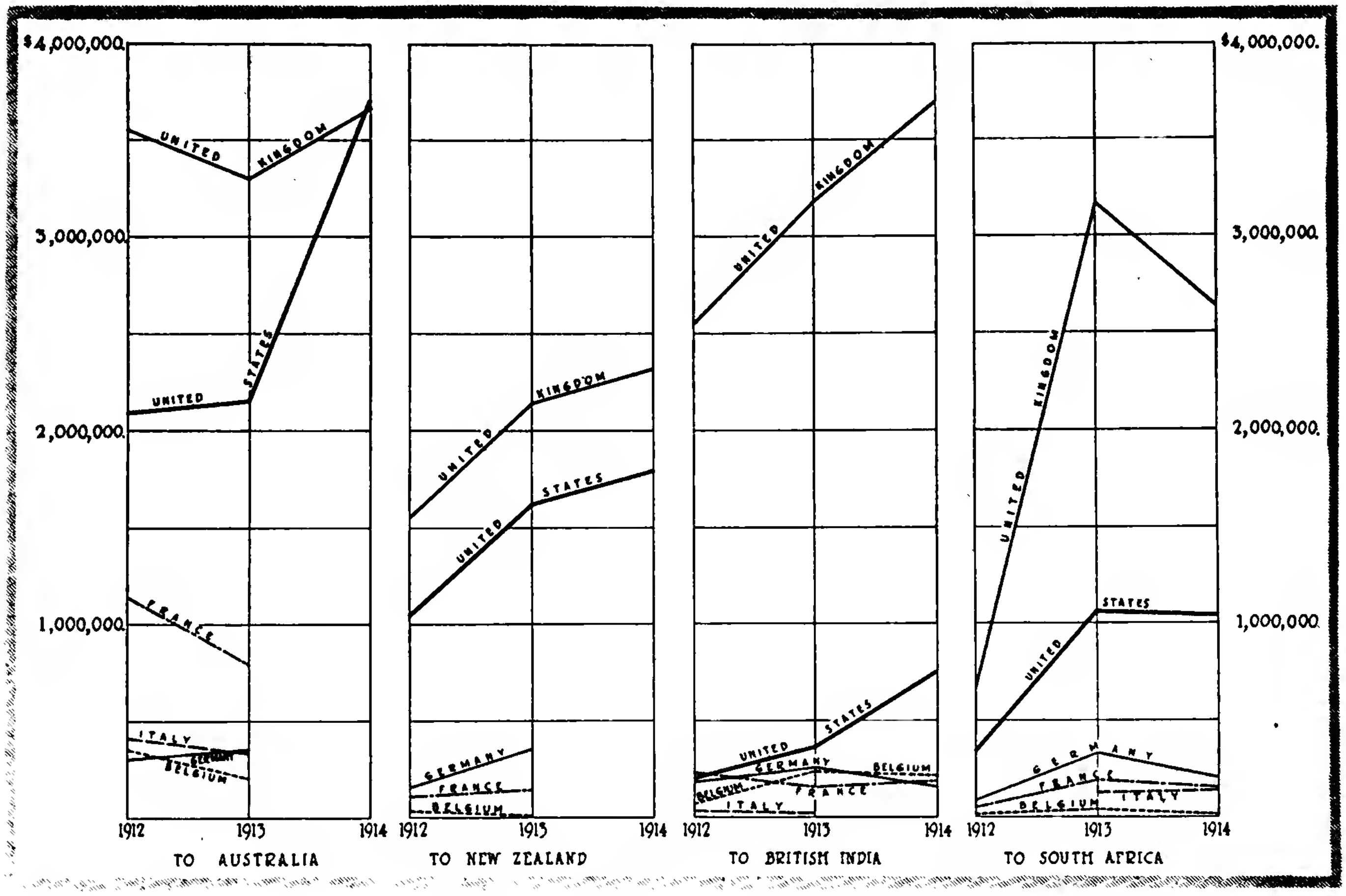
Exports of Motor Vehicles, Motor Cycles and Accessories —In American Dollars

	To Australia			To New Zealand		
From	1912	1913	1914	1912	1913	1914
United States	$2,088,225	$2,123,321	$3,695,595	$1,045,000	$1,620,000	$1,789,951
United Kingdom	3,545,268	3,308,956	3,663,600	1,560,000	2,145,000	2,325,900
Germany	332,142	366,645	....	157,000	355,000	....
Belgium	360,948	220,248	....	24,000	5,000	....
France	1,145,526	779,458	....	120,000	131,200	....
Italy	430,980	359,936	....	....	....	....
Total	$7,903,089	$7,158,564	$7,359,195	$2,906,000	$4,256,000	$4,115,851

	To British India			To South Africa (‡British)		
From	1912	1913	1914	1912	1913	1914
United States	$201,000	$365,500	$752,698	$348,300	$1,167,371	$1,045,000
United Kingdom	2,560,000	3,185,000	3,699,917	670,800	3,180,000	2,630,000
Germany	195,000	260,000	167,802	77,400	330,000	205,000
Belgium	79,500	240,000	220,959	12,900	35,027	9,510
France	220,500	165,000	195,181	51,600	195,300	154,500
Italy	25,100	13,500	....	....	121,000	139,932
Total	$3,281,100	$4,229,000	$5,036,559	$1,161,000	$5,028,698	$4,183,942

‡Figures are for year ending Dec. 31, 1914, which, because it includes 6 months of the war slump period, no doubt accounts for the decrease shown all down this one line. Note that U. S. exports show an increase to each country for 1914, except South Africa, which is not the case in regard to the exports from the other countries.

Curves Showing Trends in Importation from America, United Kingdom, France, Italy, Belgium and Germany from 1911 to 1914



Despite the war the British colonies are all in a state of fair prosperity. Every year for the past five the total imports to Australia, South Africa, New Zealand and India have increased with the exception of South Africa, which showed a slight drop in 1914. Probably this was because South Africa had some actual fighting to do in its own territory.

On the whole it is reasonable to assume that the upward trend has been maintained through 1915, judging by individual reports we have published. Assume the upward curve to be persisting and the four principal parts of the British Empire (excepting Canada) would have wanted about forty million dollars worth of automobiles in 1916. Of these, thirty millions would come from Europe in normal times. At present Europe cannot supply a single vehicle.

$30,000,000 This Year

This means that, if they can seize the chance offered, American automobile manufacturers have a market for a minimum of $30,000,000 worth of goods this year in four countries, all easily reached from our ports without going near any war zone.

Nor is it for this year only, for, if the war should end to-morrow, it will be two good years and more before the factories of Europe are again ready for exportation in any substantial quantity.

Then again, in 1913 the total value of German exports to the four parts of the British Empire which we are considering was $1,311,645, and the total figures for the first half of 1914 show that there would have been a substantial increase if the war had not intervened. Germany will have to wait many years before these markets are open again. Italy is not an important factor, and the French imports show a general decline. This means that Great Britain and America are left alone, almost, to struggle for the rich markets of the Empire.

America's Help Essential

Nor is it really a question of struggling. Great Britain, unless her methods of manufacture undergo a vast change, will be totally unable to supply the needs of the overseas parts of her dominions. The demand for passenger cars and trucks in England itself to-day keeps the importers busy, and, when the war is over and the British factories are once more producing automobiles, the domestic demand will easily absorb all the output. No doubt the importation of American cars into England will receive a check at the end of the war, as the feeling is very strong that Great Britain ought to do everything to keep her money within her own boundaries, but the more of her own output that England takes, the less will she have for export purposes.

This being so the American manufacturer is the only one left who can possibly satisfy the needs of Australia, South Africa, New Zealand and India, for the next five years or more, and probably longer.

The possibilities of the British Empire as an automobile market are staggering in their immensity. The enormous areas and the immense population provide an ever-increasing outlet for every possible sort of machinery.

Taking the Indian Empire alone, its 2,000,000 square miles with over 300,000,000 inhabitants represents an area of fairly dense population and with far from good means of transportation. Certainly, of that 300,000,000 the vast majority is semi-savage, but fully civilized or half civilized, there are many millions who spend their time in going to and fro just as in more fully developed Western lands. For the truck and omnibus as well as for the passenger car India offers a field almost as big as the U. S. A., which will develop slowly year by year for a century ahead.

Unexploited Fields

In Australia, New Zealand and South Africa, much of the land is yet unbroken, is trackless and railroadless, but the kerosene tractor, and the automobile plow, are wanted to convert the wild land for cultivation; and then the motor truck will come to haul the produce to rail or river head. Countries developed a century ago were essentially railroad countries, but those which are just being opened up to-day will be automobile countries first, because a practicable road for automobiles is a far cheaper thing to build than a rail track.

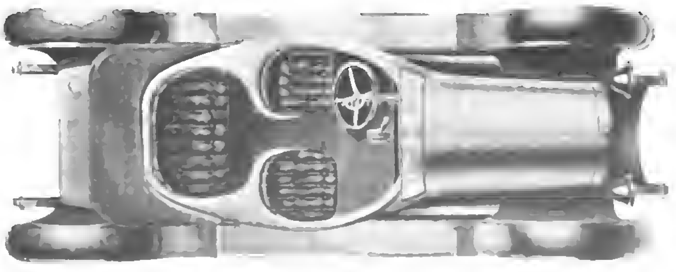
There is no river in the world where the chug-chug of the motor boat cannot be heard, there are few cities where the motor car is not being used in the great work of expanding and extending civilization. Great roads cut through the forests of Africa may be a vision of the future, but it is a less far distant future than most men would imagine.

Overland Adds Clover Leaf Body Type

THE six-cylinder Overland, model 86, can now be obtained in limited quantities with a clover leaf body to seat three or four passengers. The car will sell for $1,290 f.o.b. New York, and the chassis is identical with the standard six Overland except that the gasoline tank is at the rear, on the deck and with the filling cap at the side.

The new body will be finished in four colors, gray, green, red or blue, the wheels being a suitable contrasting tint, except for the vermillion car, which has wheels in the same paint as the rest of the body.

The Ohio Electric Car Co., Toledo, Ohio, are the manufacturers of the body, and the procedure for buying one of these cars is to order the chassis from the Overland Co., with instructions to deliver to the Ohio Electric Car Co., who will receive separate payment from the dealer ordering the car.



Overland Model 86 size cylinder chassis with clover leaf body equipment

The Sizes of Motors for Trucks and Outline of British Practice in This Field

An Exposition Covering Especially Those Features in the Design of Automobile Motors Which Should Vary According to the Different Conditions of Vehicle Service

By W. D. Williamson

Extracted from a paper entitled "Engines for Petrol Commercial Vehicles" presented by Mr. Williamson to the British Institution of Automobile Engineers. In the review of practice, forming a part of this paper, only motors for vehicles having a useful load capacity of two tons and upwards are considered, so as to exclude design which is artificially influenced by taxation based upon the bore of cylinders.

Part 1—Factors Governing the Sizes of Motors

THE designer of pleasure cars, after doing all he can to obtain the maximum of torque from a given cylinder, devotes his energies to the pursuit of "revolutions." To him, and to the aeronautical engineer, horsepower for weight is a serious consideration. In motors for commercial vehicles, on the other hand, the design is unhampered in this respect, in so far as additional weight is not of great moment, except in reciprocating parts, if it serves a useful purpose. Utility and manufacturing cost are the guiding considerations, and the designer can set out to produce a motor which will give the best possible results, in the hands of the average user, under the conditions for which it is intended.

Requirements in General

The user demands a vehicle with high fuel economy per ton-mile and reasonable speed. The motor must be robust, to insure against breakdowns, and the parts must be accessible, to facilitate adjustments and replacements. Here bore and weight are not involved. The user is often favorably impressed if the cylinder bore is, for example, ⅛ in. larger than in a competing vehicle.

Silence of operation has not so far been an outstanding feature or indispensable for the success of commercial vehicles. Motor noises were drowned in the general uproar. But live axles, inclosed chains and quiet gear boxes are bringing about a change. Motor buses and char-a-bancs set the fashion. The quietness of one portion of the chassis throws the noise from another into prominence. In one after another the noise is remedied, and finally the demand for a quiet motor, too, makes itself heard. To-day, on fair roads, high-class lorries operate with a lack of fussiness undreamed of a few years ago.

The motor must be produced at a competitive price. This requirement is related to those already mentioned, in so far as a low production cost for the motor enables a manufacturer to meet competition by putting all or a part of what he saves on the motor into improvements or workmanship that will tend to maintain his prestige.

The design must be adaptable to variations in size. As few British builders of commercial vehicles confine themselves exclusively to one type or size of chassis but usually cover load capacities from two to five tons and sometimes one or two sizes for passenger work, they have to provide a suitable range of motors, and from a manufacturing point of view it is highly desirable to obtain this range or series of motors with the fewest possible changes. The engines may be grouped so that one size is made suitable for two or three different types of vehicles, and provision can be made in some cases for larger cylinders and pistons to be used in conjunction with standard crankcases where additional power is required. The methods for attaching the motors to the frame can be standardized, so that it becomes possible to fit, for example, either a 30-hp. or a 40-hp. motor in the same frame without too many alterations. A little forethought in this direction may mean advantages both to himself and to the user.

Determining the Size of Motor

Motor speed and road speed are the most important factors for determining what the size of the motor should be. The ratio between them must be decided, and, in order to do so, the most economical motor speed must be discovered, as well as the average road speed giving the best vehicle results.

In ordinary delivery work for loads of two to four tons, a very satisfactory maximum speed is 15 m.p.h. For loads of four to five tons, this should be reduced to 10 or 12 m.p.h. For passenger vehicles greater speed is frequently demanded, and their hill-climbing speed must be better than that of a lorry or van, so that their motors must be correspondingly larger, but for commercial vehicles in general the figures mentioned may be taken as normal.

The best motor speed for these vehicle speeds depends largely on the type of engine used. Hence the type of the engine must be considered first. Broadly, it is found that the high-speed and high-compression motor so largely used for pleasure cars does not suit. Such a motor in a pleasure car is rarely required to run at low speeds with full throttle opening, and then usually only for short periods. In other words, in its average use the volumetric efficiency is low, its compression is reduced by throttle restriction and its rate of revolution is considerably below the maximum. Motors of this type are also apt to require more attention to minor points than the commercial vehicle motor obtains. While it is desirable to fit an engine no larger than the work requires, the weight consideration, which is mostly responsible for the pleasure car type of motor, should give way to those related to length of life and reliability.

One of the principal points in determining the most suitable type is to ascertain the motor speed at which the best results are obtained for the gasoline consumed. And, with the vehicle speed decided upon, this means the motor speed which will drive the vehicle at the selected road speed with the minimum of fuel cost, unless other factors cause a modification in this. In other words, the desirable speed for any particular motor must be determined through comparison and consideration of its torque and consumption curves.

Characteristic Torque Curves

The diagram of curves taken from a Dorman motor and shown in Fig. 1 illustrates the points to be considered. In examining this torque curve it is seen that from the lowest speed at which regular torque is obtained—about 300 r.p.m.—there is a rise showing increased load on the piston. The effective torque of the motor depends upon volumetric efficiency, cooling, carburetion, internal mechanical loss and on the relative gains and losses due to these governing factors at various speeds.

The volumetric efficiency should be greatest at the lowest speed at which the engine will run steadily, as under such conditions the cylinder should receive a full charge of mixture. At this speed, however, the cooling effect is most pronounced. The working temperature of the whole engine is lower; the heat losses during the cycle are considerably greater than at high speeds, and the thermal efficiency of the engine suffers. Carburetion at this speed with the usual carbureter setting would probably not be as perfect as at higher speeds.

Mechanical loss per stroke or per cycle where lubrication is thorough, might be expected to decrease with increased speed, if the actual loss due to friction alone is taken into account. In addition to this, however, the engine is called upon to overcome the valve spring pressure and valve inertia, and to drive the fan, water pump and magneto. The loss due to these increases more rapidly than the gain due to decreased friction, so that there is a probability of a greater total mechanical loss at high speeds.

It might be suggested that by suitable carbureter setting and by modification of the cooling arrangement the thermal losses at low speeds could be reduced, and the engine made to give an excellent torque at this speed. This is, no doubt, quite true, but the object is not to endeavor to alter the conditions to make the engine produce good results at any particular speed, but rather to find out at what speed the engine gives the best all round results for our purpose.

Tracing the torque curve through its rising speed the maximum is approached at about 700 r.p.m., and the curve remains fairly flat from there to 1000 revolutions, where it commences to fall.

Up to 700 r.p.m. the power of the engine per cycle is evidently increasing. The volumetric efficiency may be decreasing, the mechanical losses probably increasing, but these are evidently more than balanced by the increase in thermal efficiency and the more perfect mixing of the charge.

From 700 to 1100 r.p.m. the gains and losses are evidently almost balanced, as there is little variation in torque between those speeds, but as the speed increases, restrictions due to the valves and pipes begin to have their effect. Volumetric efficiency probably falls off and mechanical losses increase, and the net result is a decreased torque.

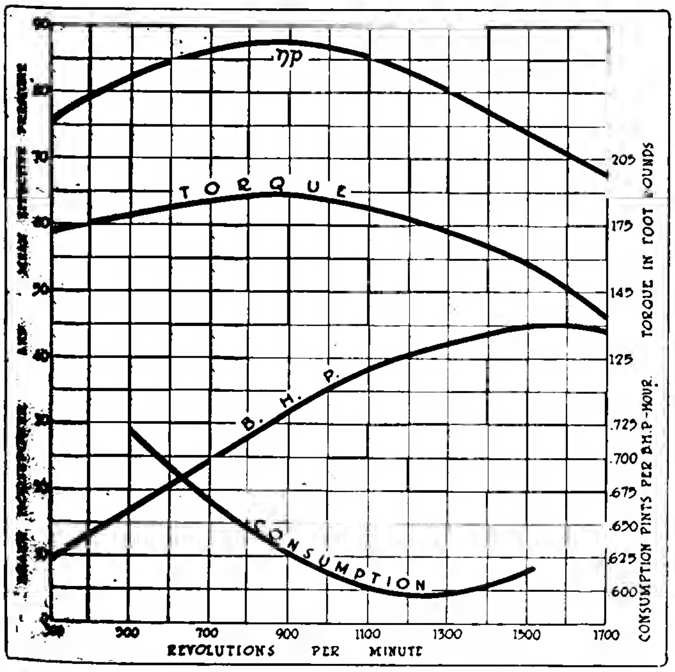


Fig. 1—Curves showing Torque and Consumption. 110 MM. × 140 MM. Dorman Engine

Consumption Curves

Considerations of torque alone would lead to the conclusion that unless the valve and pipe diameters are increased the engine is likely to give the best results if its range of revolutions is kept between 700 and 1100 r.p.m. Before any definite conclusion can be arrived at, however, it is necessary to go into the cost of this torque. The object in a commercial vehicle engine is to obtain torque for the least possible expenditure of gasoline, the ideal being attained when the range of maximum torque coincides with the speeds for minimum consumption—a result which is rarely obtained. While the consumption curve must depend on the carbureter setting for its actual value and relationship to the torque curve, it is generally found that the range of minimum consumption is at a higher rate of revolutions than that of maximum torque. When this range is confined to within 15 per cent of the best consumption, the curve shown would give from about 700 to 1300 r.p.m. as the correct range of speeds.

At 1300 r.p.m. the torque is falling, and although the torque per foot-pound is costing no more, since the consumption is at its best, yet the best range of mechanical efficiency is being departed from. If the maximum engine speed is taken at a point far down on the descent of the torque curve, the resulting torque is only equivalent to what might be obtained from a smaller engine at a lower speed. There appears to be no objection to allowing the maximum speed to be located some little distance down the curve, as on meeting increased tractive resistance the reduction in engine speed to come within the range of maximum torque would not be great. This maximum speed might then be taken at 1300 r.p.m.

An examination of the curves on these lines would lead to the conclusion that the maximum engine speed would be governed by the torque curve, and the minimum speed by the consumption curve.

If the left-hand end of the curves be considered, it is found that from 700 to 500 r.p.m. the torque value is moderately high, but the consumption curve shows that this torque is only obtained at a very expensive rate.

Take the case of a vehicle under load ascending a hill which eventually causes a change to a lower gear. As the tractive effort increases the engine speed falls from its maximum to a speed at which a higher torque value is obtained, and this continues until, with the driver's well-known persistence in hanging on to the top gear as long as possible, the engine speed has fallen back to below 700 r.p.m., and the engine is running outside its range of economical working.

High torque at this low speed end of the torque curve is therefore not an advantage unless it is accompanied by reasonable fuel efficiency.

Number of Cylinders

The four-cylinder engine appears to have become firmly established for commercial work, and can be taken as standard for the vehicles under consideration. The only heavy vehicles having engines of more than four cylinders are for fire engine or other special purposes.

Calculations for Engine Size

The usual ratio of engine to road speed in modern vehicles is for 1000 r.p.m. to correspond to about 15 m.p.h., but for any engine with curves corresponding to Fig. 1 there is a decided advantage in increasing the engine speed to 1300 r.p.m. Not only is the consumption improved, but the increased speed allows a decrease in engine size for any given weight of vehicle, with a corresponding lightening of transmission parts up to but not including the final drive. For the engine under consideration it is proposed to assume 1300 engine revolutions per minute for 15 m.p.h. The next step is to arrive at some formula to give the actual figures for engine sizes to meet particular requirements.

In the following method the author has aimed at obtaining a formula that is easy to handle rather than one which will give accuracy to a large number of decimal places.

The useful work obtained from the engine per minute is represented in foot-pounds by:

Mean effective brake pressure × area of cylinder in square inches × stroke in feet × number of working strokes.

Let V represent volume of one cylinder in cubic inches,
D the diameter of cylinder in inches,
S the stroke in inches, and
N the revolutions per minute.

and if r is taken as $\frac{\text{stroke}}{\text{bore}}$, then stroke $= r\,D$ and the useful work obtained per minute is:

$$\eta p \times \frac{\pi D^2}{4} \times \frac{r D}{12} \times 2N$$

(In which ηp represents, as usual, *M.E.P.* multiplied by the percentage of mechanical efficiency.)

or

$$\eta p \times \frac{\pi r D^3}{4} \times \frac{N}{6} \text{foot-pound}$$

but

$$\frac{\pi r D^3}{4} = \text{Volume of one cylinder,}$$

and therefore $\eta p \times \frac{N}{6} \times V =$ foot-pound per minute.

The Factor "Q"

The work this engine has to perform is to propel the vehicle against the internal friction of the vehicle itself, the external resistance due to the road and the wind pressure.

Let S represent the speed of vehicle in miles per hour.
W the gross weight of vehicle in tons.
R the total resistance on the level in pounds per ton.

Then the total foot-pound of work per minute required by the vehicle on the level is:

$$W \times R \times S \times \frac{5280}{60}$$

Hence, for an engine just large enough to drive any vehicle of gross weight W on a level road:

$$\eta p \times \frac{N}{6} \times V = W \times R \times S \times \frac{5280}{60}$$

Taking ηp at 80 lb. from Fig. 1, and R at 71.5 from Fig. 2, with 15 m.p.h. at 1300 r.p.m. we get:

$$80 \times \frac{1300}{6} \times V = W \times 71.5 \times 15 \times \frac{5280}{60}$$

or $$V = W \times \frac{71.5 \times 15 \times 1760 \times 3 \times 6}{60 \times 80 \times 1300}$$

or $V = 5.5\ W$ approximately

That is to say, the cubic capacity of one cylinder of the engine is found by multiplying the gross weight of the vehicle in tons by 5.5. This factor the author has called "Q." In dealing with "Q," it must be remembered that the factor assumes a definite ratio between engine and road speed—in this case 1300 r.p.m. and 15 m.p.h.

An engine designed with a "Q" of 5.5 would not be a commercial success. As long as the vehicle remained on a level road and had a total resistance of 71.5 lb. per ton the engine would be equal to the work required, and would be doing that work under most economical conditions. The drawback is that it has practically no reserve for hill climbing.

Curve 1, on Fig. 2, shows the engine torque taken from Fig. 1, and is plotted to correspond with the figures for road resistance. This shows the engine torque and road resistance cutting each other at 15 m.p.h. On an increasing gradient, as the engine speed falls the torque increases to a maximum at about 1000 r.p.m. and the road resistance decreases. The ability of this vehicle to climb is represented by the distance between the Curve R and Curve No. 1, Fig. 2, but at its maximum is less than 30 lb. per ton, which is the increase in resistance due to a gradient of only 1 in 74.

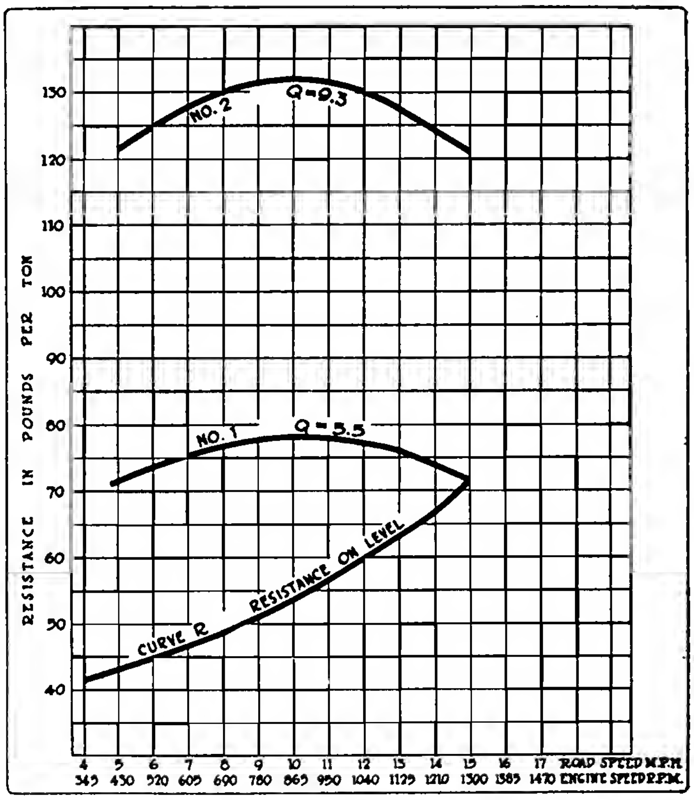


Fig. 2—Curve R is from Mr. Wimper's formula: Resistance = 40 + 14 $\frac{V}{10}{}^2$ lb. per ton where V is speed in M.P.H.

The maximum gradient up which the engine would drive the vehicle on top gear is represented by Curve 1 in Fig. 3.

Engine Sizes for Hill Climbing

The modern lorry is expected to be able to climb gradients of about 1 in 30 on top speed with full load, and we may take this to be a reasonable figure. From Fig. 1 it is found that the engine has its range of highest torque at about 1000 r.p.m. or 11½ m.p.h., and this is taken as the climbing speed.

ηp is 87 lb. and R is 58.5.

The total resistance due to R and the incline is

$$W\left(R + \frac{2240}{30}\right)$$

or

$$W\left(\frac{1755 + 2240}{30}\right)$$

$= W\frac{3995}{30}$ (approximate total resistance = 133 lb. per ton)

(*Continued on page 476.*)

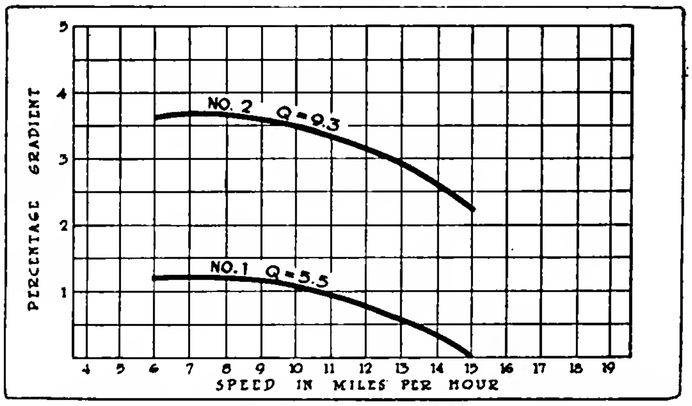


Fig. 3—Hill climbing capacity for "Q" = 5.5 compared with same for "Q" = 9.3

Proving New England Prosperity

Boston Show Discloses Demand Equal to Expectations—Buying Active Throughout Winter — Many Closed Cars Wanted

By David Beecroft

BOSTON, March 7—Last week THE AUTOMOBILE stated that 1916 would be one of the most prosperous years for the automobile in New England. This week, after spending two days at the fourteenth annual automobile show now running in this city, we are led to confirm the fact, not because of crowded exhibits and aisles in the show, but because we have talked with a majority of the Boston distributors who handle New England through scores of agents, and because we have seen the Boston populace and the New England populace look over cars and buy them. Only two days of the show have passed. Five more remain, and the story that could be written if the complete history of the business of show week could be accurately collected would be one of the most impressive automobile stories that New England ever heard. The out-of-town dealer tells the same story that the Boston distributor tells, a story of unprecedented demand for cars, a story of unparalleled wealth through the six States, and a story of greater confidence than heretofore experienced.

Last week the prediction was made that New England could absorb 50,000 cars this year. She can readily do this if the cars can be secured, if shortage in materials does not restrict production in many factories not fortified against the days that seem in store in the metal world. If New England can get the cars when the buyers want them she can absorb 60,000 machines; in fact, the demand is here for 75,000 machines.

The possible shortage of material has permeated the farthest town in Maine, in New Hampshire, in Vermont as well as the three southerly States, Massachusetts, Rhode Island and Connecticut. New England is much closer to the metal market than some other parts of the world—closer than the great Mississippi Valley with its almost limitless areas of productive acres. New England has breathed machinery for years and knows of the rising prices of metals and the possibility, grave possibility, of not being able to perhaps secure as many cars a few months hence as she would like to receive. New England remembers the past season when, if more cars could have been had, much more money would have been made.

This combination of circumstances has brought about an entire change in conditions throughout the six States and particularly through the three northern States, Maine, New Hampshire and Vermont. Never before has there been such a generous and widespread storing of cars by dealers in these States during the winter months. Heretofore the New England dealer was adamant to all solicitations of the maker and the distributor to store cars and have them ready for spring delivery. To-day he is stocking up in an unheard-of manner, and apparently for varied reasons. He knows the money is in his territory to buy cars, he knows that the material market is rising and he feels in his very bones there is grave probability of a car shortage when the big selling season comes. He wants to be protected at that time. He has turned over a new leaf in automobile selling. The arguments that manufacturers have been hurling at him year after year have at last fallen in fertile soil. The old New England tradition appears broken. A new order has set in.

The Boston distributor has come to the dealers' assistance in this storing work by making the storing process as easy financially as possible. Often the dealer has to give a deposit of but $100 per car, and in addition pay interest on the money the dealer has invested in it and carry the insurance, if he takes such protection, which the distributor generally requires. This proposition, attractive as it is, lacked appeal a year ago. To-day it is a potential.

The used-car market has experienced a desirable stimulation. It is perceptibly better than a year ago, notwithstanding the fact that many distributors in Boston are stocked up with far too many cars taken in in trades. To-day these distributors, some of them dealers, hope to find a ready

Invention, Progress, Industry and Success uphold the giant wheel market, due to a possible lack of new cars. Already this is having its effect, and were it not for the heavy snow generally throughout the six States which has been on the ground for the past two weeks, the used-car business would be moving at a very healthy rate to-day. New England freezes up in buying automobiles much in proportion to the temperature and snow condition. Hundreds of sales have been delayed by the snow. Opening conditions are looked for and anticipations are for the biggest March and April of years. Some predict a very short active selling season. They go so far as to say that by May 15 the selling season will be over. Definite reasons for such an opinion are wanting. The answer seems to be in the atmosphere.

Carload Shipments All Winter Through

Reverting to the question of winter deliveries to dealers throughout all New England: Carload shipments have been made to the several States all winter, a condition not existing heretofore. A Maine dealer recently placed an order for fifty cars. In Vermont such centers as Rutland, Burlington, St. Johnsbury and Barre have been taking deliveries constantly. There is a tendency in these cities to keep cars more in commission than formerly, but only a very small percentage of the sales are going into actual use. Dealers in these cities are making deliveries, although the ultimate purchaser is perhaps not putting the car into commission. He is taking time by the forelock. He wants to know that he will have the car, and that new turns in the war, new developments in Washington, or other unexpected conditions such as shortage of materials, shortage of cars, etc., cannot rob him of his machine.

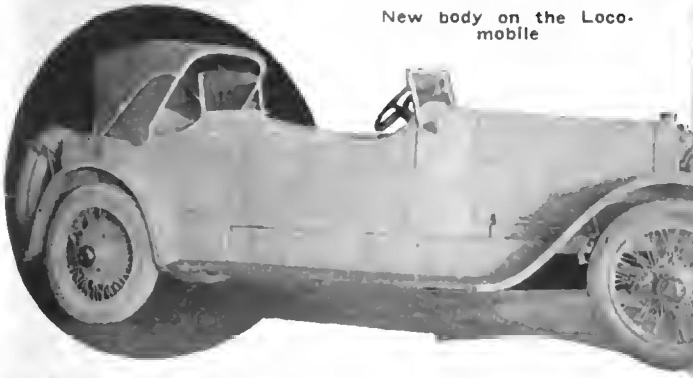
Reverting to the Boston show: The show is revealing many changes in the general trend of the industry in the six States. Closed cars are making very pronounced headway, this not only in Boston, but in all the States. The progress is slow in such Vermont centers as Burlington, Rutland, Montpelier and Barre, where very few cars are seen on the streets in the winter. The cities in Maine along the Atlantic Coast enjoy a climate moderated by the salt waters of the ocean and so can use their cars to advantage all winter, while those cities farther inland have to lay them up because of heavy snow falls and cold weather.

The sedan is proving a popular New England car, not only in Boston, but outside as well. It is the ideal family car. The same is true of the detachable winter body. Coupes are not in demand. The conventional coupe accommodates three people, and for a winter vehicle that is not enough. There must be accommodation for four. Boston is a good limousine town. The Berline is not known at all.

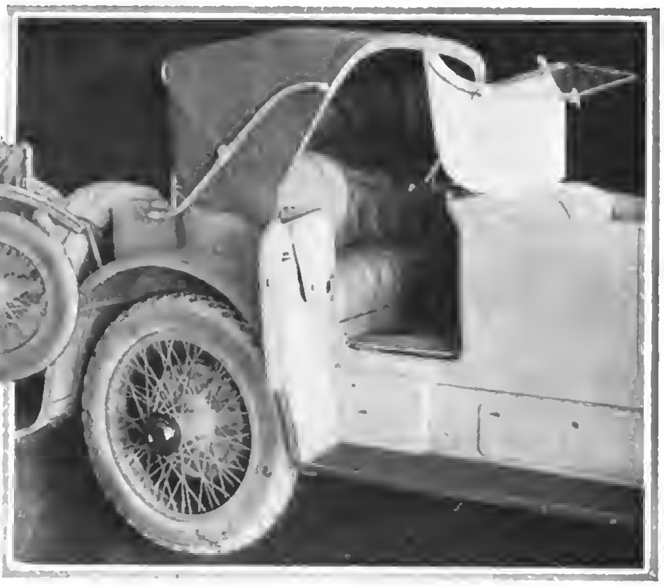
An official count of the different styles of bodies at the show generally reveals the types of bodies most in demand. This cannot be taken without modification, because to-day the selling period of closed cars is over and naturally touring cars and roadsters are featured. There are more closed cars shown than might be expected because several Boston dealers were not able to get their closed types early in the fall. Instead of getting them in October, they came through in December and then in small quantities.

Many distributors are quite emphatic in their condemnation of manufacturers who disappointed them so seriously in the closed car business. Some of the makers in turn were held up by labor troubles. The net result is that the maker does not start his closed car business early enough. He should lay his program out in May and have them in the dealers' hands in September. This is true for Boston and is equally true for Minneapolis, Kansas City, Omaha and many

Paul Revere Hall, on second floor of Mechanics Building, given over entirely to Mitchell exhibit. At the far end is a real full-sized touring car set in a huge painting of New England scenery



New body on the Locomobile



other Western cities that are rapidly developing closed car business.

Now the count: Boston has 273 passenger vehicles of all kinds in the show. There are but three electrics and three steam. Touring cars are the big leaders, there being twice as many of them as roadsters. Limousines are third, then come detachables or winter bodies and closely grouped on about even terms are coupes, sedans, cabriolets, and town cars.

The figures are: Touring cars 120, roadsters 60, chassis 32, limousines 21, detachables 9, cabriolets 6, town cars 5, coupes 4, sedans 4, landaulettes 2 and berlines 1, and a few miscellaneous types. The three electrics are closed types.

A Fine Truck Display

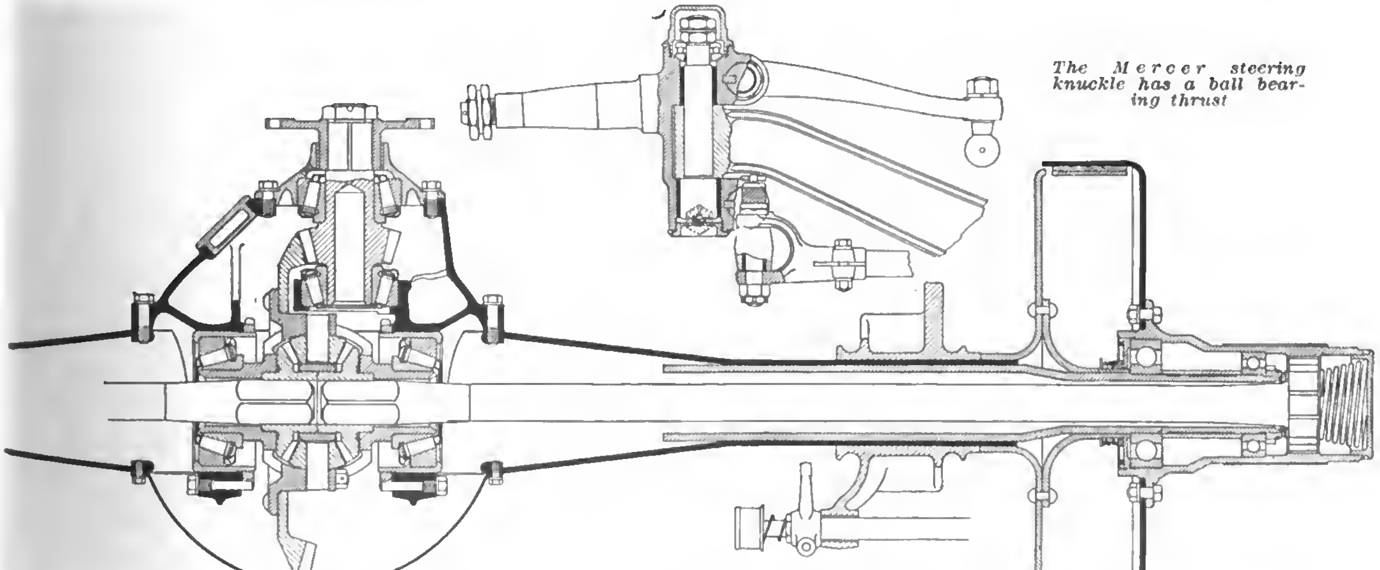
But this is not all. The Boston show has thirty-eight different makes of motor trucks; in fact, the greatest truck show of the year. Never before have there been so many trucks exhibited at a passenger car show. Some years ago Boston had a separate truck show a week after the passenger car show. The attendance was not up to the mark and the separate show was discontinued. To-day there is not room in the basement for the trucks.

The exhibit of electrics is poorer than ever before seen in Boston. There are anly three vehicles. Boston is not a good electric town with its narrow streets and its shopping district boxed up in the heart of the city. Add to this the fact that the city regulations will not permit unattended vehicles standing by the curb more than a certain length of time and you are at once convinced why women have not taken kindly to the electric.

Boston always brings out something new in bodies, styles not seen at either New York or Chicago. Some of these are the creation of local body builders. Others have originated in New England, where there are many high-class body manufacturers. The most original body style seen and one which gives promise of being largely copied is a four-passenger Locomobile touring type with a hinged cowl and windshield for the tonneau. The cowl carries a sloping windshield just as the dash cowl and practically as large. This tonneau cowl hinges to the back of the front seat and is raised when passengers enter. The windshield is back close to the passengers. A victoria top is used. It is the first time this hinged form of cowl and windshield has been seen.

Kissel has a new form of four-passenger roadster with disappearing rear seats. The front seats are individual with a passage between them to the rear, and when the rear seat is folded into the body and out of sight this passage is filled by a hinged filler board. This filler board swings back into the floor when the rear seat is opened. Rear seat passengers slt side by side, and there is comfortable room for two. The body was built by McNear, a local builder.

A high-water mark in exhibit ideas is carried out by the Mitchell distributor, the Pope-Hartford Co. of Boston. The exhibit is staged in Paul Revere Hall, a separate room in the show building, as illustrated opposite.



The Mercer steering knuckle has a ball bearing thrust

Features of the Mercer axle are the light casing, the double support for the drive pinion and the spring retained drive shafts (See page 452)

Refinements Feature New Mercers

Two Chassis, Similar Except for Wheelbase, and Four Body Models Continued—The Improvements Made Are Principally in Bodywork

SERIES 22-72 Mercer, which has recently been announced, is a continuation of the line introduced last season with minor refinements. Following Mercer traditions, the series is equipped with four-cylinder motors, and throughout, the new models adhere very closely to their predecessors of the 22-70 line. However, there have been a few refinements during the year.

Four different body styles are marketed this season. They are a six-passenger at $3,000, a four-passenger at $3,000, a runabout at $2,900, and a raceabout at $2,750. This also is in accordance with the practice of last year. The six-passenger touring model is a roomy vehicle adapted to family use, while the four-passenger is a sporting model and is designed for those who want a light car with quick acceleration and speed. Both of these models are mounted on chassis of 132-in. wheelbase.

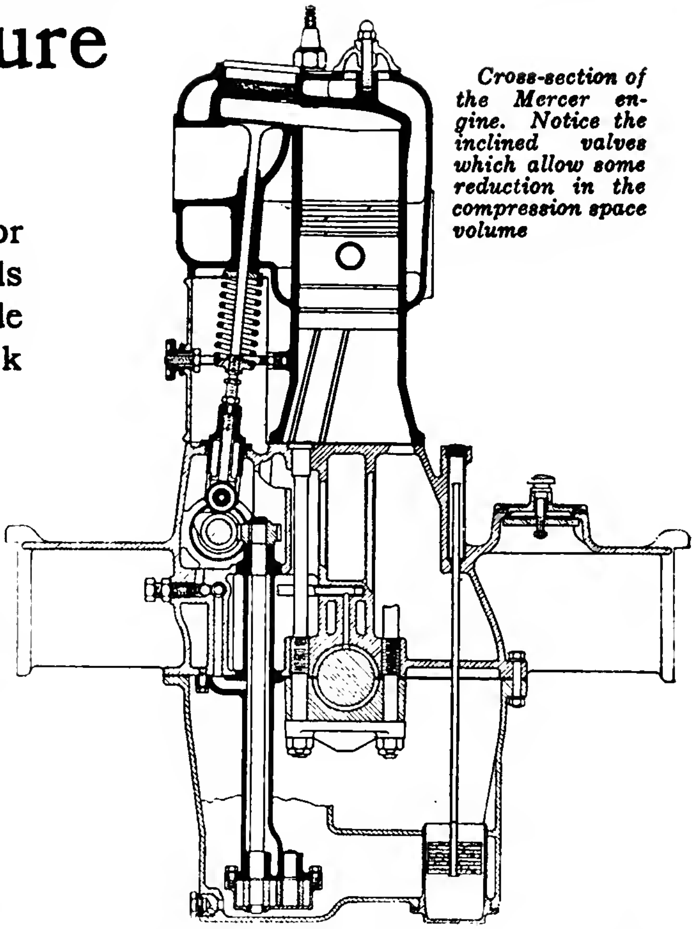
The runabout and raceabout are built on chassis which are similar in practically every particular to the touring chassis, except that the wheelbase is 115 in. The runabout is suitable for two-passenger touring, while the raceabout is confessedly a speed car and is guaranteed to be able to make a mile in 48 sec. or, in other words, to travel at the rate of 75 m.p.h.

The Mercers of last year were distinguished in the touring bodies by the graceful center cowl, and the same idea has again been carried out, but the interior work of the body has been improved considerably. For instance, the auxiliary seat compartment of the six-passenger is finished in black walnut paneling. The extra seats are hidden from view when not in use by doors which can be rolled out of sight similarly to the cover of a roll-top desk, and another convenience is a special compartment built into the right front door to carry a complete set of tools.

Under the center cowl of the sporting model are three separate compartments also covered with black walnut paneling, the center compartment being sufficiently large to carry a good sized suitcase, while the other compartments on either sides are smaller and can be used for carrying such articles as Thermos bottles and miscellaneous items.

Details of Mercer 22-72

Number of Cylinders	Four
Shape	*L Head*
Bore	3¾
Stroke	6¾
S. A. E. Horsepower	22
Magneto	*Bosch*
Carbureter	*Zenith*
Engine Starter	*U. S. L.*
Lighting System	*U. S. L.*
Clutch	*Dry Disk*
Gearset	*Four Speed*
Wheelbase	115
Front Tires	32 *x* 4
Rear Tires	32 *x* 4
Type Rear Axle	*Full Floating*



Cross-section of the Mercer engine. Notice the inclined valves which allow some reduction in the compression space volume

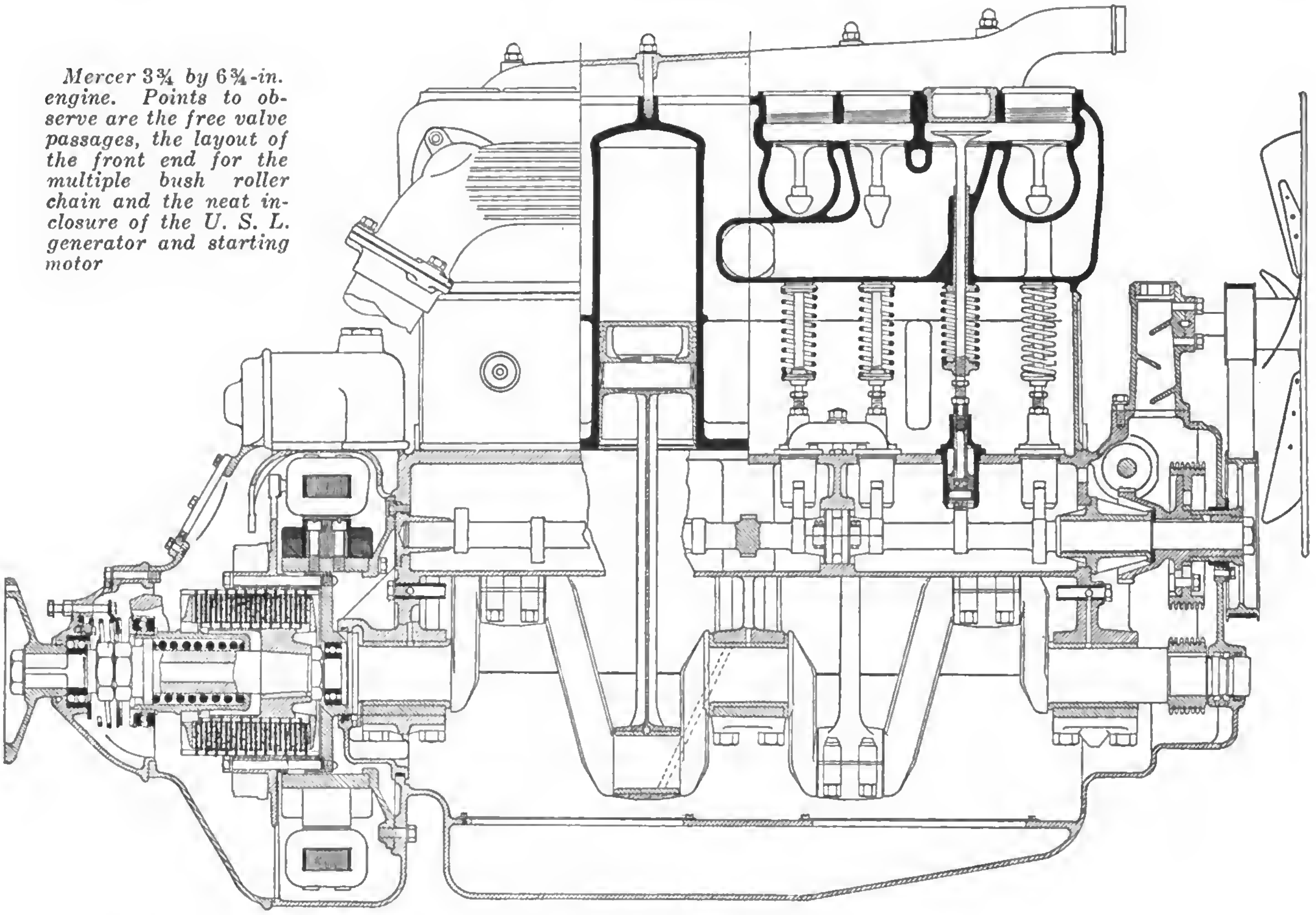
The Mercer car occupies a position in the automobile world that is very nearly unique. It is a car built for a class of buyer that is not very large, and it is thus a machine which has but a few direct competitors. The total number of cars being built in America for this special class of consumer is to be reckoned in hundreds rather than in thousands.

Probably the Mercer is the most European engineering job being made in America to-day, being a high efficiency four of considerable power, capacity for very high speed and a very high accuracy of finish on all parts. In addition it has other features that are considered typically European, such as the powerful transmission foot-brake, the amidships gearbox and last, but far from least, the body lines. In the body the Mercer engineers have made a wonderfully happy combination of American and European ideas. The outside lines are unexcelled by any stock car in the world, the internal fittings combine comfort and convenience to a high degree. It is essentially a British style of body with the best of American and French ideas added to enhance its qualities.

A Really Good Four

It has often been said, and truly, that the four-cylinder engine lacked a proper appreciation because there were so few fours made with the care that is possible in a car demanding a high price. The Mercer engineers, like many others who have not yet shown the courage of their convictions, believe that a four can be made to provide every quality of performance that is necessary or desirable, and have chosen the dimensions of 3¾ by 6¾ in. giving a piston displacement of 298 cu. in.

Since this is not the customary view, it may be well to begin by giving some attention to the performance of the car, before describing it in detail. First, as regards high gear ability, the stock model handles well from speeds of 8 m.p.h. upward, it will run more slowly than 8 m.p.h., but that is the lowest speed that the average driver would use



Mercer 3¾ by 6¾-in. engine. Points to observe are the free valve passages, the layout of the front end for the multiple bush roller chain and the neat inclosure of the U. S. L. generator and starting motor

normally, in fact the change to third gear is so easy that many a man would not employ the high gear for speeds much under 12 m.p.h. This figure of 8 m.p.h. is not a bottom limit as are the 2 m.p.h. speeds possible for some other cars with lower gearing and more cylinders, it is about 2 m.p.h. higher than would ordinarily be obtainable with a six or eight geared to the same ratio.

After 12 m.p.h. is attained it is not possible to distinguish the impulses so as to pick out the engine as being a four, and then, as the speed rises, up to the maximum there is no detectible periodic vibration. Vibration is present of course, but it is extremely small in amount and not perceptible till crankshaft speeds over 2000 r.p.m. are attained. At no speed is the vibration so great as that observable at some speed or another on all but a very select few of the sixes and eights.

Engine Speed Runs High

The speed capabilities of the engine are quite unusual. On second gear on a good road with top up and two passengers the writer obtained 46 m.p.h. and on third gear under the same conditions, 60 m.p.h. On the fourth gear, which is the direct drive, 65 m.p.h. was attained easily, road conditions at the time preventing any greater speed. At 65 m.p.h. the engine is running easily, and evidently the car would touch the 70 mark or a little over.

The gear ratios are, 3.6 to 1 on high; 5.4 to 1 on third; 7.9 to 1 on second and the low speed ratio is 13.8 to 1. This means that at 46 m.p.h. on second the engine is turning at 3800 r.p.m. and at 60 m.p.h. on third it is making 3400, these corresponding to piston speeds of 4270 and 3820 ft. per minute. These figures give an idea of the engine's elasticity and serve to show that the almost total elimination of vibration is a testimonial to the care taken in the design and in the manufacture.

A short time ago the Mercer had a balanced crankshaft, but this has now been discarded, as it is found that the same results are obtained with the conventional type. An idea of the strength is given by the dimensions, the diameter of the main crankshaft journals and crank pins being 2⅛ in. A rather unusual feature of the bearing design is that the front and rear bearings are both the same length, 3⅝ in., the center bearing being 3⅛ in. The 2⅛ in. diameter gives a bearing speed of 556 ft. per minute per thousand revolutions. Since the stroke is 6¾ in. the piston speed at 1000 r.p.m. is 1125 ft. per minute; almost exactly twice the bearing speed.

On high gear the piston displacement is 390 cu. ft. per mile.

Vibration Notably Absent

Returning for a moment to the matter of vibration, since its elmination from the Mercer is one of the car's most striking characteristics, some interesting things have been done to get the good effect obtained. For instance the pistons are Lynite permanent mold aluminum of a lighter section than usual, the webs beneath the head having been removed because it is thought their expansion may cause piston distortion. Each piston has two rings only, oil being kept down by the use of a long skirt and the weight of the piston assembly with rings and wrist pin is only 1.15 lb. Another factor in vibration elimination is the use of long connecting-rods, these being 15 in. center to center, the ratio connecting-rod to stroke thus being 2.22. This, of course, cuts down the unbalanced forces to some extent as it is a perceptible amount longer than the conventional. The connecting-rod weighs only 3.3 lb. being a highly finished I-beam forging.

Reciprocating Parts Are Light

Lightness of reciprocating parts is studied also in the valve mechanism, both the valves themselves and the tappets being as light as considerations of strength will allow. These parts can be studied in the drawings which also make clear the method of assembly of the four-bearing camshaft. For the latter a very interesting form of drive is used this being a multiple bush roller chain. In effect this is a number of narrow roller chains side by side, but the rivets or pins pass right across the whole row so that there is a series of small rollers separated by side plates. This type of chain operates as quietly, or even more quietly than a silent chain, and does not required any adjustment because a spring-supported idler bearing upon the back of the chain can be used to maintain the tension. It is a light form of chain camshaft drive and highly efficient.

Lubrication is a high pressure system, all the crank and connecting rod bearings receiving a supply, together with separate feeds to the camshaft bearings, the chain and the chain idler. In the cross section of the engine it will be noticed that the oil filling cap is located on one of the crankcase arms in a position of ideal accessibility.

Transversely across the front of the engine is a shaft driven by skew gear from the camshaft, this having the magneto and water pump mounted at opposite ends the thrust of the water pump being balanced by the thrust of the skew gear.

The cylinders being an exceptionally neat block casting the carbureter bolts directly to a flange on the left side the intake passage passing between the middle cylinders and then running fore and aft in close proximity to the separate exhaust manifold, this giving the necessary warmth. In the sections of the engine it will be noticed that the water spaces are proportioned very well, giving a free flow everywhere. The U. S. L. flywheel generator and starting motor is entirely inclosed within the crankcase, a hand hole giving access to the brushes and to the dry-disk clutch. This clutch, by the way, has twenty-four disks and operates with a very light pedal pressure; it is one of the easiest clutches to control in use to-day. Having a small diameter center, and a clutch brake, the inner member has but little flywheel effect, making it easy to change gears without much regard to the speed the car is making.

The engine bolts rigidly to the frame having four supporting arms on the crankcase and the amidships gearbox is brought into alignment, the two being connected by a flexible coupling. Placing the gearbox well back in this way permits the gearshift lever and the brake lever to be brought up conveniently from the top of the box and yet stand in the correct position relative to the driver. There is no especial peculiarity in the gearset, it being characterized by large diameter shafts and wide gears.

Brakes Are Large in Area

Behind the gearbox is the foot brake, this having expanding shoes faced with Raybestos and a steel drum with cooling ribs turned upon it. Its dimensions are 11 in. by 2½ in. and it has immense power combined with smooth action. The easiest way to obtain smoothness in a brake is to provide large surfaces, and it may be interesting to calculate the effective area of the Mercer transmission brake. On the assumption that of the total circumference of the drum the brake shoes only bear effectively on two segments of a 90 deg. angle, and this is the usual assumption, the Mercer brake area works out at just under 14 sq. in. The expanding brakes on the rear axle, operated by the hand lever, are 16 in. by 2½ in. and thus their combined effective area is 40 sq. in. At 20 m.p.h. the rear wheel is making 210 r.p.m. and, since the gear ratio is 3.6 to 1 the rubbing speed of the transmission brake is 36 ft. per second, as compared with 14 ft. per second for the road wheel brakes. Multiplying rubbing speed by area engaged and we get figures of comparative effectiveness for the road wheel and transmission brakes of 560 and 504 respectively.

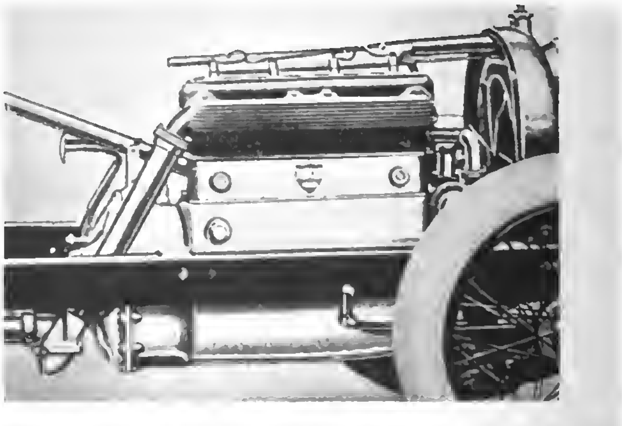
In the rear axle, lightness has again been a consideration, but the particular features being the spigot bearing for the bevel pinion, shown on page 449, and the method by which the driveshafts are slid in through the hubs and held secure against rattle by springs. There is no torque rod, the axle being bolted directly to the springs, which are underslung.

Semi-elliptic springs are used both front and rear, the latter being 59 in. by 2¾ in.; all the shackle bolts are hollow and fitted with oil retaining lubricators.

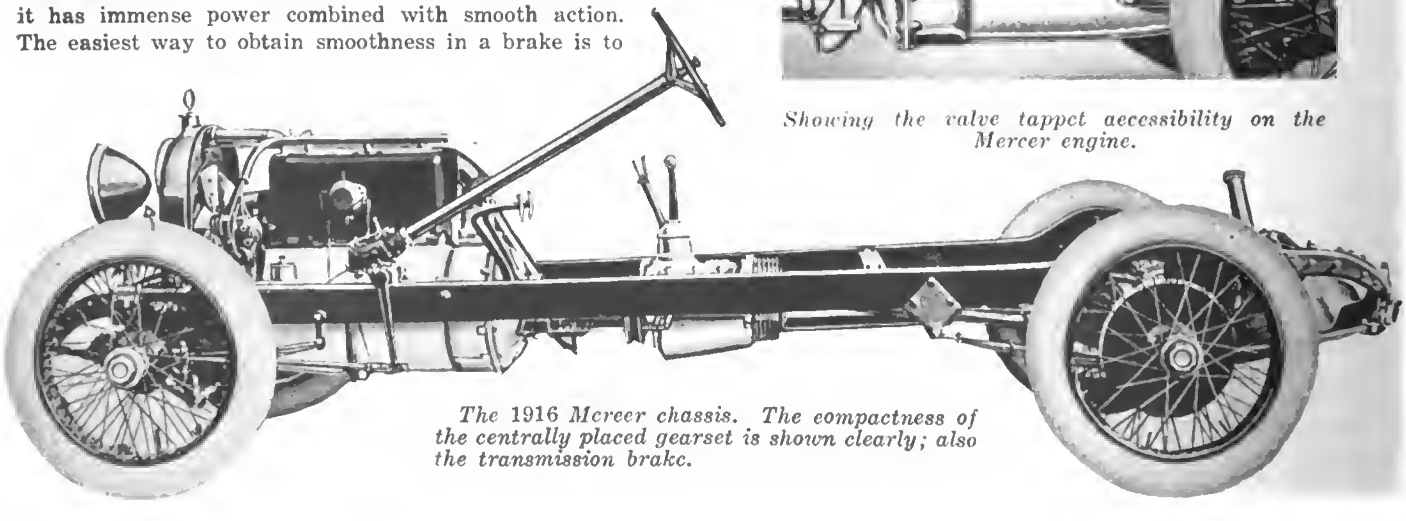
Great care has been taken in laying out the steering, which is irreproachable for lightness and accuracy. At 60 m.p.h. it operates as easily as at twenty and this is doubtless largely due to the use of ball thrust bearings for the steering knuckles and in the steering worm box.

Accessibility a Strong Feature

As to the detail, this is equally well worked out, and accessibility is a strong feature. Brake adjustments can all be made readily by large hand nuts situated beneath the front floor board, the carbureter with its vacuum fuel feed has no other parts near it, the magneto is likewise clear of all obstructions and the valves have nothing in front of them. This accessibility on the engine is certainly aided by the U. S. L. starter, since this needs no mechanism outside the flywheel case.



Showing the valve tappet accessibility on the Mercer engine.



The 1916 Mercer chassis. The compactness of the centrally placed gearset is shown clearly; also the transmission brake.

General view of Grand Hall at the Boston show finished in black with gold striping. The group at the intersection of center aisles represents Invention, Progress, Industry and Success bearing aloft a giant wheel. The gallery is given over to car and accessory exhibits

Dealing With Freight Car Shortage

A shipment of fifty-six Chalmers cars to Philadelphia on flat and gondola cars. Two cars go on a freight car. They are well protected with oilcloth and then boxed, the boxes being roofed with waterproof material

Packard, owing to the shortage of automobile freight cars, is well satisfied with getting gondola cars to ship its trucks

A 3½-ton Federal with special large van body had to be shipped on a flat car

Several trucks had to be shipped by express by the Federal Motor Truck Co.

Above—Part of a shipment of Cadillacs going to Auckland, New Zealand. These cars are boxed, the top being waterproof. They are shipped to the coast on flat cars. Below—How Paige cars are being shipped, showing how they are being protected against rain and theft. Right—Studebaker cars are shipped from three to five in a freight car now. This illustration shows how two cars are loaded in one end of the freight car, two others being in the opposite end, while the fifth car stands in the middle. The latter goes with the top folded

New Kelly-Springfields Have Worm Drive

Six Models With Chain Drive and Two With Worm Drive Now Form Kelly Line

K-32 1½-ton Kelly worm driven chassis

THE Kelly-Springfield Motor Truck Co., Springfield, Ohio, has been one of the last of the larger producers to abandon the chain, although such abandonment in this case only amounts to its adoption as an alternative on two of the lighter models, there being six chain-driven sizes still in the catalog.

The two newcomers are of 1½- and 2½-ton capacity and are similar in almost every respect, excepting only final drive, to two chain-driven models of the same capacity. In addition to these there are 3½-, 4-, 5- and 6-ton models, all chain-driven. The last four of these are the same as announced at the beginning of the year and listed in THE AUTOMOBILE'S specification tables published Jan. 13. The 3½-tonner is the same vehicle as was formerly built for 3 tons, but with some heavier parts to sustain the increased load. The 2½-tonner is a similar outgrowth of the former 2-ton model. The 1½-tonner is practically as before, the 1-ton size being dropped.

Adaptation of the worm drive to the Kelly chassis has not entailed any other radical changes. The same motor, under its French hood, with drive through a torque-tube-inclosed shaft to a midships gearset is employed, and the frame remains of pressed steel in a flexible form, there being only three cross-members, with round bars supporting the spring shackles.

The driveshaft has been connected with the driven gearset shaft with a universal and carries another between it and the axle. The gearset occupies practically the same position as in the chain-driven models and is suspended on a wide yoked cross-member drilled to receive the rear flange of the gearset on the same jig as is the jackshaft flange.

The axle, while containing a Timken worm and gear, is otherwise of Kelly manufacture and is of the semi-floating type. Radius rods are used, as on the chain-driven models, with the torsional stresses falling on the springs. A feature of the Kelly spring suspension is that the right rear springs contain one leaf more than the left rears, thus allowing for the excess load imposed on the right spring when running on the usual crowned road.

Brakes on the new models have been placed on the rear axle, side by side, and are expanded by cams of unusual size. The brake carrier is a solid casting which includes the spring perch and wheel bearing housing and bolts directly to the axle housing. It is lubricated by one grease cup of large size, supplying lubricant to all parts contained in it excepting the brake-shoe pivots.

The new models are subject to the same wide range of wheelbase options that is offered in the chain-driven ones, affording load platform lengths of from 9 to 15 ft. back of the driver's cab.

From the motor the drive is taken by a cone clutch, mounted on the end of a rigid torsion member extending with its shaft back to the gearset. This eliminates any flexible joints between these two members. The gearset affords three forward speeds on the selective plan.

The steering wheel is to the left with central levers.

Above—K-32 1½-ton Kelly worm driven chassis showing semi-floating rear axle
Below—Brake and radius rod on K-32 1½-ton Kelly worm driven chassis

The History of the American Automobile Industry—20

Lenoir Experiments Advanced Knowledge—Steam Engine Taken as Basis and Explosion Used to Heat Air—Engine Driven by Air Expansion

By David Beecroft

LAST week the Perry explosion engine of 1844, incorporating many of the essentials of an internal combustion, was shown as the high mark of American inventive genius of seventy years ago. Now the thread of progress in the internal combustion engine shifts to Paris, France, and instead of 1844 it is 1861, seventeen years later. After Perry the next great forward step was taken by Jean Etienne Lenoir, Paris, France, whose now famous patent shows what a grasp he had on the explosion engine, although even then Lenoir looked upon it more as a modification of steam rather than a complete internal combustion type.

Used Steam System

Lenoir was convinced that he could take a steam engine and, by few changes, convert it into an explosion type. Lenoir did not look upon his engine as an explosion type as we do to-day, but rather as one in which he took in a part charge of pure air, and followed it by an explosive mixture of some hydrocarbon and air. Lenoir then exploded the mixture by an electric spark, as the heat of this explosion was wanted to expand the volume of air, the expansive force of the air driving the piston.

With this partial conception of the internal combustion engine as we know it to-day, it is but natural to find Lenoir's engine very similar in design to a steam engine. The illustrations are taken from his engine as manufactured in large quantities in 1865. At that time over 400 of them were in use in France and 100 had been built in England. To Lenoir belongs the credit of being the father of the practical explosion engine. Previous to his day all explosion engines had been largely experimental. Lenoir in 1861 to 1865 was to the explosion engine what Newcommen was to the steam engine in 1704. Each added the practical touch to his invention.

Lenoir's engine was a double-acting type, an explosion taking place at each end of the piston, steam engine fashion. He used slide valves at one side of the cylinder for the intake air and gaseous mixture and a similar slide valve at the opposite side for the exhaust. The one valve served for intake at each end of the piston and the exhaust valve performed a similar function. These valves were driven by eccentric shafts from the crankshaft (see illustration). The top illustration with a cylinder in section shows intake and exhaust passages very small, but they extended a considerable distance circumferentially, thus obtaining sufficient area. The intake valve operated to first let in a volume of 85 per cent of the combustion chamber of pure air; this was then followed by 15 per cent of explosive mixture.

Lenoir did not have a carbureter in even a vague sense as we know it to-day. Instead he carried the hydrocarbon in a small vessel or boiler. In the bottom of this boiler he placed a coil which he connected with the exhaust jacket of the engine, thus using heat as we do in the carbureter to-day. The heat from the coil caused part of the hydrocarbon to pass off in vapor, and Lenoir conducted it directly into the cylinder.

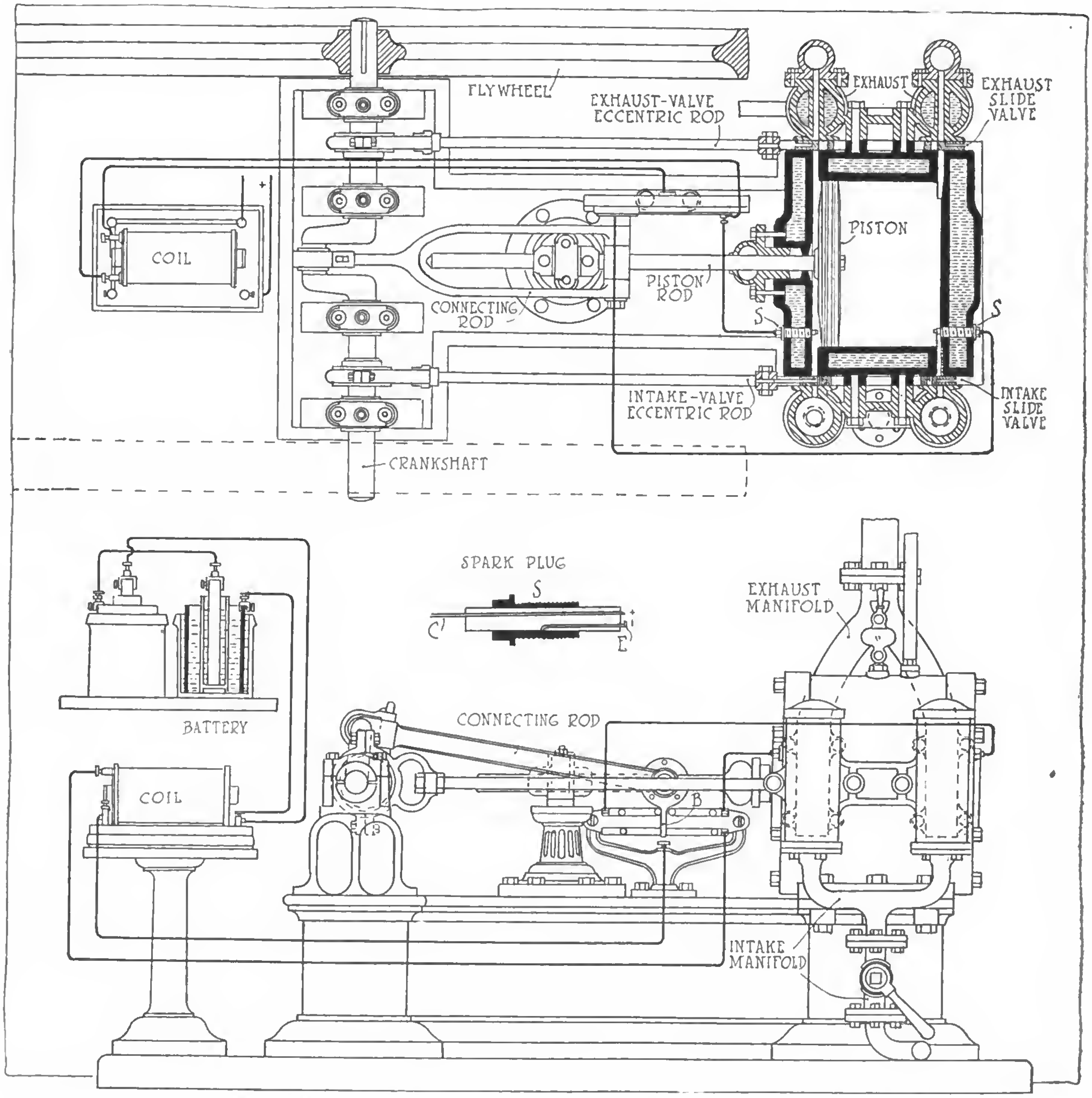
Passing to the ignition system as used by Lenoir, we find him using every essential of modern electric ignition. He used spark plugs (see illustration) that are identical in functioning with those of to-day, and only differ substantially in design in that there was a separate electrode *E* connected with the spark plug shell—the center electrode *C* was practically identical with modern practice.

But Lenoir went farther in his electric system, and was among the first to use the step-up or Rhumkorff coil to give his high voltage current. The low voltage current was taken from a primary battery (see lower illustration). As a means to deliver the current first to one spark and then to the other Lenoir was entirely modern. He attached his distributer *B* to the piston rod and contact was made to the two plugs in proper sequence. In his crude distributer he used hard rubber or gutta-percha in which he embedded the metal segments, practically identical in principle with what is done to-day.

Water Cooled Spark Plug

One feature in which Lenoir was perhaps a little in advance of the art of to-day was in water-jacketing his spark plugs. The illustration shows how the two plugs extend entirely through the cylinder waterjacket. Lenoir waterjacketed his entire cylinder walls and both ends. Although Lenoir had in reality the internal combustion engine as we know it to-day, he was not aware of what really took place within the combustion chamber, or if he later became aware of it, this fact remains that when his patent was issued he had not such a conception. His patent has only one claim which clearly sets forth his conception of the engine. Here it is: "The arrangement in an engine substantially as described, of the parts for the admission to the cylinder successively of air and inflammable vapor or gas in such requisite quantities and proportions as that the former (air) shall act upon the piston by expansion on being heated by the ignition of the latter (gas).

Lenoir very clearly set forth the fact that his engine was not a gas engine, but rather an explosion one. In his patent he sets this forth in the following terms: "My intention relates to engines in which the motive power is air diluted or expanded or heated by the combustion of an inflammable gas; and it is based on two fundamental principles: First—the application or the combination or mixture with atmospheric air of lighting gas or any other inflammable gas; and second, the simultaneous action of both in an engine deriving its elements of function from electricity and operating substantially in the manner of a steam engine. I employ gas and air in the proportions of 15 and 85 per cent; thus in my engine the function of the gas is as a fuel that can be ignited without producing any shock, for the purpose of heating the air that is mixed with it. The air thus dilated acts on the piston as steam in a steam engine."



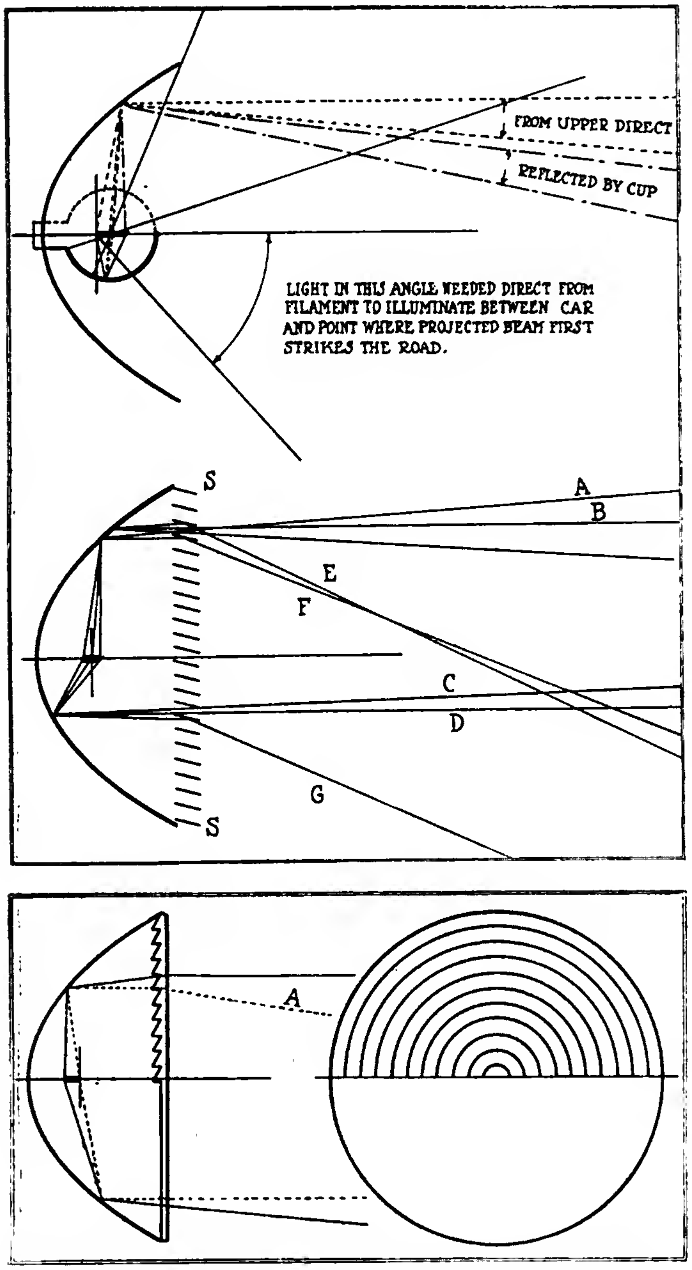
Lenoir's explosion motor of 1861, the first practical explosion motor built. Over 400 of these were made in Paris and 100 in England. Lenoir used modern electric ignition for the first time. His engine used slide valves

What Good Lighting Really Is[*]

Automobile Lighting Analyzed from the Lighting Viewpoint

By Emerson L. Clark

THE reflector does not actually have to be cut away, it is sufficient to put a shield over half of its surface or over half of the glass front of the lamp. However, if this shield is over the lower half of the glass front the light on the road directly from the filament is cut off and this light is needed to illuminate the space between the car and where the beam first becomes effective. The change in the road surface covered by changing the same reflector and light source to this type of beam is indicated in Fig. 6 by the difference in the area within the full and the dotted lines. The space between the lamp and where the beam becomes of effective width depends upon light directly from the filament for illumination. The absence of such light will be quickly noticed. Instead of putting an opaque screen over half of the lamp front, use has been made of a translucent diffusing screen; this absorbs and scatters light from one-half of the reflector so that its glare is reduced. This increases the illumination near the car, but does not appreciably increase the illumination at a distance over what would be obtained by the opaque shade. This translucent diffusing screen has two defects: First, unless it is very dense it will glare when a high candlepower bulb is used and the glare region is a large one; second, the strong scattered light thrown upward will cause blinding of the driver in fog and snowstorms, as was explained before.



Figs. 16, 17 and 18, showing effect of silvered bulb, of light-deflecting parts and of a prism front glass

Half Light Wasted

The great disadvantage of these various methods of using one-half of the reflector to get an improved distribution is that about one-half of the light that was in the old type of beam is wasted and the intensity especially at a distance is reduced.

Fig. 20 indicates a reflector construction which produces the same type of distribution but puts into the beam the light from both halves of the reflector. This reflector is constructed with an offset on a horizontal plane and the focus of the lower half is near the front end of the filament and the focus of the upper half is near the back end of the filament. In this position each half throws a beam having the distribution above described for a half reflector. The beams from the two halves superpose a short distance from the lamp and the intensity is doubled all over the field. There is an additional advantage over the single half reflector, in that slight irregularities in the single half reflector beam are smoothed out when two beams having different irregularities are superposed.

When properly made, using the correct separation of the foci of the two halves and used with a bulb having an axial length of filament a little greater than the separation of the foci, this reflector will give better lighting with the same candlepower than any other known arrangement. These reflectors are best made with dies from a single piece of metal. The slide shows a lamp containing a reflector of this type.

Fig. 18 shows a construction which was designed to produce the same results as the reflector above described. In this construction the glass front is moulded with a series of concentric semi-circular prism rings covering the upper half of the lamp front. The filament is drawn to the rear of the focus so that the uncovered half produces the desired distribution before mentioned. The prisms on the upper half refract the rising cones of light across the axis, thus superposing them on the beam from the lower half. The simple theory of this device would indicate that it should be very good, but there are a number of circumstances that combine to reduce its efficiency. First, if made of a single piece of

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[*] Concluded from page 415.

glass, it will not be achromatic, the prisms will disperse and spread the light cones, as well as deflect them. The intensity of the maximum is thus reduced. Second, some light is scattered from the risers of the prism steps. Third, molded glass having abruptly changing thickness as the prisms have, often small cooling wrinkles form which scatter light and thus cut down beam intensity and efficiency.

Those types of prism fronts which deflect the top half of the beam downward as a whole without making each individual cone cross the axis are not as good as the above, because the portion of the beam which they deflect has its maximum intensity on the bottom, and as it is deflected downward as a whole the maximum intensity is still on the bottom after being deflected, whereas to produce uniform lighting it should be near the top.

Fig. 16 represents another arrangement designed to increase the light from one-half of a parabolic reflector, while still retaining the desirable distribution which it gives with the filament drawn out of center. To have the maximum effect in reinforcing the beam direct from the unshaded half, the reflecting cup must be truly hemispherical and set with its center coinciding with the center of the bulb filament. This is difficult with many bulbs because the filaments are not in the center of the bulbs. If the bulb filament is located to one side of the cup center the light reflected by the cup forms a real image on the side of the center diametrically opposite from the filament and this image may be considered as the source of all of the light striking the main reflector from the cup. It will form a beam of light which is mostly separated from that formed by light coming direct from the filament to the main reflector. Under these conditions the light reflected by the cup does not reinforce the beam of light cast from the half reflector.

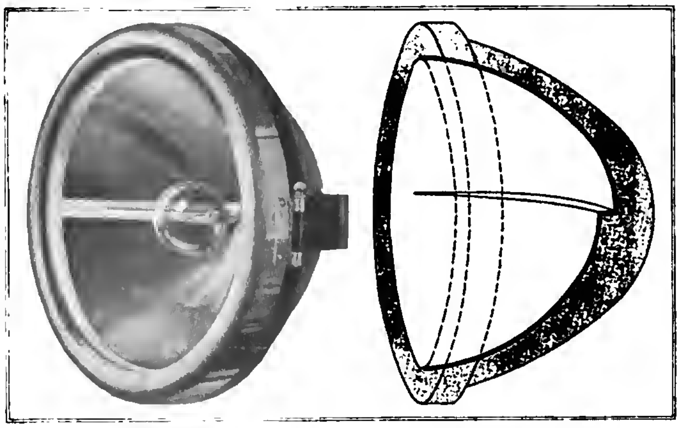


Fig. 20, Details of lamp with divided reflector

If these cups are placed on the lower half of the bulb the light on the road direct from the filament is cut off giving a dark area immediately in front of the car. To overcome this portions of the front of the cups have been cut away to let out the light on the road. This reduces its reinforcing power. Light from a certain zone in the rear of the cup is reflected directly out the front of the lamp and upward without striking the main reflector and contributes nothing to the beam intensity. The light which finally does get into the beam suffers loss by one extra reflection and two extra transmissions through the walls of the bulb. With all of these losses the hemispherical reflector attached to the bulb forms little more than a convenient means of shading one-half of the main reflector, and for this purpose is extremely effective.

Deflecting Slats

Another type of no glare attachment is shown in Fig. 17. In this device a number of closely spaced reflecting slats or louvers are placed across the front of the reflector to prevent rays of light rising above the horizontal. This device prevents glare but does not give effective lighting at a distance. The light acted upon undergoes the loss of an additional reflection and strikes the ground too near the car.

Focusing

With all of the foregoing arrangements for improving the distribution of the light one definite position of the filament gives the best result. This was not true with the plain parabolic reflector where sharp focusing gave a good light at a distance and a poor light near the car, while drawing the filament a little out of focus gave a better light near the car but a poor light at a distance. Some people preferred one evil, some the other, and each focused his lamps to suit his own preference. Interchangeable bulbs under these conditions would be of little advantage because the car owner would not want a fixed focus lamp in which he could not control the focusing. But with constructions designed to give a distribution of light suitable for no-glare lighting and general increased illuminating efficiency as previously described, the case is different. Here one focusing of the filament unquestionably gives the best results and it is not a question of deciding which of two evils is to be preferred as is the case with the plain parabolic reflector. This being the case it would be a distinct advantage to have bulbs that are optically interchangeable, that is bulbs in which the filament coil dimensions run reasonably uniform and which have the filament axis coincident with the axis of the base and with the distance from the locating pins on the base to the filament center within distinctly close limits.

With such standardized interchangeable bulbs the headlamp could be built without any focusing adjustment, but with the bayonet socket rigidly set at the factory to give the correct light distribution with the standardized interchangeable bulbs. This would obviate any skilled adjusting by the car owner when replacing bulbs and would insure good results in lighting regardless of the skill of the owner.

(Fig. 21 shows a base construction and optical jig with which interchangeable bulbs can be produced.)

To secure the best results in lighting and at the same time

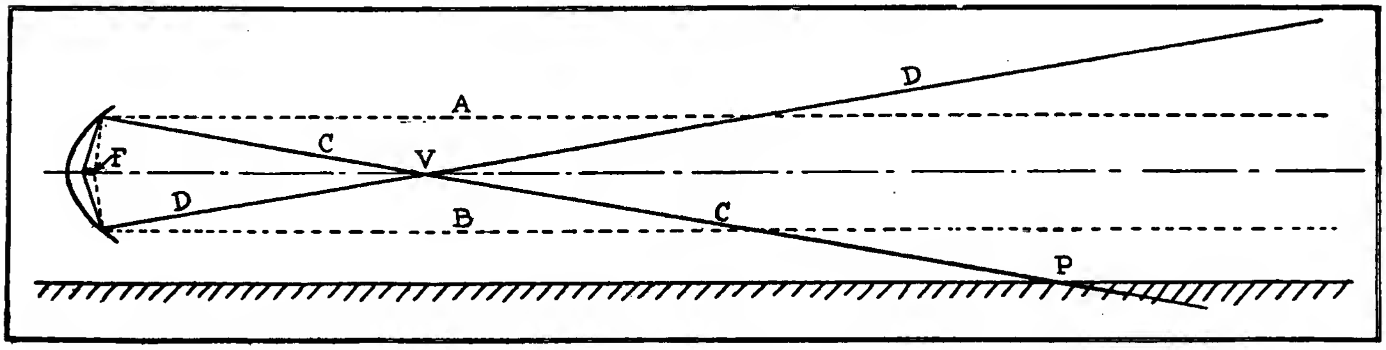


Fig. 19, Rays from part of filament at focus point F reflected parallel, rays from behind F cast D, D the glaring light, and C, C on road avoid glare it is necessary that the lamps not only give the proper distribution but also that they be properly pointed. Bulbs having their filament to one side of the axis of the base will change the direction of the beam of light and require repointing of the lamps. This will either require bending of the lamp brackets or using means especially provided for the purpose. Car makers would do well to devote some attention to this point. If interchangeable lamp bulbs were available the lamp once pointed correctly would never have to be adjusted again unless deranged through accident.

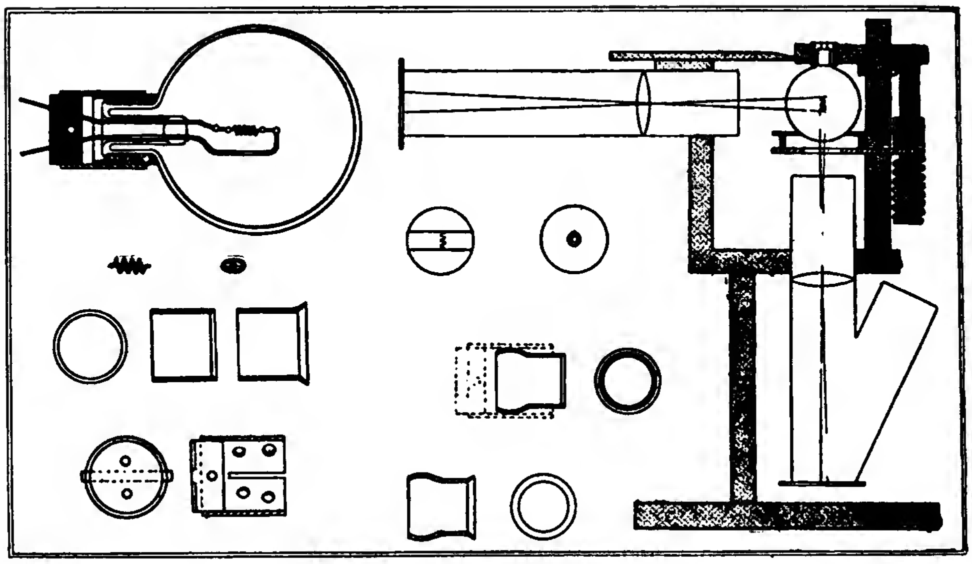


Fig. 21, Device for testing location of filament in bulb

Mounting Height

Other things being equal, the lamps should be mounted as high as possible consistent with avoiding glare. The higher the lamps are the more nearly normal do the rays strike the roadway and the smaller the difference between the vertical and the horizontal illumination, and the less exaggerated are the shadows of projections on the road surface. High mounting requires a greater vertical spread of beam to properly light the road and therefore to secure the best results the lamp and filament dimensions will have to be chosen to suit the mounting height.

I venture to say that the reason why some high priced cars made to-day have low mounted lamps is because the experimenters found that with the particular type of lamps in their possession they secured better results with low than with high mountings. But a properly designed lamp mounted high will give better all around results than any lamp mounted low. I believe that a height of 3½ ft. to the center of a lamp having a 9 in. or smaller reflector is about the highest that can be used where the beam is kept below 3½ ft. beyond 75 ft. from the car.

It needs little argument to show the advantage that would accrue to the automobile public through having uniform lighting regulations over the whole country. The automobilist is essentially a traveler and in the course of a season he is liable to come within the jurisdiction of many different authorities. The annoyance caused by having to comply with many diverse lighting regulations during these travels can easily be appreciated.

There is one system of legislation which is the best. The essential requirements of lighting regulation are the same everywhere and can therefore be met by a single set of regulations. The first great requirement in lighting regulation is to insure a maximum of safety to all parties concerned. The second is to reduce any annoyance or nuisance that may be connected with lighting to the smallest degree consistent with the meeting of safety requirements. The third requirement is that the comfort, convenience and pleasure of the automobilists should be insured in the highest degree consistent with meeting conditions one and two.

A system of regulation which best meets all three of these demands is the best system possible and should be adopted uniformly everywhere. Lighting regulations should be as simple as possible consistent with attaining the desired results. They should be couched in such terms that they can be readily understood by people of moderate intelligence and education, and in such a manner that it is easy to ascertain with precision whether they are violated.

The requirement that no strong beams of light be projected from the lamps above a level of 3½ ft. beyond 75 ft. from the car and placing no limit on the intensity which may be used below this height is a step in the right direction, and this regulation is coming into wider and wider use, which speaks well for the intelligence of the officials who have adopted it.

This regulation fulfills part of the three essential requirements but only a part. The easiest way to comply with this regulation is perhaps to greatly cut down the light and drive with an insufficient illumination. This does not meet with the requirements of safety as pointed out earlier in the paper. An addition should be made to the regulations which will specify a certain minimum of illumination that will promote the interests of safety. This should specify that the lamps throw an illumination of 0.025 ft. candles measured on the surface of a level road 200 ft. in front of the car. Also normal to a line from the nearest lamp the illumination should measure 0.1 ft. candle 10 ft. to the front and 10 ft. to the side. This latter requirement is easily met if improper attachments are avoided.

Appended to the regulations should be some recommendations as to what constitutes good lighting, for the purpose of disseminating knowledge of good lighting to the public that would be difficult to reach otherwise. In this could be briefly embodied the statements that uniformity of the illumination on the road surface is desirable; that patches of excessive brightness are undesirable; that a large area of illuminated surface promotes efficiency of vision as well as safety; that strong diffused or scattered light above the level of the lamps even though insufficient to cause glare makes driving in a fog and snow storm dangerous.

Form for Legislation

All motor vehicles capable of traveling 20 m.p.h. shall be equipped with two headlights adjusted so as to project a beam of light on a level road surface covering at least a length of the road between a point 25 ft. in front of the car and a point 200 ft. in front of the car, with an illumination that shall measure on the horizontal surface of the road at every place on the straight line joining these two points at least 0.025 ft. candles.

Also the illumination measured anywhere between the road surface and 3 ft. above it and normal to the rays from the lamps, over a point 10 ft. in front of the car and 10 ft. to either side of the center line of the car shall not be less than 0.1 ft. candle.

Further, no headlight on motor vehicles shall emit illumination measuring over 1000 apparent candlepower when measured from any point above 3½ ft. from the surface of a level road and over 75 ft. in front of the car.

South's Profits $10,000,000,000—Car Sales Gain

Rapid Agricultural and Industrial Progress of This Great Section Forecasts Opening of Enlarged Market for Automobile, Truck and Accessory Manufacturers

AT the very door of the bulk of the American automobile factories lies a great consuming territory which holds immense possibilities for the sales organizations of the various concerns. It is the South, with an area of one-third of the total area of the United States, and a population of about 35,000,000. The people of this rich region have drawn $10,000,000,000 of wealth from the rich coffers of their land. This money demands an outlet through the buying of all the necessaries and luxuries the country can supply. Of this sum, $1,000,000,000 comes from the cotton crop—$720,000,000 from the lint and the balance from the products of the seed.

The close of the year found spot cotton future contracts 4½ cents higher than one year previous, or a minimum gain of $25 per bale. Some are predicting 15-cent cotton by spring and 20-cent by Jan. 1, 1917.

King Cotton's Rivals

The war has taught the Southern farmer a great lesson, for it is no longer a one-crop land. During the past year the doctrine of crop diversification has spread to the four corners of Dixie. In evidence of her emancipation from the slavery of cotton there is the significant fact that the value of the grain crop produced by the South last year was $1,330,000,000, which is $100,000,000 in excess of the value of the most profitable cotton crop ever gathered.

The South produces 88 per cent of the total tobacco crop; 28,000,000,000 ft. of the total of 31,000,000,000 ft. of lumber manufactured in the United States last year came from the South; she produces 75 per cent of the coking coal; 41 per cent of the zinc; 42 per cent of the lead; 80 per cent of the phosphate, and produces fifty-five of the fifty-seven useful minerals mined in the United States.

The New South is a growth of a scant fifty years out of the ruins of war, while the stable institutions of New England have thriven undisturbed for centuries. Comparing the two sections, the people of the South had a few weeks ago on deposit in national banks alone $735,561,874. New England had demand deposits of $484,654,630; the South, $586,155,168. New England had time deposits of $73,175,851; the South, $149,406,705.

A Rapid Growth

Commercially, industrially and agriculturally, the South has grown faster during the last decade than any other section of the country. The population of the South in 1910 was about 30,510,000, and during the past five years population has increased at the rate of sixteen per cent. Outside of the main centers of density, where there is a natural growth of large proportions, regardless of accretions from the outside, no other section of the United States has shown a larger growth during the period named.

With no design or inspired relation, news articles are appearing in the daily press singularly consistent and of one note, in their relation, of a healthy activity and industrial condition over the Southern States.

This year, as a result of their labors, the people of Dixie have more wealth than they ever had at the close of any year. The money constitutes a factor that cannot be neglected by the sales campaigns of the automobile industry. There are few automobile factories in the South. Alabama, Arkansas, Florida and South Carolina have none. Kentucky, Tennessee and Texas have three each, while Louisiana, Virginia, Georgia and North Carolina each have one automobile factory within their borders. They cannot supply the demand.

Many New Dealers

That the factories are beginning to awaken to the possibilities in the South is shown by the fact that the manufacturers who have no representatives in this territory are sending traveling men to the big distributing centers to establish an office or branch, or to make contracts with a new dealer or distributor.

A comprehensive review of the activities of seven of the Southern states, Alabama, Florida, Georgia, Kentucky, Mississippi, Louisiana and Tennessee, forcibly brings out the growing industrial importance of the South.

South Grows 60 Per Cent of World's Cotton Crop

OF course cotton is the great staple of the South, which raises about 60 per cent of the 22,000,000 bales constituting the annual crop of the world, the contribution of the United States to this total being normally 15,500,000 bales per year. The 1913-1914 crop was 14,000,000 bales, and the 1914-1915 total was approximately 16,500,000.

The seven States, Alabama, Florida, Georgia, Kentucky, Mississippi, Louisiana and Tennessee, produce nearly 5,000,000 bales per year, with a total valuation of over $266,000,000. As shown in the accompanying tabulation, compiled from the most recent Government ginner reports, the bulk of this crop is upland cotton bales, the total being 4,424,475, as compared with only 84,769 bales of sea island cotton, which is largely used for automobile tire fabric, and 294,472 linter's bales. The value of the upland cotton is $248,876,718.75, that of the sea island $8,264,977.50 and the linter's bales are worth $9,010,843.20.

Cottonseed Products Important

Besides the cotton itself, these States produce 1,228,688 tons of cottonseed products, which sells at an average price to the cottonseed oil mills of $37.50 per ton, or a total of $46,075,800. Cottonseed oil crude obtained by the mills totals 1,150,000 bbl., of 50 gal. each, other products being cottonseed cake, meal and hulls.

The upland cotton is used for yarn, sheeting, toweling, thread, etc. Sea island cotton is useful for tire fabric and covers, fine thread, lace curtains and underwear, filling for silk ribbon and mail sack duck. Linter's is employed in gun cotton, nitro-cellulose, batting, wadding, mattress stuffing, carpet lining, mixing with shoddy, etc.

Cottonseed oil is used for insulating material, cosmetics, cooking and salad oil, oleomargarine, soap, roof composition, nitroglycerin, linoleum, cheap paint base, etc. The cake and meal are utilized in bread and cake and as feed for cattle, horses, mules, swine and sheep, and the hulls for feed, fertilizer and bran. Thus many fields of usefulness are filled and waste is minimized.

Georgia Leads in Cotton

Of the seven States mentioned, Georgia is credited with the largest cotton crop, according to recent statistics, producing 1,865,624 bales of upland, 56,722 bales of sea island and 118,000 bales of linter's, a total of 2,040,346, or more than any two of the other States combined. It produces two-thirds of the total crop of sea island of the group, 56,722 bales, Florida, with 28,047, being the only other producer of this variety.

Alabama ranks second of the seven States in total output, its 1,073,666 bales being made up of 1,012,966 bales of upland and only 60,700 bales of linter's.

Mississippi is a close third, with a crop of 958,814 bales, consisting of 898,414 bales of upland and 60,400 bales of linter's.

The Other States

Louisiana's 354,530 bales give that State fourth place, its upland being 333,908 bales and its linter's only 20,622, or much less than Tennessee's linter's crop. Although this was 32,250 bales, Tennessee's total was only 318,775, including the 286,525 bales of upland, ranking the State fifth of the group. Florida is sixth with only 57,585 bales, of which 28,047 are sea island, or more than the 27,038 bales of upland. Kentucky's crop of cotton is so insignificant that it is classed with other States than those comprising the rest of the group.

Southern States Rank High as Lumber Producers

STANDING out prominently among the resources of the South is its contribution to the lumber-consuming world. The South may be said to have three leading industries—lumber, cotton and steel. Of the three lumber is second only to cotton in the matter of dollars and cents. Ranking high among the lumber-producing sections of the United States, being a locality in which conservation of timber, perhaps, has not been adhered to more than in other regions, but by reason of a vast visible supply, standing well near the top of the ranks of future production, the South to-day is contributing a lion's share of the aggregate footage of lumber consumed in the Central, Southern and Eastern States, as well as sending millions of feet overseas every year.

Supply Is Abundant

The foregoing being true, it is not to be wondered at that advocates of the Greater South point with pride to its vast buying power in the commercial world. While it is true that in the river sections of the Southern States difficulties arise which must be considered when comparing the natural advantages of other sections, nevertheless, the South, taken as a whole, must attribute much of its financial showing to the fact that the activity in the lumber industry is at its height. There is a visible supply of timber in the South to last many years yet, if proper conservation is practiced, and with the Federal Government co-operating with timber owners, teaching them how to take from the forest, it seems likely that the people south of the Ohio River will not see the forests depleted for several generations.

Probably the South is more prolific of wood varieties than any other section of the United States. Two of the more common are yellow pine and cypress. Of the yellow pine there are two kinds—long and short leaf, the distinction between them being that the former has greater tensile strength than the latter by reason of its longer fibers. Yellow pine goes into the construction of building and manufactured articles where strength is a factor. It is harder and more durable.

Much Yellow Pine

Yellow pine of both grades go into building construction in large quantities. Certain grades go into the manufacture of boxes. Cypress found along the Gulf of Mexico and the lower Mississippi is used for nearly every purpose. Being known as "the wood eternal" it comes in as a building material in large quantities and by a burning and scouring process finds a place high in the estimation of users of interior finish, since the grain is thereby given in relief.

Kentucky and parts of Tennessee are in the hardwood region of the South. Red and white oak are found there in large quantity and as to their uses, one has but to look on every side to find them. Poplar and cotton, as well as sycamore are used considerably in interior finish, boxes and for pattern making to some extent.

The Atlantic States have another grade of pine, known as North Carolina pine, which is quite similar to long-leaf yellow pine, while Georgia has a species all her own, very hard and finding a place in all the uses to which long-leaf yellow pine generally is put. Some sections of the southeast produce walnut and other fine finishing woods, but the supply of these is more or less limited.

The consensus of opinion at the present time, according to several leading figures in the lumber industry of the South who are in a position to know, is that the lumber industry is on the eve of a period of prosperity, the equal of which has not been approximated in several years. Granting that this is true, other lines of business should prosper. The man who sells automobiles should find fertile fields for his selling campaign during the coming year. True, the sections along the Mississippi have suffered from floods, but that is no unusual thing and this year's inundation has been less severe than on several other occasions.

After a period of depression extending over the last year and a half, building activity has taken on a new impetus and in consequence new mills, bigger production plans and greater selling campaigns in the lumber industry of the South are the order of procedure. The good showing of the early part of 1914 was robbed to offset a declining market after the first

(*Continued on page* 478)

COTTON PRODUCTION STATISTICS FROM MOST RECENT GOVERNMENT GINNER'S REPORTS*

States	Upland Cotton Bales	Sea-Island Cotton Bales	Linter's Bales	Total
Alabama	1,012,966	....	60,700	1,073,666
Florida	27,038	28,047	2,500	57,585
Georgia	1,865,624	56,722	118,000	2,040,346
Kentucky†	....	....	....	....
Mississippi	898,414	....	60,400	958,814
Louisiana	333,908	....	20,622	354,530
Tennessee	286,525	....	32,250	318,775
Total production	4,424,475	84,769	294,472	4,803,716
Average weight per bale (approximate)	500	390	510	....
Average price sold (approximate)	11¼c	25c	6c	....
Prices range for season	$8\frac{9}{16}$ to 12¾c	18c to 30c	3½c to 8½c	....
Total valuation	$248,876,718.75	$8,264,977.50	$9,010,843.20	$266,152,539.45

*There is yet to be ginned of the present crop about 5 per cent.

†Kentucky is classed in with other States, the production of that territory being insignificant.

The FORVM

MORE IDEAS ON BODIES—BEAUTY AND COMFORT SHOULD GO HAND IN HAND—THE CASE FOR MAGNETO IGNITION

Efficiency, Beauty and Comfort the Three Ideals

By Charles H. Tuft

Daniels Motor Car Company

IN Mr. Schipper's article on Body Discomfort in THE AUTOMOBILE for Feb. 3, I believe Mr. Schipper has summed up the situation by his statement, "It is recognized that it is impossible to turn out the bodies of stock cars in the same manner as a tailor fitting suits of clothing.

Thinks Comfort Not Forgotten

I do not think that in the race after beauty of exterior, the designer lost sight of the comfort of the interior. I am sure that the majority of designers have kept this matter in mind. That some have been more successful in their efforts than others, goes without saying. There are, as the article in question states, "a multitude of things that go to make a car comfortable." As a rule, the layout of the chassis governs. The steering gear must be mounted on the frame at a place very often determined by the location of the spring links, engine legs, starter, generator, magneto or water pump, etc.

Cylinders of V-type, multiple-cylinder motors, the tops of which overhang near the frame, largely determine the position and angle of the steering gear. The unit power plant largely determines the location of pedals, hand brake and gearshift levers. Pedals and hand levers may be so designed as to make them accessible and convenient for use, but the fact remains that their fulcrums are fixed by the location of the power plant and that their efficiency to a certain extent controls their design.

Comfort Should Follow Beauty

It is no more than natural that the mechanical features and performance of a car should determine its popularity and success. Of what advantage would the most handsome and comfortable body be were the chassis faulty? Who would be satisfied with a beautiful exterior and comfortable interior, should his car lack the power and speed to take him where he wanted to go and come?

Comfort, however, should be the very next consideration after efficiency and beauty, for were it a choice between beauty and comfort in a car after its efficiency were assured, I believe the public would demand the beauty. An owner takes more or less pride in his car, and if he is assured of its beauty and gracefulness of lines, in the eyes of others, minor discomforts, if such he may have, are more than made up for. I do not believe there are many cars of later design and average price that are uncomfortable, in the real sense of the word, to the driver. There is no doubt that there are some that are inconvenient of entrance to the driver's seat, but the buyer has demanded fore doors, the center control and the individual front seat, and these have all added more or less to his inconvenience in entering and leaving the driver's seat.

A few cars have been made with adjustable front seats and sliding steering wheels, but the majority of manufacturers have encountered no public demand for a radical change in the driver's compartment. Cars have been made in which the driver has been given the extra inch or two of the surplus space which Mr. Schipper speaks of in the tonneau, with the result that the driver uses a cushion at his back and extension pads on his pedals.

I do not believe it possible to standardize any set of dimensions pertaining to the driver's seat and the location of the various controls. There are too many variables that enter into the matter. If 9 in. were accepted as the proper distance from the bottom of the steering wheel to the top of the cushion, a thick cushion with light springs and plenty of hair would allow the driver to sink 3 or 4 in. and the wheel is then too high. If 19 in. were accepted as the proper dimensions from the pedal pads to the front of the front seat it would depend altogether on the depth of the cushion (the distance from the front seat to the upholstering of the back), whether the pedals can be operated or not. The driver must have his seat "back him up" when he applies his pedal or compresses his clutch spring. He also must apply his emergency brake, in emergency, with a pull from the shoulder and a straight arm. To do this he must necessarily lean for his lever, and in this case the pedals, both pushed down, must afford the support to pull against. A great deal of the driver's weariness comes from the friction between his back and the upholstering, due to the workings of the springs in the seat cushions. Thick soft cushions, especially, have this tendency. One would tire very easily in a Turkish rocker were he continually bouncing up and down. The only way to overcome this is by having the back upholstering move with the seat, and I understand that patents have been taken out covering this form of seat construction.

Individual Tastes Differ

The writer was connected with one concern that specialized in custom-made cars and hardly two cars ever went out alike, in regard to the location of the steering wheels, pedals, levers and location and height of the front seats. Every customer wished a change of some respect made. Some wanted to sit on the floor, others wanted to sit up in the air. Some would want the steering wheel up against their bodies, others wanted to drive with the wheel at arm's length. We had a hundred and one different steering column brackets until we adopted the ball joint universal bracket similar to the Minerva. Pedals were made in numerous lengths and hand levers bent into every conceivable shape.

Must Consider Human Limitations

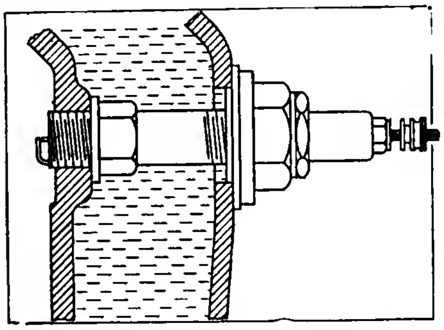
I am a thorough believer in standardization wherever possible, but as long as human beings go on varying in stature, as they have a habit of doing, I do not believe that any standards for comfort that may be adopted will meet with the approval that would be expected.

To Avoid Plug Trouble in Racing Engines

By J. E. Schipper

ALTHOUGH they were nearly all able to overcome the difficulty as the season wore on, at the start of the racing program of 1915 the major motor trouble was the difficulty of obtaining spark plugs that would stand up under the punishing conditions of high temperature prevailing in modern engines of high efficiency.

It appeared, afterwards, that the temperature was the chief cause of the trouble, and that those engines in which the spark plug was in a good position for cooling were the easiest to equip with plugs of sufficient durability.



The accompanying sketch shows an idea for providing the plug with a maximum of cooling. It is suggested that the plug boss be cast in the cylinder wall itself, instead of forming a lug connecting the inner cylinder wall with the water jacket, and that the plug body be screwed directly into the cylinder. To allow this plug body to be water-cooled direct, it would need to be longer than usual, and it would, of course, have to be put in before the water. When the plug was screwed home with a tube spanner, a nut with a soft gasket would seal the orifice in the water jacket wall.

Obviously, a plug inserted in this way, having a special, long body to suit the design of the engine, could not be changed except by first letting out the water. To combat this it is suggested that the insulator might be detachable. There are some obvious difficulties, in the details of the plug, but it seems that the efficiency of the cooling could scarcely be bettered and the idea is one that might be worth elaboration.

The Case for the Magneto

By N. J. Hart

THERE is a very distinct advantage in having an increasingly hot spark as the engine speed increases, because such a hot spark has the property of being able to clear fouled plugs and to keep clean ones from fouling up.

There are magnetos that are capable of maintaining perfect ignition at lowest possible engine speeds under all conditions. In fact, so efficient are these instruments that they will furnish absolutely perfect firing to engines revolving so slowly that not enough energy is stored up in the rim of the flywheel to carry the pistons over the next following compression point, and if it were not for the momentum of the rolling mass of the car pushing the engine over the engine would stop.

The storage battery was discarded for ignition purposes immediately the magneto was brought to its present state of perfection because of the fact that the ordinary driver could get the very best possible effort out of his engine when magneto-equipped for the reason that the current and voltage increase and decrease with the speed of the engine. This had the much desired effect of doing away with the necessity of pulling and hauling the advance and retard mechanism at every change in road condition or speed. Drivers had some comfort then. Much manipulation of the battery-ignition advance lever is absolutely necessary if one is to get any kind of power out of the engine.

Let us face the truth. Battery ignition systems cost less than magnetos and this is the prime and only cause of the adoption of methods abandoned long ago in Europe as unsatisfactory. The battery is necessary on a modern car to supply current for lighting and for starting the engine and when used for ignition purposes does not give the ideal spark for starting which is so much boasted about by the supporters of this system and for the following reason: When the starting switch is operated there is a terrific "inrush" of current into the armature of the starting motor and as the capacity of the battery generally supplied is limited first by weight, then by size, and last but not least, by cost, there occurs an immediate drop in voltage of at least twenty-five per cent, and this drop is much greater in cold weather. Coils to operate successfully must be wound for the voltages on which they are intended to work and it is therefore a fallacy to imagine that a fat spark when starting is at all possible in the face of the drop in voltage at the battery terminals when starting motor is called into action.

Battery Ill Kept

Another point to be considered is the following: The storage battery in the hands of the novice is rarely kept in even a semblance of good condition and as the battery is the "weakest link" in the most vital part of the car, it seems to me to be like "placing too many eggs in one basket."

In a great measure the carbonizing of the engine and deterioration of the exhaust valves can be laid to the door of the weak and inefficient ignition and not to bad gasoline or cylinder oil as claimed.

Misleading Switches

Another point is that the switches of the battery system have had two points indicated on their faces, the word "Bat" at the starting point and "Mag" at the running point. People have been under the impression that they have been buying magneto-equipped cars and that the word "Mag" signified magneto, when as a matter of fact, none of these cars equipped with these switches had even a place on the engine where a magneto of any kind could be installed. Even if a magneto were installed it could not be operated *with that kind of a switch* in the circuit.

RENE THOMAS, winner of the 1914 *Indianapolis race, who will drive a Peugeot car in all the leading American track races during the coming season. Thomas, who is free from military obligations in Europe, has made arrangements with the Indianapolis Motor Speedway to rebuild one of their Peugeot racing cars and will make his first appearance in the* 300*-mile race on May* 30. *It is expected that Thomas will sail from France about the middle of March and will be in Indianapolis on April* 1.

The Rostrum

How a Gear Pump Operates

IN THE AUTOMOBILE for Feb. 24, a description of the action of the gear pump was given which was incorrect, owing to the inversion of the intake and exhaust sides. The diagram shows the true action which is as follows:

When the pump is stationary it is full of oil and all the small spaces between the teeth of the gears are filled likewise. Regarding those teeth which are on the outer edges furthest from the center of the pump, it is easy to see that the small quantities of oil between the teeth are shut in by the edge of the casing. This is equivalent to saying that the space between each pair of teeth acts like a small bucket or pocket.

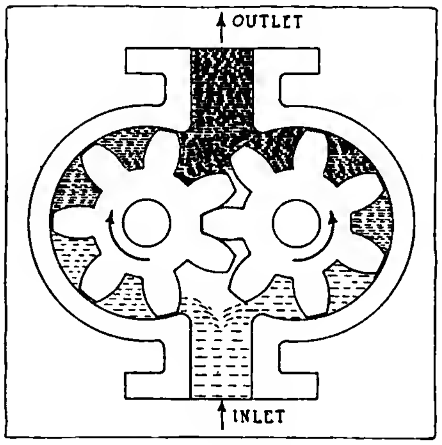


Fig. 1—Diagram of gear pump action

Now, if the gears start to turn, each tooth space as it leaves the suction side picks up its "charge" of oil and carries it round. When the point is reached where the two gears mesh together, the oil lying between the teeth is squeezed out. Thus as each successive pair of teeth meets, the effect upon the oil is the same as the downstroke of a minute plunger pump. Normally the teeth spaces are kept filled with oil and every time the teeth meet, the oil is expelled by the other tooth filling the gap.

The limit of pressure which a gear pump can create is determined by the relative areas of the teeth and of the clearance space surrounding the gears. The oil that is thrown out on the discharge side can leak back to the intake side by flowing across the faces of the gears. The amount of oil discharged varies directly with the width of the teeth, thus if two pumps are of the same size, save that one has double the width of tooth, then the larger should pump twice the quantity of oil per minute that the other will do at the same speed. This means that by making the gears wide we can create a very great pressure; indeed, there is practically no limit to it.

Lauds Studebaker Service

Editor THE AUTOMOBILE:—In the last issue of your paper I noticed a very good article entitled "Trend and Possibilities of Automobile Design," and my attention was especially attracted to the latter part of this article regarding the cost of maintaining automobiles. It seems to me, as a new owner and operator, that the different automobile companies should aim to operate their mechanical departments so as to give cheerful service and service that is not only good, but that which is honest and reasonably priced. In other words keep the customer so well satisfied with his car that he will be a booster instead of a knocker.

The scheme of the Studebaker people is an excellent one and while it does not go far enough—the first six months' use being the best life of the car—it is the right spirit for the manufacturer to have toward the operators and cannot help but make them satisfied customers. The typewriter folks keep their machines in repair for a year and I guess the automobile people are coming to the year themselves, gradually creeping up to it. I believe that if the auto folks would offer a year's upkeep of their machines with the price of the machine the increased sale of that particular machine would soon indicate very clearly the worth of the offer. I know people who are ten times more able to own a machine than I am, but who do not own one because of the excessive charges for repairs and maintenance of the machines. I know a former operator of a Ford who found the cost of keeping the machine more than he had been led to believe it would be, and now preaches the doctrine of hiring. He says you can afford to hire a machine for an occasional ride and rid yourself of owners' troubles and have a free mind. He, like thousands of others, was robbed by the repair folk. I think this form of robbery is doing more harm to the industry than even faults of the machines.

Your paper seems to be going after such practices as these and I hope you will keep up the good work and educate the manufacturers up to the idea that they must satisfy the customer if they expect to continue in the business. W. M.

Washington, D. C.

Prolonging the Life of Automobile Tires

Editor THE AUTOMOBILE:—From time to time various schemes have been suggested for equalizing the wear on tires, most of them aiming apparently to have the tires all wear out at the same time, which, to most of us not blessed with unlimited money is a calamity rather than a saving.

A plan which the writer has tried out very successfully and which he has not seen advocated elsewhere is here given. Assuming the average car with four tires on the wheels in various stages of wear and one new one as a spare, take off the right rear tire and carry it as a spare, replacing it with the new tire. Run the car 1000 miles and then move this tire to the left rear wheel, putting a new tire on the right rear. At the end of the next 1000 miles move the left rear to the left front, the right rear to the left rear and put another new tire on the right rear. After 1000 miles more repeat the process, keeping the tires moving from wheel to wheel at each 1000 miles, moving them around the car in clockwise direction. There are a number of advantages in this which are not apparent at first thought. The rear wheels naturally are the hardest on tires and of these the right rear will generally get more wear than the left due to the fact that the left usually has the better part of the road to travel on. Therefore the new tire, which is best able to withstand the wear is put on the right rear each time. When it is moved to the left rear the direction of wear is reversed. This is beneficial to the tire and is of advantage on a non-skid tire as the gripping portions presented to the road are the opposite of those we

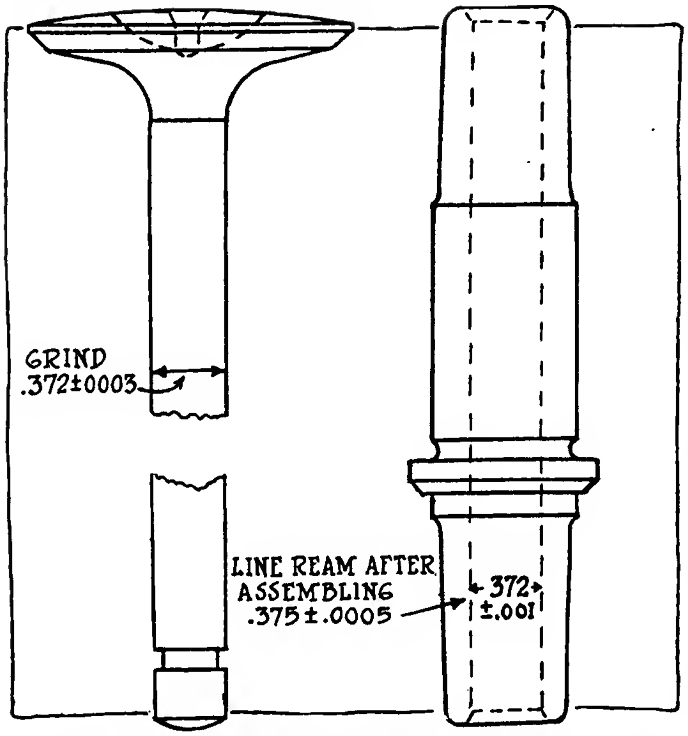


Fig. 2—Details of Continental 7-H model motor valve and valve stem guide, illustrating clearance

ran on the other wheel. To those who use reliners it may be said that the time to insert the reliner is when the tire is moved to the front wheel after running 2000 miles on the rear wheels.

The writer has tried this out on several of his friends and has yet to see a car with tires adequate to its weight which has not given greatly increased mileage per tire, in every case the tires running over the 4000 miles necessary to complete the cycle. On one car on which the owner formerly considered himself lucky if he got 2500 miles from a tire, the tires now give better than 4000 miles. To get the best results non-skid tires should be used and reliners will give additional mileage when the tires are moved up to the front wheels.

The writer's experience with reliners has been unsatisfactory when used on rear wheels or in new tires and he does not believe they should be so used.

If after a season's trial it is found that the cars are averaging well over 4000 miles (on one car on which this plan has been tried out they have averaged over 6000) the change can be made at 1100, 1200 or more miles—the whole object of the scheme being to get the utmost of wear from each tire, to have it about completely worn out by the time it has made a circuit of the four wheels and to have the expense for tire renewals come regularly and one at a time instead of irregularly and sometimes in bunches.

While on this subject why not give us a well worked out table showing the actual inflation pressures for tires of different sizes and under different loads, giving actual load weights and not empty car weights which plainly mean nothing when taking a seven-passenger car and a runabout with the same size tires. There is no use carrying a greater inflation than is necessary and proper for the weight the tire has to support, and, if we could get a really well worked out table of this sort, it would add to the life of the tires and to the comfort of the motorist. Most tires are either over or under inflated and either one is injurious. If such a table has ever been published it would bear repeating, especially if it gave bona fide pressures for bona fide weights under complete load. In these days of power pumps it is not necessary to allow 10 to 20 lb. for "that tired feeling" which comes from hand-pumping and this is just what many of the tire companies do in their tables of recommended pressures.

Larchmont, N. Y. M. C. C.

Bright Brass Dipping Solution

Editor The Automobile:—We understand that there is an acid solution or bath used by brass workers, clock makers and others in which brass parts may be dipped and the brass will not be affected by the acid, which will, however, remove all dirt, grease and tarnish and the brass will come out of the bath bright and clean. Can you give us the formula for this acid bath and instructions for its use, advising us also whether it must be kept in lead or glass containers?

2—Will you also kindly advise us what is considered good practice in the way of clearance between valve stems and their guides? For instance, in a used motor where the stems and guides are worn, assuming the stems to have been originally 0.375 diameter, new guides are fitted, or if the guides are integral, they are reamed out oversize and bushed, and in either case the finished hole is made 1/64 undersize, or 0.359. What size then should the stems on the valve be ground to—in other words, how many thousands under 0.359 to allow proper clearance when the valves are heated up and yet make a strictly first-class job? Should exhaust valves and inlet valves both have the same stem clearance in the hole?

Larchmont, N. Y. L. Mfg. Co.

—The parts to be cleaned are first dipped into a solution of hot lye and then dipped into what is known as a bright brass dip. This is made up as follows: Two parts sulphuric acid to one part nitric acid with a tablespoonful of salt to each 3½ gal. of acid. Care must be used in mixing. Put the sulphuric acid in a jar first, then add the nitric acid. Let this stand until it stops working or fuming, then add the salt. The parts to be dipped should be dipped first into the hot lye solution and then into the acid solution. Immediately after the acid dip the parts should be rinsed in cold water and then given a second dip into the acid, and then into the cold water to rinse them off. After this they should be dipped into very hot water and thrown into sawdust to dry.

2—Practice on clearance between stems and guides is shown in the accompanying illustration, Fig. 2, which details the 7-H model Continental motor valve and valve stem guide. The dimensions apply to both intake and exhaust. It is the practice of the National Co. if a finished hole of 0.358 to 0.360 is indicated, to use a valve stem diameter of 0.355 or 0.356. This clearance would be suitable according to the National company for both inlet and exhaust. The Northway company states that the valve clearances vary between 0.0025 and 0.004, depending on the design of the exhaust port. The Buick Motor Car Co. allows a clearance of 0.0015 to 0.002 on the intake and 0.0025 to 0.003 for the exhaust.

Carbon Monoxide a Poisonous Gas

Editor The Automobile:—What are the chemical composition and the chemical and physical properties of the gas called Petromortis supposed to be deadly?

2—Are there any unusual atmospheric conditions conducive to its formation?

3—Could theoretically imperfect carburetion or ignition cause the generation of the gas?

4—Could the improper composition or condition of gasoline or lubricating oil cause the generation of the gas?

5—Is the gas liberated in such concentration that ordinary ventilation of the garage will not prevent asphyxiation?

6—Is the presence of the gas in harmful proportions in the garage detectable by the ordinary human senses?

7—Is the harmful effect of the gas immediate or might its effect be noticed a given length of time after inhalation?

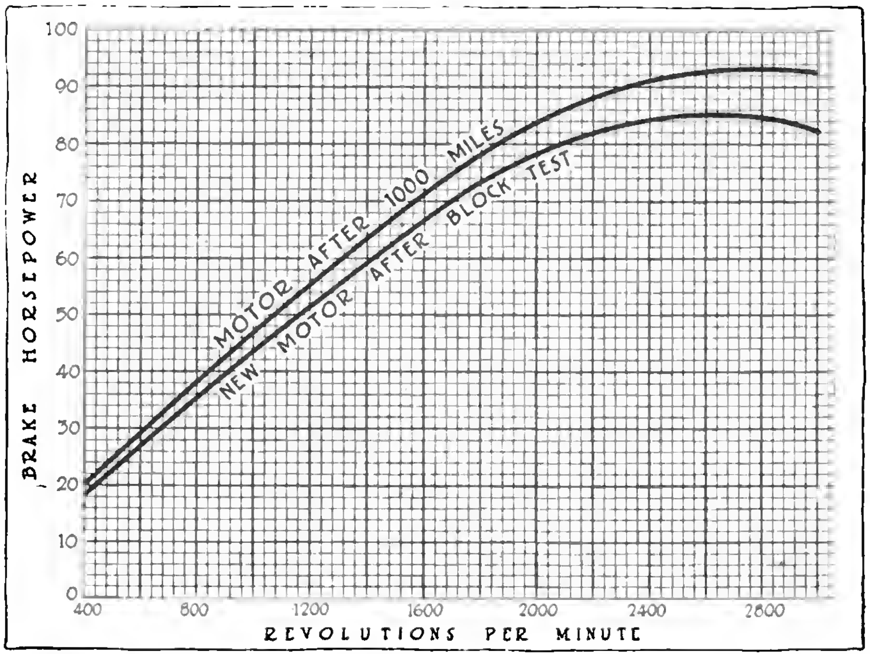


Fig. 3—Horsepower curves of Packard twin-six motor when new and after 1000 miles

8—In general does unconsciousness result so quickly that the victim could not reach the open air after realizing approaching danger?

9—Would access to open air be sufficient to relieve all harmful results in case open air was reached after discovery of the presence of the gas and its inhalation?

10—Are the physical and chemical properties of this gas well enough known so that a simple means of detecting its presence in the garage is possible even though its accidental generation could not be prevented in a practical manner? C. M. C.

Fort Canby, Wash.

—The gas which has the deadly effect is carbon monoxide. This is not only a suffocating medium but is also a poison. Carbon dioxide is a deadly medium, too, but only in that it is a non-supporter of life, although not a posion.

2—No.

3—Yes

4—Yes.

5—With very bad or incomplete combustion the carbon monoxide ingredient can be so large that it will cause bad effects even with average ventilation, but it will hardly be fatal except in an entirely enclosed room, or a room in which there is no air circulation.

6—No.

7—Headache and pain in the eyes are felt by some people in the presence of the gas, but not by all.

8—There may be no direct warning except a drowsy sensation which quickly deadens the senses of the victim.

9—Yes.

10—The stinging sensation in the eyes and headache is usually sufficient warning.

Explanation of Systems of Ignition

Editor The Automobile:—In your list of technical specifications for passenger automobiles published in the issue of The Automobile of Dec. 30, 1915, the systems of ignition are given as single, dual, double, 2 point and duplex.

Will you kindly furnish me with the correct definition of each of these terms? W. H. R.

New York City.

—Single ignition is where there is one source of current and one set of spark plugs.

Dual ignition is where there are two sources of current and one set of plugs, the systems being independent in every respect until the distributor mechanism is reached. In this point, including the distributor, high tension leads and spark plugs, the one set does for both systems.

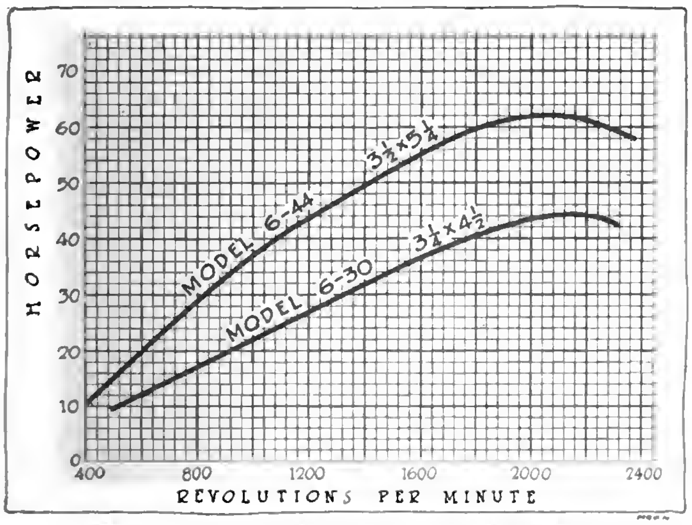


Fig. 4—Horsepower curves of two high-speed Moon motors

Double ignition employs two current sources and two entirely independent systems, either one of which may be used independently of the other. Both may be used at the same time, but perfect synchronism will not be attained unless there is some special arrangement for attaining it. The double system means that there are two absolutely independent ignition systems.

Two-point ignition is where two sparks occur in the cylinder at the same time; generally this is done by the use of a double distributor, but recently there have been series spark plugs put on the market by means of which a single spark ignition is made into a two-point system by simply connecting the plugs in series.

The duplex system is where a coil is used in a battery circuit and connected to the primary of the magneto. This gives a hot spark at low rotative speeds and is only intended as a booster current for starting. After the motor is running at normal speeds the circuit is the same as the single magneto system, the duplex cil not being in use.

Horsepower Output of the Moon Motors

Editor The Automobile:—Will you kindly publish the horsepower curve of the Moon model 6-44 and 6.30 motors?

New York City. J. E. S.

—These horsepower curves are shown in Fig. 4 and are illustrative of the typical up-to-date high-speed practice.

Horsepower Output of Packard Twin Six

Editor The Automobile:—Will you kindly give the horsepower curves of the 1916 Stearns-Knight eight and the Packard twelve? G. A. S.

Philadelphia, Pa.

—The horsepower curve of the Stearns-Knight eight is not available. That of the Packard twelve is shown in Fig. 3. It will be noted that two curves are shown of the Twin Six Packard. The lower curve represents a comparatively new motor well worked in on the dynamometer, while the other curve represents the power that it is possible to get out of a motor when well worked in by a lot of road service.

ACCESSORIES

K-P Aluminum Pistons

EACH set of K-P aluminum alloy pistons for Ford motors has a complete equipment of properly fitted rings; the pistons are of standard size and are ready to slip into the cylinders. The rings are the K-P, made by the same concern; they are of the three-piece type with all joints blocked by the solid metal of the jointless sections of other parts, and the ends are so locked that they cannot warp up and score the cylinders in case of overheating, the makers state. The pistons sell for $26 per set of four. —Keys Piston Ring, Inc., St. Louis, Mo.

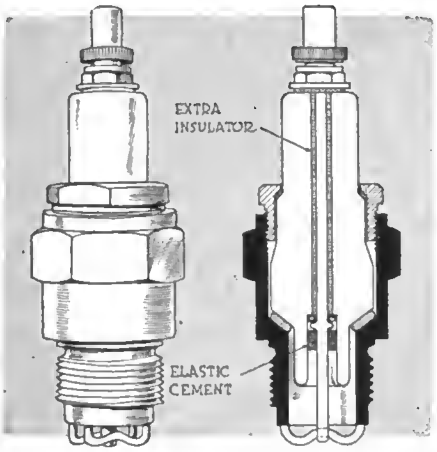
K-P aluminum pistons for Ford motors

Jumbo Spark Plugs

The Jumbo Jiant is the leader of this line, which comprises three other plugs, the Jumbo Regular, Junior and Ford Special. The Jiant is designed for the utmost durability in service on high-speed, high-compression motors as well as in all heavy-duty types. It is made in S. A. E. ½-in., metric and S. A. E. long sizes. The Regular is made in S. A. E., ½-in. and ½-in. long sizes. The Junior is for medium-speed, medium-compression motors and is made in S. A. E., ½-in. and special motorcycle sizes.

Some of the advantages claimed for the Jumbo construction, illustrated herewith, are: Terminal will fit any connection; extra insulator insures spark in case porcelain is cracked or broken; asbestos washers allow for expansion and prevent leakage; elastic cement strengthens lower part of insulator and prevents compression escaping around electrode; massive nickel-alloy points gives hottest possible spark, prevent pre-ignition at points and will not burn off; two large shell electrodes fastened at both ends cannot be bent or twisted out of place; downward slope of electrodes from points of contact allows oil to run off, thus preventing fouling.

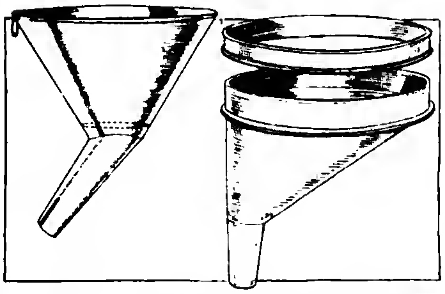
The Jumbo Jiant sells for $1.25; the Regular for $1; Junior for 75 cents and Ford Special for 75 cents.—Wales-Adamson Co., Chicago, Ill.



Jumbo spark plug, showing construction

Dover Funnel for Cadillacs

Designed especially for Cadillacs, this funnel has the spout set at an angle so that the filling of the oil reservoir in the eight-cylinder car is greatly simplified. Capacity, 1 qt.; top diameter, 6½ in; height, 7½ in; outlet, 1 in. The funnel is of heavy pressed steel, copper plated, and is fitted with brass strainers. The Kompact, the other funnel illustrated, is of the offset type, one side being vertical and directly in line with the spout, so that it is easily used in places where there is little or no room at one side. The top has a removable hoop to hold a chamois strainer, and a fine brass strainer is provided. Capacity, 4 qt.; top diameter, 9½ in.; height, 9½ in.; outlet, ⅞ in. Price, Cadillac, 50 cents; Kompact, $1.25.—Dover Stamping & Mfg. Co., Cambridge, Mass.



Two new Dover funnels. Left is especially for Cadillac cars. Right is the Kompact offset type for general purposes

Eveready Starter for Fords

The Eveready is a one-wire electric starting and lighting system for Ford cars, the motor-generator being directly connected to the crankshaft by a flexible coupling. It runs at engine speed, causing no drag on the engine and has no chains or sprockets. The starting motor acts as an auxiliary flywheel, reducing vibration and making it possible to throttle down to 3 miles per hour on high gear, according to the maker.

Besides the motor-generator, the system comprises a special 12-volt storage battery, lighting and starting switches and wiring. The battery is carried on the footboard, flat against the heelboard of the front seat.

To start the car, the spark lever is shifted to the full retard position, which sets the starter spinning. When the spark lever is advanced as the engine attains the necessary speed the dynamo automatically begins to regulate and charge the storage battery. The system is so simple that it can be installed in a few hours without drilling or making any changes in the engine or car.—American Ever Ready Works, Long Island City, N. Y.

Mounting of motor-generator used in Eveready starting and lighting system for Ford cars. A flexible coupling is used

Blackmoor Curtain Opener

A suitable bracket is attached to the door so that the storm curtain opens with the door. The bracket is adjustable to any make of car and can be quickly removed when not in use. Curtains to be used with these brackets are furnished with all makes of cars. The price for the opener is $2.50 per door.—Dayton Top Improvement Co., Dayton, Ohio.

Outlook Windshield Cleaner

In this device, an adjustable wiper for rubbing off a section of the windshield glass is mounted in a suitable bracket and can be operated easily by the driver. It is finished in black or nickel and the wiper itself is made of rubber. It lists at $1.50.—Outlook Co., Cleveland, Ohio.

Universal Radiator for Fords

In THE AUTOMOBILE for Feb. 10 it was stated that the Universal radiator for Ford cars was of heavy steel, well enameled and finished. This should have referred to the Universal hood, as the radiator is made in black enamel and nickel.

The AUTOMOBILE

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Good Lighting

WHAT good lighting really is is well explained in the S. A. E. paper which is concluded in this issue of THE AUTOMOBILE. It is a careful analysis of the *details* which affect the whole difficult subject. Mr. Clark has explained, both in exact terms of scientific units and in simple language also, what sort of a beam and what sort of general illumination is necessary in an automobile headlight to produce a safe driving light which will not exercise a dazzling effect upon other users of the road.

The fact that Mr. Clark favors a particular method of producing a lamp to suit the conditions is beside the case. The lamp he describes may be the best possible, and there may be many other means for obtaining the desired light. The important thing is that we have here a full and easily understandable definition of the things which a lamp ought to do.

The requirements once stated thus clearly, the problem of devising lamps to suit them is facilitated greatly, the problem of legislating so as properly to control lights ought to be rendered easier, and the way out from the present chaos brought within sight.

Even supposing that Mr. Clark's conclusions are capable of destructive criticism, suppose even that they were proved wrong in some respects, we still have before us the proper way to attack the problem. A proper system of gaging light and what it does is three-quarters of the battle for a sensible and simple means for obtaining the results which everyone desires.

It may be recalled that an effort to establish some sort of automobile standard of lighting was made by a German scientist in 1913 and his suggestions were given in THE AUTOMOBILE for July 17, 1913. Since then no more has been heard of the idea from that source and the professor had not worked it out to nearly as fine a point as Mr. Clark has now done.

Strengthening the Grip

THE manufacturing conditions of Europe are such at present that the whole world has to look to America for automobiles. Large parts of that world, outside Europe itself, offer wealthy and prosperous markets; ready money markets where the American manufacturer has no work to do in selling his product.

Simultaneously, the domestic demand is at least as great as the supply. It is difficult to find automobiles for shipment overseas, so urgent are the calls from domestic dealers.

The condition prevailed all last year, but it was only in the late fall that American automobile manufacturers showed signs of appreciating the facts of the case.

There is one aspect of it that is still liable to be neglected, and this is that when demand exceeds supply for any commodity, the price is raised automatically. The value of an article in ultimate terms is the price that those wanting it are prepared to pay. This means that the overseas markets which cannot get automobiles from anywhere except America are able and willing to pay handsomely for them. The foreign markets were never conditioned so advantageously to the American manufacturer, and it is safe to predict that they will remain in the present state not longer than for two years after the conclusion of the war. This gives America not less than three years and possibly a little longer to make the best of the opportunity to establish a worldwide trade on a firm and lasting basis.

Manufacturers of all kinds of goods are getting so strong a hold on South America that they will be entrenched against any recommencement of European exportation. Instead of being offensive they will in future be defensive, or, in other words, the tables have been turned in every country in the world. The proportion of America's automobiles being exported, even including all the war orders, is a vastly smaller percentage of the total output than it ought to be.

The overseas markets are not to be held without effort. Just now it is easy to sell anything to countries which are stripped of their normal European supply, but this easiness will not persist after the war. To pay the costs of warfare Europe will be forced to give far more attention to her export trade than ever before, and to retain the markets now so wide open, America must be prepared to meet competition of the keenest kind.

Court Issues Injunction Against Standard Welding

Prohibits Manufacture and Sale of Demountable Rims Held To Infringe Perlman Patent—Hoped-for Adjustment of Royalties and Damages Not Accomplished

NEW YORK CITY, March 8—An injunction was issued to-day by the U. S. district court for the Southern district of New York by which the Standard Welding Co., Cleveland, Ohio, maker of a large proportion of the demountable rims used on automobiles, is prohibited from further manufacture and sales of such rims. The injunction is the result of a suit brought by Louis Perlman, New York, against the Standard Welding Co., charging infringement of Perlman's basic patent on demountable rim construction and applies to this type of rim only.

This court action ranks second in importance to the Selden patent decision, in that it is believed to affect the manufacture of the majority of demountable rims. Stopping production of a large percentage of demountable rims will have serious consequences with many car concerns, and may require using clincher or quick-detachable types. It is impossible at this time to forecast the consequences.

Previous to the granting of the injunction conferences were held with the object of effecting a settlement by the payment of royalties and damages, but it is reported that royalties asked were too high and negotiations failed.

The court of appeals denied the Standard Welding Co.'s petition for a rehearing based on the contention that Perlman's alleged date of invention is wrong, and that his patent is invalidated by the Tillinghast patent, which is alleged to be of prior date. The petition also cites a decision by the court of appeals of the District of Columbia, alleging that it definitely limits the breadth of the claims in Perlman's patent so that they do not cover the Standard Welding construction.

A motion by the Standard Welding interests, to include in the mandate a clause in regard to the right of the district court to suspend the injunction upon sufficient cause being shown and after due notice, was also denied by the court of appeals.

The serious consequences to the automobile industry of the enforcement of the injunction may be realized when it is considered that over 700,000 of the cars to be made this year may use demountable rims and that a large percentage of the output is furnished by the Standard Welding Co.

The Standard Welding interests state that Perlman's demands are exorbitant, and that, while they are willing to pay the inventor a reasonable sum and a just royalty on future manufacture, they cannot meet the terms he names at present.

Perlman's contention is that his claims are reasonable, and that, as he has consistently maintained, he seeks an equitable, fair and honorable adjustment for all concerned.

Suit Filed in 1913

Perlman filed suit against the Standard Welding Co., Oct. 7, 1913, in the U. S. district court for the Southern district of New York, charging infringement of his demountable rim patent No. 1,052,270 issued on an application filed June 29, 1906, which was a continuation of and substitute for an application filed May 21, 1906. Perlman's idea, he said, was to patent "a wheel whose demountable rim is bodily detachable from its fixed rim and felly, means being provided for firmly and rigidly retaining the demountable rim on the fixed rim and felly while in use, such means at the same time being adapted to be manipulated for enabling ready, rapid and easy removal of the demountable rim when desired."

A decision in Perlman's favor was handed down by Judge Hunt Aug. 18, 1915, the court stating:

"Finally, Perlman's patent shows invention, completed by him in 1903. Two distinct features mark the invention: (1) The demountable rim combination with its locking means; and (2) the short-stem lug combination for clamping the tire to the demountable rim. The invention claimed was based upon a provision for a demountable rim which is loose on the wheel when applied, but is locked by locking means which may be unlocked and thereby may restore the loose condition before commencing removal. This same combination has been adopted by defendant and the same combination as disclosed and claimed in the patent in suit has been taken. Plaintiff disclosed to the defendant the patented invention before defendant began to manufacture demountable rims.

"The evidence requires the finding of infringement and the granting of an injunction and accounting in usual form."

A Decree Issued

In due time, early in September, 1915, an interlocutory decree was issued by the court in favor of Perlman, perpetually enjoining the Standard Welding Co. from further infringement of his patent and appointing a special master to determine the amount of damages.

An order was also issued at this time allowing the Standard Welding Co. to appeal to the circuit court of appeals, which was subsequently done, the decision of that court, upholding Judge Hunt in declaring the patent valid and infringed, being reported in THE AUTOMOBILE for Feb. 17, 1916.

Standard Welding May Build Under Other Patents

CLEVELAND, OHIO, March 6—General Manager J. C. Manternach of the Standard Welding Co., the only official of the company in the city at present, said he thought that Perlman would not bring an injunction suit to enforce the terms of the recent rim decision, without giving some notification of his intention to the company or its attorneys. The decision, he said, gave him the right to bring such a suit, if he so desires.

Regarding the payment of royalties on rims already manufactured under patents said to infringe those held by Perlman, it is said that this will depend somewhat on negotiations with him.

Mr. Manternach did not care to indicate what course would be taken in the future, but indicated that some of the many patents held by the company might be used in place of those which have been adjudicated in favor of Perlman. This, however, will be a matter for future decision.

Locomobile Changes Truck Name

Commercial Vehicles of Locomobile Manufacture to Be Called "Riker" in Future

BRIDGEPORT, CONN., March 7—The name of Locomobile as applied to motor trucks built by the Locomobile Co. of America, this city, has been changed to Riker, the new name being a distinct recognition of the work of Andrew L. Riker, now vice-president of the company, and who has been in charge of engineering since the four-cylinder Locomobile car was brought out in 1902. Although the name Locomobile will be discontinued as applied to trucks, the Locomobile passenger cars will continue the use of the name Locomobile as they have done in the past.

Several reasons are advanced for adopting the name Riker for the trucks of this concern. Foremost is the fact that the name Locomobile is to-day associated with expensive, luxurious automobiles, manufactured in limited quantities. This fact contrasts with the motor truck which is a vehicle of business, and which is used because of its money-earning ability. As a truck-builder, Mr. Riker's experience goes back 16 or 18 years, when he built the Riker electric delivery vehicles, some of which are still in the service of B. Altman & Co., one of New York's largest department stores, and the Gorham Company, a leading New York silversmith. After being engaged in the manufacture of electric vehicles in Brooklyn, and later in Elizabethport, N. J., Mr. Riker was engaged by the Locomobile company to develop a line of gasoline cars, and brought out the first Locomobile four-cylindered car.

Although the name of the trucks has been changed from Locomobile to Riker, there will be no changes in the line of vehicles manufactured other than natural improvements that come from time to time. The Locomobile Co. of America stands back of the product as it did before the name was changed.

National United Service Co. Takes Over Arbenz

NEW YORK CITY, March 8—The National United Service Co., with headquarters in the U. S. Rubber Building, has taken over the Arbenz Car Co., Chillicothe, Ohio. The National United Service Co. is preparing to take over four other automobile concerns and has increased its capital from $150,000 to $1,000,000. It is planned to assemble the Arbenz car, three models of trucks, 1-ton, 1½-ton and 3-ton, and an agricultural tractor in the plants to be acquired in various parts of the country.

H. F. Vortkamp, Jr., is president of the company, the other officers being A. C. Hartho, vice-president and treasurer; C. V. Neal, second vice-president; and L. T. Gresser, secretary.

Pullen, in Mercer, Wins Ascot Speedway Race

LOS ANGELES, CAL., March 5—Pullen in a Mercer won the George Washington Sweepstakes, a 100-mile race, at the opening here to-day of the new Ascot Speedway. His time was 1 hr. 30 min. and 42 sec., or 66 m.p.h.

Burman in a Peugeot finished second and Cooper in a Stutz was third. Their time was 1:32:43 and 1:32:44 1/5 respectively.

Peerless Truck Profits $2,555,773

NEW YORK CITY, March 8—The Peerless Truck and Motor Corp. reports for the year ended Dec. 31, 1915, net profits of $2,555,773, after providing for the full year's interest on the company's notes, on which there only accrued one month's interest, deducting all interest charges of subsidiary companies and creating a special reserve account of $600,000. This is equivalent to 22⅛ per cent, earned on the capital stock.

The balance sheets of the subsidiaries show current assets of $5,611,780 and current liabilities of $1,391,587, leaving working assets of $4,220,193.

Buick Elects Officers and Directors

FLINT, MICH., Feb. 29.—Officers and directors for the current year of the Buick Motor Co., are the following: Charles W. Nash, president and general manager; C. S. Mott, vice-president; T. S. Merrill, secretary; James T. Shaw, treasurer; Floyd A. Allen, assistant secretary-treasurer; L. F. Oland, comptroller.

Sparks-Withington Trebles Capital

JACKSON, MICH.—At the annual meeting of the Sparks-Withington Co. the capital stock of the company was increased from $300,000 to $1,000,000, and it was decided to double the size of the plant.

J. Walter Thompson Co. Has Jeffery Advertising

CHICAGO, ILL., March 8—The J. Walter Thompson Co. will continue to handle the advertising business of the Thomas B. Jeffery Co. In THE AUTOMOBILE for Feb. 24, it was stated otherwise but this was an error.

New Company Will Cast Car Bodies

Officials of Aluminum Castings Co. Form $100,000 Co. for Body Specialization

DETROIT, MICH., March 8—The Castaluminum Body Co. has been incorporated here with a capital stock of $100,000 to build aluminum automobile bodies. Those interested in the new concern are Charles B. Bohn, Michigan manager of the Aluminum Castings Co.; Robert F. Dyer, assistant sales manager of that company, and Wm. A. Watts, sales manager of the Pantasote Co., Windsor, Ont. As its name implies, the new concern will manufacture automobile bodies constructed of cast aluminum, though the exact plans of the new organization are withheld for the present.

It will be remembered that the Pierce Co. has used cast bodies for many years and that Cadillac has just commenced to do so for closed cars.

Pierce Plant Closed

BUFFALO, N. Y., March 4—The whole plant of the Pierce-Arrow Motor Car Co. has been closed down, owing to the strike of the machinists. This throws about 6000 men out of employment temporarily. Officials of the Pierce company state that they preferred to close the whole plant rather than to endeavor to run with the machine shop closed to the unavoidable disorganization of the factory system.

Santa Monica Gets Grand Prix and Vanderbilt

SANTA MONICA, CAL., March 8—The Grand Prix and Vanderbilt Cup races will be held on the Santa Monica course this year. The struggle for the honor of promoting the two classics has been very keen. The decision of the Motor Cups Holdings Assn., which controls both the Grand Prix and Vanderbilt cups, not to allow these for competition on speedways, paved the way for road racing associations to make a bid for the classics.

Omaha Man Sues Automobile Manufacturer

OMAHA, NEB., March 6—If the $100,000 damage suit brought for personal injuries by William Adair of North Platte, Neb., against an automobile manufacturer is won by the plaintiff, many similar suits against automobile manufacturers the country over are likely to follow. The outcome of the suit, which was brought in the district court of Pottawatomie county, Iowa, a few days ago, hinges upon the jury's decision as to the liability of a manufacturer for an accident in which its car is involved after the car has been sold to a private individual.

The petition sets forth that George Coffee of North Platte, Neb., bought a six-cylinder automobile on May 29, 1914, and that on June 10, 1914, Coffee was taking Adair from North Platte to Cheyenne, Wyo., in this car. One of the wheels broke, and the car turned over upon Adair. He sustained a fractured hip and internal injuries.

The grounds for the suit are that the manufacturing company was negligent in putting a car with defective wheels on the market. The petition sets forth that the spokes were brittle, notwithstanding the fact that the company had advertised that the woodwork was constructed of the best material on the market, and that the car was a perfectly safe vehicle for the transportation of persons on a public highway while running at a speed of 30 to 40 m.p.h.

G. M. Davis with Stewart Motor Corp.

DETROIT, March 1—George M. Davis who was manager of the Internal Gear Drive Association which he organized last year, has joined the organization of the Stewart Motor Corp., Buffalo, in the capacity of sales and advertising manager. Mr. Davis is an old timer in the automobile industry, having been advertising manager years ago of the old E. R. Thomas Motor Car Co., also assistant sales manager and advertising manager of the Pierce-Arrow Motor Car Co., both in Buffalo.

Champion Increases Output to 100,000 Spark Plugs Daily

TOLEDO, OHIO, March 2—The Champion Spark Plug Co., this city, will increase its output from 45,000 to 100,000 spark plugs per day as soon as a new six-story addition to its present quarters is finished. Work will be started on this new building during this month. And to further add to the present production, the company will build another story to its present four-story addition which was built some two years ago. When these additions are completed, it will have 60,000 more square feet of space.

San Diego Race March 5

SAN DIEGO, CAL., March 2—A 50-mile automobile race is scheduled for March 25 at the Fair Grounds in this city. The race will be under the direction of the Panama-California International Exposition. Entries have already been received from half a dozen drivers. The entrants will compete for a $2,500 cup offered by the Exposition and money prizes. The race will be run over a mile track inside the Exposition grounds.

War Truck Orders Near Finish

England Now Fully Supplied —Exports Trucks to Russia —France Fully Equipped

LONDON, ENGLAND, Feb. 18—There is every reason to believe that England now possesses such a supply of automobile trucks that no more orders will be placed in America. Absolute confirmation of this is unobtainable, for only the military authorities are in possession of the full facts, and they refuse to make any statement or to give any indication as to conditions. It is no secret, however, that there is a slackening off in the production of ordinary trucks for military purposes, and that deliveries can be made, under certain restrictions to private concerns. More frequently, however, when the English factories are told to diminish their output of army trucks they are given other military work, instead of being allowed to meet private orders.

A very significant fact, which tends to confirm the statement of England's sufficiency in the matter of trucks, is the recent sale of a number of American trucks to Russia. This sale comprises 500 trucks of the make which has given the greatest satisfaction, originally bought for service in the British army, but since transferred to Russia.

A similar tendency is observable in France, where there appears to be a sufficiency of trucks for all immediate requirements, even supposing, as is quite probable, that hard fighting with frequent movements takes place during the next few months. For some time past only spares have been coming in for the five best known American trucks used by the French, and although Velie has recently received a big order, there is every indication that France has now got as many supplies from America as she needs for some time to come.

Roto Light Delivery Truck at $695

HANNIBAL, MO., March 7—The Roto Motor Co. has been incorporated here with a capital stock of $350,000 for the manufacture of light delivery trucks. The new company was organized by N. L. Le Blond, manager of the Hannibal Wagon Co., and he expects to start the manufacture of a ½-ton model within the next sixty days.

The Hannibal Wagon Co. will pass out of existence and its plant at Collier and South Eleventh Streets will be turned over to the new concern. L. E. Jerome of Chicago is heavily interested in the Roto company and will reside here. The president will be T. A. Legris of Kankakee, Ill., a member of the Legris Brothers' Banking Co. of that city, and J. E. McNally of this city will be the vice-president.

The plans are to build at least 1500 trucks the first year. It will have a wheelbase of 112 in., with a 31 by 4 tire, a 3½-in. bore overhead-valve engine of the factory's own design and will be sold for $695, equipped with electric starting and lighting system. The car will be assembled at the plant here. A trailer also will be placed on the market.

Automobiles and Trucks To Star in Military Tournament

NEW YORK CITY, March 7—Automobiles, motor trucks and armored cars will play an important part in the military and naval tournament scheduled to be held at Sheepshead Bay during the week beginning May 20 and ending May 27.

Prizes will be offered to both manufacturers and drivers of armored cars and motor trucks of various sizes and types in endurance trials and field tests. There will be 5000 militiamen camped at the speedway and their transportation and commissary arrangements will require a wide use of both passenger cars and motor trucks of all sorts. Moreover, there are to be parades, searchlight drills, night signalling, etc., all of which will bring the motor vehicle opportunity to prove its value for military purposes.

Over 100% Rebates to Exhibitors at National Shows

NEW YORK CITY, March 6—At the regular quarterly meeting of the members of the National Automobile Chamber of Commerce, Inc., held yesterday, the show committee reported that 120 per cent will be returned to the exhibitors at New York and 102 per cent to those taking space at Chicago. This excellent showing is entirely due to increased attendance, the public paying approximately 30 per cent more than last year for admission to the shows.

The traffic department report showed that carload shipments of automobiles during February were larger than on any month in the history of the industry.

The freight car shortage is causing considerable inconvenience to the manufacturers, while the increasing difficulty of obtaining cars has been responsible for numerous delays in delivery. Many manufacturers have been obliged to utilize flat cars, while it is becoming frequent for cars to be shipped with fenders removed, so that the narrow-door box cars can be used.

About seventy-five manufacturers were represented at the meeting. T. C. Leland, vice-president of the chamber, presided, as Col. Chas. Clifton is still in Florida.

Chevrolet Earns $1,653,686

Cash on Hand $5,377,079—Predict $6,000,000 Profits for 1916—Materials Scarce

New York City, March 7.—Earnings of $1,128,590 are reported by the Chevrolet Motor Co., for the 4½ months ended December 31, 1915, after deducting expenses. To this total was added $525,096 from other sources, making the aggregate revenue $1,653,686.

Cash on hand on Dec. 31 amounted to $4,192,968 and the statement issued yesterday showed that this has been increased to $5,377,079 by March 3, a gain of nearly 28 per cent in slightly more than 2 months.

W. C. Durant, president of the company, in his statement to the stockholders said: "While materials at the moment are difficult to obtain and prices are considerably higher in some instances the reduction in overhead expenses due to increased volume of product enables us to show a reduction in cost as compared to the 4½ months covered by the report.

"Due to abnormal conditions, as a matter of protection, we are carrying extremely large inventories, fortifying ourselves, to take care of contracts and orders representing a value in excess of $26,000,000 now upon our books for delivery within the next 5 months. The operating profits of the Chevrolet companies for the year ended Dec. 31, 1916, should approximate $6,000,000, to which will be added the income from other sources."

Detailed figures of the income account follow:

Net earnings from operations, after deducting cost of manufacture and expenses of advertising, selling, administration, taxes, etc.		$1,128,590
Other income:		
Cash discounts on goods purchased	$64,129	
Interest earned........	24,434	
Dividends received.....	2,742	
Profit-sale of securities	448,323	
Miscellaneous revenue..	15,857	
	$555,488	
Deduct:		
Expenses incidental to organization	30,392	
		525,096
Net income for period (4½ months)		$1,653.686

The Chevrolet company produced in the 4½-month period just 11,888 cars through its five plants in New York City, Tarrytown and Flint. The Oshawa, Ont., and St. Louis plants, which were recently started, have turned out comparatively few cars, their output not being included in the above figures. In February, President W. C. Durant announced that within the next six months the daily output of the company was to be doubled, at the rate of 230 cars a day and stepped up monthly until the plants are producing 460 daily in August.

C. M. Hall Lamp Co. Doubles Floor Space

Detroit, Mich., March 6—Additions were completed recently to the plant of the C. M. Hall Lamp Co., which provide about 15,000 sq. ft. of additional floor space for manufacturing purpose. The company has also increased its capital stock from $150,000 to $300,000 a few days ago. At present about 230 men are on the pay roll. They work 14 hours a day during four days. Wednesday and Saturday no overtime is scheduled.

During January and February the increase in business was between 65 and 70 per cent, as compared with the first two months of 1915. Orders now on hand are sufficient to keep the plant in full operation till 1917. This may also be said about the needed materials on hand, which is even sufficient for a large per centage of the 1917 output. The company has large contract orders with the Packard, Hudson, Studebaker, and other automobile manufacturing concerns. Their value is in excess of $1,000,000 of gross business.

The capital stock of the company has been placed on a 2½ per cent monthly dividend basis. Previous to the increase of the capital, the stock had been for some time on a 30 per cent yearly basis.

United Garage Assn. Appoints Officers

Albany, N. Y., March 2—William M. Haradon, New York, was re-elected president of the United Garage Associations of New York, Inc., at the annual meeting and convention held here yesterday and to-day. All other officers also were re-elected, these including vice-president John Van Benschoten, Poughkeepsie and treasurer Edward W. Leahy, Albany. George F. Kaiser was appointed secretary for a term of three years. Among other things, the meeting adopted resolutions deprecating the action of the gasoline refiners in permitting a chaotic condition with regard to prices; approved the passage of a lien law similar to that now in force in New Jersey; approved the introduction and passage of a Fraud on Garage Keepers measure; changed the date of the annual meeting from the first Wednesday in March to the first Wednesday in January, during the New York show; changed the place of the annual meeting from Albany to New York City; revised the By-Laws. The meeting made plain that the association soon will take an active interest and a prominent place in the affairs of the retail trade in New York State. Secretary Robert A. Wilson of the National Automobile Trade Association was present and explained the scope and objects of that body.

Tractors Worth $300,000 Shipped to Russia

Baldwin Locomotive Works Sends Special Train Across Continent to Seattle

York, Pa., March 3—One of the largest shipments of motor tractors to Russia, on the large contract being filled by the Morton Truck and Tractor Company of Harrisburg, was sent this week to Seattle, Wash., for export shipment. The total value of the shipment is $300,000. A solid train of sixty cars, each car loaded with a truck, was used for transporting the large war order.

The tractors were built at the plant of the Baldwin Locomotive Works, Philadelphia, on a sub-contract, and two weeks ago were shipped from the Quaker City to New York. Owing to the freight blockade at the New York terminal the cars were tied up in freight yards in the metropolis. Upon receipt of notice to rush the shipment as rapidly as possible and in view of the fact that railroad officials are unable to say how soon the blockade in the East will be lifted, the Harrisburg company believed that considerable time could be saved in shipping West, notwithstanding that the route to Russia *via* Seattle is 5000 miles further.

The Pennsylvania railroad handled the special train as preference freight with instructions to permit no delays at division terminals. Each truck is packed in a large box which takes up all the room on a gondola, 60 ft. long. Assurance was given by the railroad company officials that a boat would be ready at Seattle to take the shipment.

Chicago's Amateur Speedway Race May 20

Chicago, Ill., March 8—Entry blanks have been sent out by the Speedway Park Assn., this city, for the Western Interclub, non-professional automobile race at Speedway Park, on May 20. The race is for Class E, non-stock cars with a special invitation for fully equipped roadsters. The event is under the auspices of the Chicago Automobile Club and other leading clubs of the West.

The Western Interclub Cup has been offered and will become the permanent property of the driver winning the event three times. A gold brassard will be given the winner of each heat held on the speedway.

The contest will consist of four heats, three preliminary heats, and one final. The preliminary heats will be 20 miles or ten laps of the course, and the final will be 30 miles or fifteen laps of the course.

Maibohm Roadster Announced

New Car Is Product of Maibohm Motors, Racine—Four Cylinder Model $595

RACINE, WIS., March 6—The Maibohm roadster has been introduced and is to sell at $595. This car is of the light car type with low-hung and distinctive lines. This car is the product of the Maibohm Motors Co., Racine, Wis., recently formed and headed by H. C. Maibohm, formerly connected with the Locomobile Co. of America and until recently president of the Motor Supplies Co. Associated with him are P. C. Maibohm, former president of the Maibohm Wagon Co., and J. R. Foster, former president of the Foster-Lockwood Oil Co.

Temporary manufacturing facilities have been secured in Racine and negotiations are now pending for a permanent factory site. The company will produce 2000 cars during the first year, two-thirds of which are said to be already sold to dealers. Particular attention has been paid to the comfort of passengers, the seats being unusually low and on an almost direct horizontal line with the pedals which are adjustable to any desired leg room. The steering post is also adjustable to the requirements of the operator.

Four Cylinder 3 by 5

The four-cylinder, valve in head motor is provided with three-point suspension and is rated at 14.4 hp., having 3 by 5-in. cylinders. It has a detachable cylinder head.

Lubrication is by constant level splash under the connecting-rods and pump to the three main bearings. Cooling is thermo-syphon with extra large inlet and outlet manifolds cast integrally with cylinder block. Ignition is Atwater-Kent with automatic spark advance, current being supplied by a 6-volt 100-hr. battery located under the seat in a steel hanger. Starting and lighting is by an inclosed silent chain drive single-unit system which is attached to front gear case. Fuel is gravity supplied by a 10-gal. gasoline tank located in the dash cowl.

The frame is a pressed steel channel section 3 by ⅛-in., curved over the rear axle to permit underslung semi-elliptic rear spring construction. The wheelbase is 105-in. and size of tires is 30 by 3½. Wood or wire wheels are supplied at the option of the purchaser. Throughout the chassis, with exception of motor, Hyatt and Timken bearings are used.

The gearset is compact in form and with the dry-disk clutch is supported to the rear of the motor. Three speeds are used and center control levers are conveniently placed. The Hotchkiss system of propulsion is used and the master leaf of each rear spring has been strengthened by the use of a special heat-treated steel.

Both front and rear springs are of the semi-elliptic type, 2 in. wide and almost flat. The rear unit is built along standard lines with a pressed steel housing that carries the weight of the car and relieves the driveshaft from any duty except propulsion of the car. Equipment features include electric starting and lighting, a flush type speedometer and lock switch, electric horn, rear tire carrier, one-man top, tools, etc.

Lane Heads Truck Co.

KALAMAZOO, MICH., March 2—M. H. Lane has been elected president and general manager of the recently organized Lane Motor Truck Co. G. E. Bardeen, Jr., is secretary-treasurer. The first model is expected to be out about March 15. It will be of the worm-drive type.

Speeds Up Gasoline Price Investigation

WASHINGTON, D. C., March 6—At the request of several members of Congress the Federal Trade Commission is preparing to speed up the investigation of the increase in the cost of gasoline. Joseph E. Davies, chairman of the commission, has appointed Lewis E. Haney of Austin, Texas, chief counsel in charge of the investigation. Haney will be aided by a corps of experts, and everything possible will be done to hurry the inquiry.

Report Due Soon

All complaints to the Department of Justice regarding the rise in price of gasoline have been referred to the Federal Trade Commission. It was announced some time ago by Commissioner William J. Harris, who has been in active charge of the inquiry, that about three months would be required to complete a report. This has prompted the California Congressional delegation and other Congressmen to threaten a Congressional investigation if the commission did not give assurances that a report would be made within a few weeks.

Overland Reaches 100,000 Mark

TOLEDO, OHIO, March 2—The 100,000 mark was reached by the Willys-Overland company last Monday with shipments to date more than treble those reached a year ago. Overland dealers now number nearly 5000 in this country and Canada. Foreign dealers number about 500.

Industry Ranks Fifth in Exports

Well Up in List of Manufactured Articles—Gained 232% in 1915

NEW YORK CITY, March 6.—Automobiles and parts rank fifth in value among all manufactured articles exported from the United States, according to an analysis by the National Automobile Chamber of Commerce of the statistics contained in the December report of the Department of Commerce. The relative value of the leading manufactured articles exported during 1915 is:

Iron and steel	$338,703,720
Explosives	181,778,033
Refined mineral oils	138,689,495
Copper and manufactures	125,136,289
Automobiles and parts	111,180,139
Wheat flour	96,201,234
Cotton and manufactures	95,827,024
Other machinery	81,224,345
Chemicals, drugs, etc	80,395,321
Locomotives, vehicles, etc	78,015,574
Leather and manufactures	75,268,680

In one year the exports of motor vehicles increased more than 232 per cent—from a total value of $28,507,464 in 1914 to $94,879,738 in 1915. The foreign shipments of passenger cars almost doubled—from 22,335 valued at $19,521,708 in 1914 to 41,869 valued at $35,045,492 for the year ended December 31, last. But the exports of trucks increased nearly seven-fold, from 3,430 worth $8,985,756 to 22,082 valued at $59,834,246.

Truck Increase Large

Growth of the foreign trade in American motor trucks during the last two years is even more noteworthy, for in 1913 only 1,009 commercial vehicles were exported, of a gross value of $1,686,807, the increase in two years being 3447 per cent.

Hudson Adds 641,600 Sq. Ft. in Five Years

DETROIT, MICH., March 3—In five years, from 1910 to the end of 1915, the Hudson Motor Car Co. has added a total of 641,600 sq. ft. of floor space to its plant. In the original building there was a total of 172,282 sq. ft. of floor space. In 1912 new constructions added 72,422 sq. ft.; in 1913 there was an increase of 82,744 sq. ft. of floor space. The following year 53,370 sq. ft. were added and in 1914 the additions totaled 104,574 sq. ft. It was, however, last year when the biggest new area was added to the plant, the new buildings put up and the additions of floors to other buildings providing a total of 328,490 sq. ft. of new constructions, or more than half the total put up since 1910. The total area now occupied by the Hudson plant contains 813,882 sq. ft. of floor space.

Kerosene as Fuel for Automobiles

Colorado State Inspector Starts Campaign for Educating Automobile Users

DENVER, COL., March 4—A campaign to meet the condition of high-priced gasoline by substituting kerosene for use in combustion engines has been started by Colorado State Oil Inspector James Duce, assisted by Prof. John A. Hunter, professor of mechanical engineering in the University of Colorado. After extensive experiments, their first public step toward educating motor car owners and other users of gasoline engines was made yesterday in the way of a meeting at the State house for a general discussion of the fuel problem and the technical points involved in using kerosene. The meeting was attended by representatives of the Automobile Trades Association of Colorado and the Denver Motor Club, by tractor, and oil men and a goodly number of individual motor car and tractor users.

Kerosene Gives More Power

It was shown that tractor motors built originally for kerosene usage develop as much power from a gallon of kerosene costing 12 cents as can be produced by a gasoline tractor from a gallon of gasoline costing 23 cents, while slight mechanical changes will enable a regular gasoline motor for motor cars to develop equal power from about one-fourth more kerosene than gasoline, making the cost ratio for practically the same power in motor cars 16 cents for kerosene as against the present Denver price of 23 cents for gasoline. It was urged that the added difficulty of handling kerosene motors could easily be overcome by careful study of required methods of handling, aided by rapidly advancing engineering improvements, and that the question of more unpleasant odor from kerosene could be largely disposed of by practical education against established prejudice along this line.

Inspector Duce's records show that Colorado consumed about 15,000,000 gal. of gasoline during 1915, a gain of 45 per cent over the previous year. He argues that the most practical way to check the alarming advance in the price of gasoline is to substitute kerosene, which has become a by-product of the oil refineries, particularly those operated by independent concerns.

The present gasoline price of 23 cents, which is the highest on record for Denver in fifteen years or more, has been reached by a rapid series of one-cent jumps during the last ten months from 12 cents, which was the lowest price ever recorded here in twenty years.

Professor Hunter and other engineers at the State university at Boulder, where gasoline is now 28 cents, are experimenting along all lines of mechanical developments required to insure the success of using kerosene as a motor fuel, and declare themselves ready to furnish practical information and suggestions to all inquirers as an aid to Inspector Duce's Statewide campaign for kerosene tractoring and motoring.

Fisk Shows Good Profit Increase

CHICOPEE FALLS, MASS., March 4—The annual report of the Fisk Rubber Co. for the year ended Dec. 31, 1915, shows net profits of $1,791,579 as compared with $942,204 in 1914. The report states that, in accordance with the first preferred stock provision, there were retired Dec. 31, 1915, out of profits of the company 3750 shares of the first preferred stock, which, with the first preferred stock previously retired, represent the par value of $600,000.

The company reports the following income statement for the year ended Dec. 31, 1915:

	1915	1914
Net profits	$1,791,579	$942,204
Reserve for inventories	145,160	160,000
Balance for dividends	$1,646,579	$782,204
First preferred dividend	219,042	210,000
Second preferred dividend	140,000	140,000
Total dividends	$359,042	$350,000
Surplus	$1,287,537	$432,204
Previous surplus	619,267	187,063
Total surplus	$1,906,804	$619,267
Deductions	660,410	....
	$1,246,394	$619,267

The balance sheet as of Dec. 31, last, follows:

Assets	1915	1914
Capital assets	$12,428,564	$12,461,364
Inventories	4,531,377	2,622,721
Tires in use	40,066	49,899
Due on notes	128,955	175,482
Notes and accounts receivable	1,330,208	2,131,577
Cash	991,909	362,644
Deferred charges	127,273	84,609
Total assets	$19,578,352	$15,888,296
Liabilities		
Capital stock	$14,775,000	$13,000,000
Notes payable	2,200,000	1,745,000
Accounts payable	577,650	228,525
Dividend not paid	807	37
Reserve for contingencies	178,502	207,967
Surplus appropriation for retirement of preferred stock	600,000	....
Profit and loss surplus	1,246,394	619,267
Total liabilities	$19,578,352	$15,888,296

Maise with Springfield Metal Body

DETROIT, MICH., March 4—Herman Maise who was formerly with the Fisher Body Co., here, and with the W. F. Stewart Co., Flint, Mich., both body makers, has recently joined the Springfield Metal Body Co., Springfield, Mass., in the capacity of chief engineer.

Reo Expects General Price Rise

Cost of Materials and Tools Must Affect Selling Price Says R. C. Rueschaw

LANSING, MICH., March 4—The new and higher prices rather than the new models will be the feature of the 1917 announcements of the automobile manufacturers, according to sales manager R. C. Rueschaw of the Reo Motor Car Co.

Mr. Rueschaw has made an investigation of the general conditions prevailing among those concerns which supply raw material, other products and also machinery necessary to the automobile manufacturer. From the data gathered by George E. Smith, who is manager of the purchasing department of the Reo company, it seems, according to Mr. Rueschaw, that there is no other possibility for the motor car manufacturer than to increase his prices for next season. Not only are prices of materials at the present time without a parallel in the history of the automobile industry, but, there is no hope for a betterment of this condition.

Freight Car Is Big Trouble

Aside from the question of prices of materials, Mr. Rueschaw believes that the shortage of railroad freight cars is another reason for prices to be increased, because it will compel some factories to slow down and thus will cause an extension of the date on which the present factory run, that is the 1916 output, is to be completed. This means that instead of completing the schedule by July 1, it will probably be some time during autumn before it is completed. This unanticipated and unremediable course will thus very likely affect the price of the cars of those manufacturers.

"The present market situation was foreseen by us," said Mr. Rueschaw, and we started early to fill our warehouses so that at the present time we have not only practically everything we need up to the close of our fiscal year, but, we are also comfortably covered for most anything we will need for a year beyond that. Such action on our part was and is necessary considering the time required, or rather requested, for delivering goods ordered. For instance, orders for bar steels placed in December, 1915, will not be delivered until January, 1917. Ordinarily cold rolled bars cannot be secured in less than six months. We are able to buy odd lots of bar steel and forging steel in small quantities but at twice or three times the normal price.

"High speed steels have increased in price from 45 cents per pound to $3.

Sizes of Truck Motors and Outline of British Practice

(*Continued from page* 446)

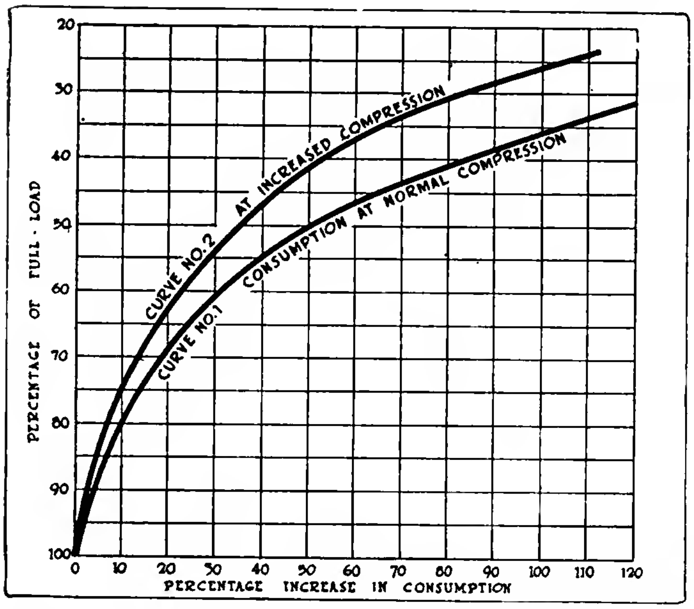

Fig. 4—Chart showing effect—with governed engine—of light loads upon consumption

and the equation becomes:

$$87 \times \frac{1000}{6} \times V = W \times \frac{3995 \times 11.5 \times 1760 \times 3}{30 \times 60}$$

or $V = W \times \dfrac{3995 \times 11.5 \times 1760 \times 3 \times 6}{30 \times 60 \times 1000 \times 87}$

$V = 9.3\ W$ approximately.

$Q = 9.3$.

The curve showing the relation of torque to road resistance is Curve 2 in Fig. 2, and the gradients the vehicle is capable of climbing on top gear at various speeds are shown in Curve 2, Fig. 3.

Gasoline Consumption

Having found the engine size for the gradient desired, the cost of this climbing power in gasoline consumption should be examined. Taking the original engine with "Q" = 5.5, and assuming the vehicle is on the level with a total resistance of 71.5 lb. per ton and a consumption of 0.58 pints per b.h.p. per hour, then for 0.58 pints

the work done =

$$33{,}000 \times 60 = 1{,}980{,}000 \text{ ft.-lb.},$$

and for 1 gal. the work done =

$$1{,}980{,}000 \times 13.8 = 27{,}324{,}000 \text{ ft.-lb.}$$

One ton of gross weight absorbs, per mile, on the level:

$$71.5 \times 1760 \times 3 = 377{,}000 \text{ ft.-lb.}$$

The consumption would therefore be

$$\frac{27{,}324{,}000}{377{,}000} = 72.5 \text{ ton-miles per gallon.}$$

In the case of the engine with "Q" = 9.3 it is capable of giving out at full load a torque to overcome a road resistance at 15 m.p.h. of 121 lb. per ton, but is only using 71.5 lb. per ton or about 59 per cent.

Reference to Curve 1, Fig. 4, shows that this means an increase in consumption of 33 per cent. The consumption per b.hp. per hour rises to 0.77 pints, and the ton-miles per gallon falls to 54.5. Probably 75 or 80 per cent of the distance traveled is on level, or almost level, roads, and this increase in consumption serves to show the cost of the reserve power considered necessary for hill climbing. As far as current practice is concerned, this would be looked upon as quite a reasonable result.

Curve 2 on Fig. 4 shows the improvement that can be obtained at decreased loads by increased compression. This curve was taken from the same engine as Curve 1. The increased compression made the engine very prone to knock at low speeds with full throttle opening. This knocking commenced at about 700 r.p.m., or, in other words, at about the speed at which a change of gear should be made to keep the engine within its range of minimum consumption.

Average Loads Versus Full Loads

It would appear than engine builders do not give sufficient attention to the fact that the normal condition of working is at about 60 per cent of full load.

Consumption curves are usually taken under full load, and the carbureter adjusted to give the best result under these conditions. Probably better consumption on the road would be obtained if the carbureter were set to meet these conditions of light load at which the engine is running for the greater portion of its time. Even though this lead to slightly decreased maximum torque and a slightly increased consumption at full load, the net result would be a decided gain.

Engine Sizes for Various Vehicles

Taking "Q" = 9.3 for 1300 r.p.m. and 15 m.p.h., Table A gives the engine sizes for various vehicles.

Table A (Q = 9.3)

Gross Weight of Vehicle		Cylinder capacity, cubic inches	Bore and stroke of engines, in inches, with approximately 1.3 ratio
4½	tons	41.85	3½ × 4½
5	"	46.5	3⅝ × 4¾
6	"	55.8	3 13/16 × 5
7	"	65.1	4 × 5¼
8	"	74.4	4 3/16 × 5½
*9	"	56.25	3 13/16 × 5
*10	"	62.5	3 15/16 × 5¼

---

*Twelve miles per hour.

Note.—For 9 and 10 tons gross weight the table is corrected for road speed and resistance, and "Q" therefore becomes 6.25 for these cases.

Current Practice in Engine Sizes

An examination of the engines in a number of successful types of commercial vehicles shows that the average ratio of engine speed to road speed is 1000 r.p.m. for 15 m.p.h., and that "Q" has a value of 12.5.

This agrees quite well with the 9.4 obtained for 1300 r.p.m. if the necessary correction be made for engine speed, as we have

$$\frac{12.5 \times 1000}{1300} = 9.64.$$

Stroke Bore Ratio

There does not appear to be any tendency to fix a definite ratio of stroke to bore. Examination of a large number of

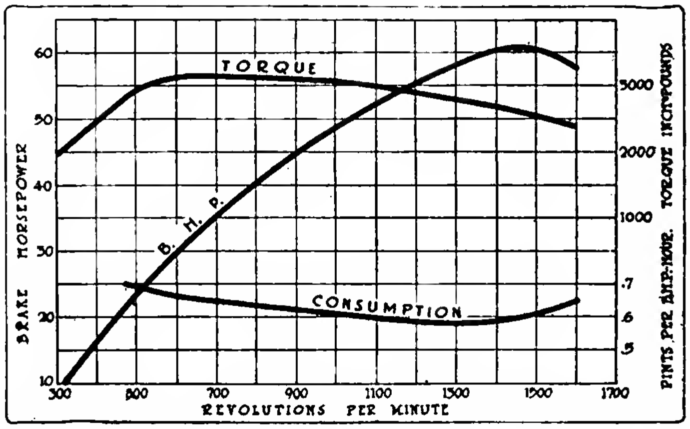

Fig. 5—Curves showing torque and consumption curves as taken from Tyler motor

motors showed an average of 1.3, but this figure would appear to be of little value since no maker appears to have two motors of different sizes with the same ratio. Curiously enough more than 50 per cent of the engines examined had strokes of 5½ in., and the tendency appears to be to have a range of engines to suit the various sizes of vehicles all having the same stroke. No doubt this arrangement materially decreases the number of jigs and allows for interchangeability of a number of parts, so cutting down cost of production.

Taking "Q" at 12.5, and allowing 15 miles an hour at 1000 r.p.m. for vehicles up to and including four-tonners, and 12 m.p.h., with the necessary correction, for five and six-tonners, Tables B and C give the engine sizes.

Table B (Q = 12.5)

Gross weight of vehicle	Cylinder capacity, cubic in.	Engine size suggested, inches	Engine size with 1-3 ratio, inches	Engine size with constant stroke (5½ in.)
4½ tons	56.25	4 × 4½	3¹³⁄₁₆ × 5	3⅝ × 5½
5 "	62.5	4¼ × 4½	3¹⁵⁄₁₆ × 5⅛	3¹³⁄₁₆ × 5½
6 "	75.	4¼ × 5½	4³⁄₁₆ × 5½	4³⁄₁₆ × 5½
7 "	87.5	4½ × 5½	4⁷⁄₁₆ × 5¾	4½ × 5½
8 "	100.	4¾ × 5¾	4⅝ × 6	4¹³⁄₁₆ × 5½
*9 "	75.	4¼ × 5½	4³⁄₁₆ × 5½	4³⁄₁₆ × 5½
*10 "	83.3	4½ × 5½	4⅜ × 5⅝	4⁷⁄₁₆ × 5½

---

*Twelve miles per hour.

The following table relates to the approximate weights of actual vehicles, and is based on the same lines as Table B.

Table C (Q = 12.5)

Useful load	Gross weight	Cylinder capacity, cubic in.	Engine size 1.3 ratio	Engine size with 5½ in stroke
2 tons	5 tons	62.5	3¹⁵⁄₁₆ × 5⅛	3¹³⁄₁₆ × 5½
2½ "	5.672 "	71.	4⅛ × 5⅜	4¹⁄₁₆ × 5½
3 "	6.56 "	81.25	4⁵⁄₁₆ × 5⅝	4⅜ × 5½
3½ "	7.56 "	93.75	4½ × 5⅞	4¾ × 5½
4 "	8.28 "	103.125	4¹¹⁄₁₆ × 6	4⅞ × 5½
5 "	10. "	83.3	4⅜ × 5⅝	4⁷⁄₁₆ × 5½
6 "	11.25 "	93.75	4½ × 5⅞	4¾ × 5½

By grouping, three sizes of motors can be used for the seven vehicles in Table C, any small discrepancy being easily regulated by adjustments in gear ratio; the arrangement might be as follows:

Table D

Engine size:	4 in. × 5½ in.	4⅜ in. × 5½ in.	4¾ in. × 5½ in.
Useful load of vehicle:	2 and 2½-ton vehicles	3-ton and 5-ton* vehicles	Subsidy type 4 and 6-ton

---

*Twelve miles per hour.

Heavy Passenger Vehicles

For motor char-a-bancs, which are expected to have greater climbing ability on top gear, the gradient may be taken as 1 in 24, to be climbed at 12 m.p.h., with the engine running at 800 r.p.m.

$$\text{Then } 87 \times \text{Volume} \frac{800}{6} = W\left(60 + \frac{2240}{24}\right) \times 12 \times 88,$$

$$\text{or} \quad 87 \times \text{Volume} \times \frac{800}{6} = \frac{1440\ W + 2240\ W}{24} \times 12 \times 88,$$

$$= \frac{3680}{24} W \times 12 \times 88,$$

$$\text{and Volume} = W \frac{3680}{24} \times \frac{12 \times 88 \times 6}{800 \times 87} = W \frac{6072}{435}$$

Or Volume = 14 W approximately.

Taking as an example a 30-seated vehicle weighing, when loaded, 6 tons, we get:

Gross weight.	Cylinder volume	Cylinder size.
6 tons..........	84 cu. in.....	4⁷⁄₁₆ in. × 5½ in.

In the last named case one of the three standard sizes suggested might be used, namely, 4⅜ in. by 5½ in. with suitable gear correction.

The curve in Fig. 6 shows current American practice, and is based on the average of 160 vehicles.

Part 2—Outline of British Truck Motor Design

Design features in British commercial vehicles which are more or less affected by the nature of the vehicle service, are referred to in the following:

Compression Pressure

An examination of a number of engines shows the average ratio of total volume to swept volume to be 4.4, and if the compression is calculated on $PV^{1.3}$ = Constant, with 13 lb. initial pressure, this shows a gage pressure on compression of about 75 lb., and an explosive pressure which, under ordinary conditions of cylinder shape and cooling, might be taken at 280 lb. per square inch.

Connecting-Rod Bearings

Coming to the bearing surface usually allowed for the big end of the connecting-rod, the practice of manufacturers shows an average of 765 lb. per square inch on the projected area. The highest pressure observed is about 950 and the lowest about 620 lb. per square inch. Neglecting the pressure and taking into account only the respective areas of cylinder and bearing, an average of 1 sq. in. of big end area for 2.73 sq. in. of piston area is obtained. In the limits of the engines under consideration, say from 3½ in. bore to 5 in. bore, the average diameter of the crankpin in use corresponds very closely with 0.4 bore + ¼ in.

Gudgeon pin pressure may be taken at 2100 lb. per square inch,

or the area of the pin is given by $\frac{D^2}{9.6}$ in square inches, D being the diameter of the cylinder.

Gudgeon pin diameters show a close approximation to big end diameter — 1 1/32 in. for the sizes of engines under consideration.

In commercial vehicle engine design, the three-bearing crankshaft is usually used, and there would appear to be no particular reason for fitting five bearings. At the same time there are two or three very successful engines having five-bearing crankshafts, and one at least with only two main bearings.

(To Be Continued)

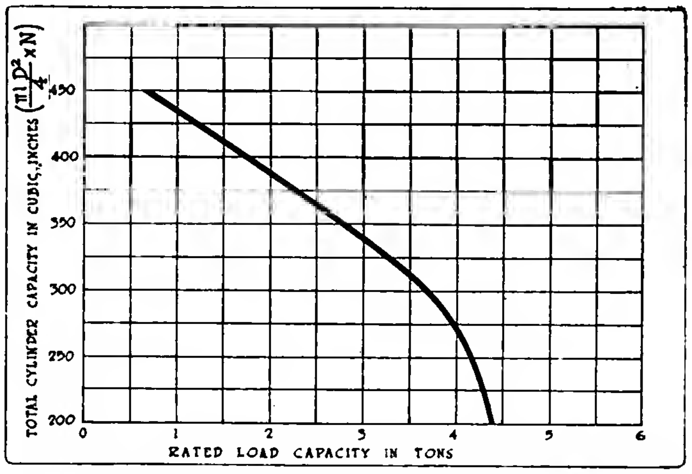

Fig. 6—Chart showing relation between total Cylinder capacity and useful load in American commercial vehicles

South's Profits $10,000,000,000—Sales Gain

(*Continued from page* 462)

of July that year. The avenues of trade shrank until they became mere alleys and in some cases ceased to exist. Then followed another twelvemonth in which business grew somewhat, and while the latter half of 1915 was far better for lumbermen than they had anticipated, the gain was not sufficient to put production back on the basis from which it was routed at the beginning of hostilities abroad. In support of this statement, note the table given herewith, showing the production of lumber in board feet in 1914 and 1915 from the several States south of the Ohio River and east of the Mississippi:

Production of Lumber—Board Feet

State	1915	1914
Arkansas	992,292,000	1,022,874,000
Texas	1,226,129,000	1,231,166,000
Louisiana	2,999,430,000	3,102,055,000
Mississippi ...	1,196,444,000	1,279,181,000
Alabama	596,550,000	662,638,000
Georgia	235,554,000	275,190,000
Florida	646,892,000	620,769,000
South Carolina	370,180,000	311,960,000
North Carolina	625,492,000	628,340,000
Virginia	259,772,000	231,800,000
West Virginia.	530,119,000	572,320,000
Kentucky	100,479,000	112,819,000
Tennessee	159,868,000	211,496,000
Total	9,939,201,000	10,262,608,000

Business done so far in 1916 is far ahead of that of the preceding year, and it appears that the predictions of the lumbermen of the South are to be realized. The South has bought many cars in the last year, and with a healthy tone of optimism to the so-called barometer of trade, it augers very well for the sale of cars during 1916.

$100,000,000 for Lumber

Granting that $10 per 1000 ft. is an average price of lumber at the mills, the foregoing figures show that approximately $100,000,000 came into these States during both of these years. Perhaps $10 a thousand is too low a figure; we know it is if we are to take the price we have to pay for it out of the city and country yards where lumber is not produced. It costs us about twice or three times that amount.

Lumber and lumber products should bring into the coffers of the South from $100,000,000 to $200,000,000 during 1916. The percentage of this that is turned over to automobile dealers will be governed very much by their aggressiveness. The lumber branch of revenue production is but one factor that contributes to the prosperity of the South, so it seems a safe wager that this year will see more cars sold south of the Ohio than in any preceding year, especially with the good roads agitation and the touring sections being exploited now as never before.

Railroads are buying timber for making cars, and much of this material comes from the South. Long-leaf yellow pine is specified in a great many cases and the railroads are preparing for a new era of prosperity in general. When the railroads begin to add to their equipment, especially the complement of freight cars, it means that they are practically sure that there will be need for them. Every railroad leading into Chicago has contracted with car makers or for material for the construction of additions to its rolling stock, especially freight cars. This will redound to the benefit of the South in two ways—it will create a good demand for material, good demand stimulating prices, and it will bring additional money to the South with which to purchase the necessities and the luxuries.

Iron and Steel Industry in South

THE South makes important contributions to the great iron and steel industry, especially Alabama, Georgia, Kentucky and Tennessee, Louisiana and Texas also deserving some mention in this particular. There are seventy-six blast furnaces in the six States, of which forty-nine were in operation a year ago, their combined output of pig iron being 2,280,070 tons, as compared with a capacity of 4,885,400 tons for the year. There are fifteen steel works, of which twelve were active a year ago, their total output for the year showing 737,037 tons of steel ingots and castings, the total annual capacity being 1,443,225 tons. Of twenty rolling mills, seventeen were working a year ago, their production for the previous year totaling 626,305 tons of rolled iron and steel products for the six States. The 5,328,911 tons of iron ore produced in this district during the same year, combined with the 44,809,714 tons of coal and 3,816,752 tons of coke, serve to give an idea of the magnitude of these industries in this region.

Alabama Leads in Steel

As shown in the accompanying tabulation, Alabama is the leader, having forty-eight blast furnaces, of which thirty were in operation a year ago, producing 1,826,929 tons of a capacity of 3,660,000 tons of pig iron during the year. Out of

Statistics of the Iron and Steel Industry in Six Southern States at the end of 1914*

State	Number Blast Furnaces	Number Active Furnaces	(Pig Iron) Capacity of Furnaces, Tons	Tons Pig Iron 1914 Output	Number Steel Works	Number Active Works	Capacity of Works, Tons	Steel Ingots and Castings, Output, Tons	Rolling Mills	Active Mills	1914 Tons Output Rolled Products	Production Iron Ore, Tons	1914 Prod. Coal, Tons	1914 Prod. Coke, Tons
Alabama.....	48	30	3,660,000	1,826,929	5	3	995,000	572,073	9	7	413,654	4,838,959	15,993,422	3,084,149
Georgia......	4	0	129,500	0	1	1	60,000		2	2	61,229 including Tenn. and Texas	67,772	166,498 including N. C.	24,517
Kentucky....	6	5	314,250	236,393	2	2	380,000	164,009 including Tennessee	7	6	151,422 including N. C.	91,966 including W. Va., Md. and N. C.	20,382,763	443,959
Louisiana....	0	0	0	0	2	2	1,850	955 including Texas	0	0	0	0	0	0
Tennessee....	18	14	781,650	216,738	3	2	6,000	See Kentucky	1	1	See Georgia	330,214	5,943,258	264,127
Texas.......	0	0	0	0	2	2	375	See Louisiana	1	1	See Georgia	0	2,323,773	0
Total......	76	49	4,885,400	2,280,070	15	12	1,443,225	737,037	20	17	626,305	5,328,911	44,809,714	3,816,752

*From the Annual Statistical Report of the American Irou and Steel Institute.

five steel works in the State, three were active last year, producing, in conjunction with the one in Georgia, 572,073 tons of steel ingots and castings, out of a capacity of 1,055,000 tons. With seven out of nine rolling mills active, Alabama produced 413,654 tons of rolled iron and steel. It is significant that of the total of 5,328,911 tons of iron ore produced during the year, this State was responsible for 4,838,959, while its coal production was 15,993,422 tons and its output of coke, 3,084,149.

Kentucky and Tennessee are well represented in the production statistics of the iron and steel industry. Kentucky has six blast furnaces, five being in operation a year ago, producing 236,393 tons of pig, as compared with a total annual capacity of 314,250 tons. Two steel works in each of the two States show an output of 164,009 tons of steel ingots and castings, their total capacity being 380,000 tons. Six of the seven rolling mills in Kentucky were active a year ago, their output, combined with that of North Carolina's mills, totaling 151,422 tons. The coal industry of Kentucky is larger than in any of the other five States mentioned, producing 20,382,763 tons annually, the output of all six being 44,809,714. The iron ore production of Kentucky, combined with that of West Virginia, Maryland and North Carolina, was 91,966 tons during 1914, while the coke output for Kentucky alone was 443,959 tons.

Tennessee had fourteen of eighteen blast furnaces working at the beginning of 1915, the production for the previous twelve months being 216,738 tons of pig, compared with an annual capacity of 781,650 tons. Tennessee's production of iron ore for the year was 330,214 tons, while 264,127 tons of coke and the 5,943,258 tons of coal give an inkling of the magnitude of other branches of the iron and steel trade in this State.

Georgia a Steel Producer

Georgia has four blast furnaces with an annual capacity of 129,500 tons of pig iron, although none were in operation at the end of 1914. Its steel works, however, produced a good share of the total of 572,073 tons of steel ingots and castings given for Alabama and Georgia. Its capacity is 60,000 tons a year. Georgia's two rolling mills, combined with one each in Tennessee and Texas, produce 61,229 tons of rolled iron and steel for the year. Iron ore to the extent of 67,772 tons, with 24,517 tons of coke and the 166,498 tons of coal mined in Georgia and North Carolina were other products for 1914.

Louisiana and Texas do not contribute quite as largely as the other States mentioned to the iron and steel industry of the country, but their steel works, rolling mills and the 2,323,773 tons of coal produced by Texas are worthy of attention. These States have two steel works each, their combined capacity being 2225 tons of steel ingots and castings, of which 955 tons were produced in 1914. Texas also has one rolling mill, its output being included in the 61,229 tons of rolled products credited to the three States, Georgia, Tennessee and Texas.

Car Registrations Gain Steadily

THOUGH the increase in car registration in the States of Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi and Tennessee has not been phenomenal, it has been steady and fairly consistent. It is only recently that several of the group have kept records of their automobile and motor truck registration, so that some of the statistics for previous years are necessarily estimates.

At the end of 1915 there were 120,126 cars and trucks in use in the States mentioned, this being a gain of 40,727, or 51 per cent over the 1914 total of 79,399. It must be pointed out that this apparent increase is somewhat misleading as the 1914 statistics for Louisiana and Mississippi were estimates made in the absence of official records and proved to be very low as compared with the 1915 figures. Probably the actual gain is nearer the average increase for the entire country, which is 39.6 per cent, including all the States.

1915 INCREASE IN REGISTRATIONS IN SEVEN STATES

State	Registration in 1914	Registration in 1915	Car Increase	Per Cent Increase
Alabama	8,425	13,798	5,373	64
Florida	11,366	13,123	1,757	15
Georgia	20,800	24,059	3,259	16
Kentucky	11,746	19,500	7,754	66
Louisiana*	3,500	10,880	7,380	210
Mississippi*	3,894	11,500	7,606	195
Tennessee	19,668	27,266	7,598	39
Total	79,399	120,123	40,727	....
Average per cent increase	....	....	....	51
Average for U.S.	....	....	....	39.6

*1914 registration statistics in Louisiana and Mississippi were estimates made in the absence of official records and proved to be low as compared with the 1915 figures so that the apparent gain is in excess of the actual increase.

POPULATION AND CAR REGISTRATION

State	Pop. to Jan. 1, 1916	Cars Reg.	Pop. per Car
Alabama	2,316,943	13,798	168
Florida	882,148	13,123	67
Georgia	2,836,177	24,059	117
Kentucky	2,372,412	19,500	121
Louisiana	1,815,218	10,880	167
Mississippi	1,939,226	11,500	168
Tennessee	2,279,691	27,266	84
Total	14,441,815	120,126	....
Average population per car	......	....	120

Average population per car for the entire United States is 42.

Many People Per Car

Something that cannot be misinterpreted, however, is the striking difference between the population-to-car ratio of the entire country, 42 to 1, and that of the seven States mentioned, 120 to 1. Of course, this is largely due to the preponderance of the impecunious negro element in the population of these States, but even allowing for this, there would seem to be a considerable margin of persons able to buy cars.

Tennessee and Georgia are the leaders of the group in total registration, Tennessee having 27,266 cars and trucks, or one to every eighty-four of its population, and Georgia 24,059, one to each 117 of its inhabitants. Tennessee's increase over 1914, however, was 7598 cars and trucks, or 39 per cent, as compared with only 3259, or 16 per cent, for Georgia. During the five years since 1911, Tennessee added 20,802 cars to its lists with only 11,819 credited to Georgia.

Kentucky's Gain Largest

Kentucky ranks third of the seven States, having 19,500 automobiles and trucks in use at the end of 1915, a gain of 7754, or the largest of the group. The 66-per cent gain seems small as compared with the 195- and 215-per cent gains apparently made by Louisiana and Mississippi, but it must be remembered that these are probably far in excess of the actual increase in registration in these States, as the only statistics available up to 1915 were estimates, which

CAR AND TRUCK REGISTRATIONS BY YEARS SINCE 1911

State	1911	1912	1913	1914	1915	Increase in 5-Year Period
Alabama	2,856	3,385	5,435	8,425	13,798	10,942
Florida	3,889	6,749	8,372	11,366	13,123	9,234
Georgia*	12,240	19,120	18,500	20,800	24,059	11,819
Kentucky	2,868	5,147	7,210	11,746	19,500	16,632
Louisiana*	4,867	7,000	7,200	3,500	10,880	6,013
Mississippi	1,240	2,895	3,000	3,894	11,500	10,260
Tennessee	6,464	9,973	14,103	19,668	27,266	20,802
Total	34,424	54,269	63,820	79,399	120,126	85,702

*Louisiana's report for 1914 was not complete owing to a new law going into effect about the time the census was made. The same applies to Georgia's statistics for 1912.

were purposely made conservative. Kentucky's population-to-car ratio, however, is not so creditable, being 121 to 1. Since 1911, Kentucky has added 16,632 cars and trucks.

Alabama, which ranks fourth, shows nearly as high a percentage increase in registration as Kentucky, having gained 5373 motor vehicles, or 64 per cent during 1915, giving a total of 13,798, with an increase of 10,942 since 1911. In respect to population-to-car ratio, Alabama ranks with Louisiana and Mississippi, being third from the bottom of the list of the entire United States, having 168 people per car, so it would seem that there is still ample opportunity for a considerable increase in the number of cars sold in the State.

Florida's Population Ratio Best

Florida is fifth of the group, its registration being only 675 below that of Alabama, though its gain over 1914 was only 15 per cent, or 1757 cars and trucks. Its gain since 1911 totals 9234 motor vehicles.

With respect to the population, Florida's registration makes the best showing of the group, there being only sixty-seven persons to each car or truck in use in the State.

Mississippi and Louisiana stand sixth and seventh, respectively, Mississippi registering 11,500 motor vehicles up to the end of 1915, and Louisiana having 10,880 on its lists. The number of people per car in these two States is unusual, as compared with other States in the country, Mississippi having 168 and Louisiana 167, so that they rank respectively second and fourth from the bottom of the list of the United States.

Security Prices Lower

General Motors Drops 16 Points — Maxwell and Studebaker Lower

New York City, March 7—A further decline in automobile security prices occurred last week. With the exception of a few issues, the majority showed declines. Those issues which equaled or passed under their low marks for 1916, have established new low marks for this year. General Motors is still quoting considerably ahead of its rock bottom price of 415, though it declined 16 points last week, reaching 460. Maxwell common, first preferred and second preferred all dropped. Its common has reached 59, a drop of 9 points in two weeks. The second preferred, which showed a little strength recently has joined the general decline with a 4-point drop.

Chevrolet, Packard and Willys-Overland were the features of the automobile issues with rises of 3½, 5 and 7 points respectively. Chevrolet has shown considerable strength on the report of $6,000,000 earnings for 1916. It is stated that the company will turn out 20 per cent more cars than were projected for 1917 at the time of public financing last fall.

Goodrich common went up 1¼ points, reaching 70¼. This company is stated to have a large quantity of crude rubber on hand which cost it under 60 cents per lb. The sales of this company in January increased 150 per cent over January a year ago.

Though the declines last week were frequent, they were, however, in the majority of cases small. Ajax Rubber dropped 2½ points to 68½; International Motors common and preferred declined 1 and 2 points; Kelly-Springfield new common went down to 67; New Departure common went down 2 points; Reo Truck and Car went down 1½ and ½ points; and Stewart-Warner common reached 84 at a decline of 2 points.

Further Rise in Market Prices

New York City, March 8—Market prices last week took another jump. With an exceptional demand for spot delivery the market as a whole is very strong. Of the metals, copper is the only one which at the present time lacks demand. The resumption of trading at London has failed to stimulate the demand for that metal and prices have declined as a result. Both electrolytic and lake copper dropped 1 cent a pound to 27½. Aluminum, Bessemer and open-hearth steel, lead, and tin, are now quoting at higher prices than last week. Aluminum has reached the record mark of 61 cents a pound, while Bessemer and open-hearth steel prices were raised to new high marks of $37 and $38 respectively per ton. Lead is scarce and the market strong at $6.70 per 100 lb. A number of the companies are selling lead only in limited quantities to their customers.

Though there was no material change in the crude rubber situation last week, the market, however, was somewhat more active and a firmer tone developed.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	68½	69	—2½
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	76	85	85	87½	+1
Chalmers Motor Co. com	..	87	130	150	..
Chalmers Motor Co. pfd	90	..	99	101	..
Chevrolet Motor Co	..	..	140	142	+3½
Electric Storage Battery Co	..	..	62	63	..
Firestone Tire & Rubber Co. com	280	..	740	750	..
Firestone Tire & Rubber Co. pfd	108	109½	113	..	..
General Motors Co. com	92	93½	460	465	—16
General Motors Co. pfd	94½	96	112½	113¾	— ½
B. F. Goodrich Co. com	30½	31	70¼	70⅛	+1¼
B. F. Goodrich Co. pfd	97	98½	113¾	115	+ ¼
Goodyear Tire & Rubber Co. com	187	190	345	350	+3
Goodyear Tire & Rubber Co. pfd	102	103	116	117½	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	19	22	—1
International Motor Co. pfd	..	..	30	40	—2
Kelly-Springfield Tire Co. com	130	140	..	..	..
Kelly-Springfield Tire Co. com. (new)	..	..	67	69	—3
Kelly-Springfield Tire Co. 1st pfd	83	84	95	98	..
Kelly-Springfield Tire Co. 2d pfd	120	125	..	..	..
Maxwell Motor Co. com	27¼	29	59	59½	—4
Maxwell Motor Co. 1st pfd	67¾	69	82¼	83½	—2¾
Maxwell Motor Co. 2d pfd	26	27¼	44	45	—4
Miller Rubber Co. com	155	160	225	240	..
Miller Rubber Co. pfd	101	103	113½	116	..
New Departure Mfg. Co. com	124	125	171	175	—2
New Departure Mfg. Co. pfd	105	107	110	..	..
Packard Motor Car Co. com	..	98	170	185	+5
Packard Motor Car Co. pfd	..	97½	102	†104	..
Paige-Detroit Motor Car	..	..	665	705	..
Peerless Motor & Truck Corp	..	..	27	28	+1
Portage Rubber Co. com	34	36	68	71	..
Portage Rubber Co. pfd	85	95	106	108	..
Regal Motor Co. pfd	..	..	13	16	..
*Reo Motor Truck Co	10¾	11¾	25	26½	—1½
*Reo Motor Car Co	26½	28	33	34	— ½
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	50	51½	84	86	—2
Stewart-Warner Speed. Corp. pfd	101½	..	108½	..	+ ½
Studebaker Corp. com	46½	47½	136½	137	—3½
Studebaker Corp. pfd	93	94	110	113	+1
Swinehart Tire & Rubber Co	73	75	88	89	..
Texas Co.	..	..	199½	201	—2½
U. S. Rubber Co. com	56¼	57	49½	50	—1
U. S. Rubber Co. pfd	103	103½	107	107½	..
Vacuum Oil Co	180	183	223	230	—4
White Motor Co. (new)	..	..	47	48	—2
Willys-Overland Co. com	98½	100	216	220	+7
Willys-Overland Co. pfd	96½	99	..	..	..

Official Quotations of the Detroit Stock Exchange

ACTIVE STOCKS

	1915		1916	
	Bid	Asked	Bid	Asked
Chalmers Motor Co. com	..	84	140	148
Chalmers Motor Co. pfd	91½	93	97½	101
Continental Motor Co. com	..	190	..	31
Continental Motor Co. pfd	80	85	9½	10
Ford Motor Co. of Canada	500	..	..	385
General Motors Co. com	90	93	425	480
General Motors Co. pfd	94	96	111	114
Maxwell Motor Co. com	27	29	58	60½
Maxwell Motor Co. 1st pfd	66½	68½	80	85
Maxwell Motor Co. 2d pfd	25½	27	43	46
Packard Motor Car Co. com	..	..	170	175
Packard Motor Car Co. pfd	..	97½	..	104
Paige-Detroit Motor Car Co	..	..	675	700
*Reo Motor Car Co	27¼	28¼	33	34
*Reo Motor Truck Co	11	11¾	25	26
Studebaker Corp. com	46	47½	135	137½
Studebaker Corp. pfd	92	94½	107	..

INACTIVE STOCKS

	1915		1916	
	Bid	Asked	Bid	Asked
*Atlas Drop Forge Co	..	25	33	..
Kelsey Wheel Co	195	..	435	..
*W. K. Prudden Co	19	20	..	33
Regal Motor Car Co. pfd	..	22	13	16

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*Par value $10. †And accrued dividend.

Shipments are coming in regularly and the manufacturers are showing a better demand. Last week Para dropped 1 cent per pound to 77 cents, while Ceylon, first latex crepe remained constant at 94.

Gasoline has taken the long expected rise to 24 cents a gallon wholesale. A further rise is predicted. On top of the general rise in gasoline throughout the country comes the announcement of another rise in Pennsylvania crude oil to $2.50 per barrel. This new advance has been expected and it is thought that it will bring out the hoarded supply of crude held for the account of producers, in tanks and pipe lines. It is stated, however, that there is no hope that this increased supply will have any material effect on the present scale of gasoline prices.

N. Y. Gasoline Now 24 Cents a Gal. Wholesale

NEW YORK CITY, March 3—Automobile owners are now paying from 26 to 31 cents a gallon for their gasoline in this city. This fuel yesterday went up another cent in the wholesale market, reaching 24 cents. Consumers last year at this time of the year were paying from 14 to 17 cents a gallon.

Despite investigations on the part of Congress and the protests of the local trade associations, prices have continued to increase at the rate of about 1 cent a month.

Action will be taken by the leading trade associations in this State. It is stated that the New York Garage Assn., and the New York State Automobile Trade Assn., are preparing a combined attack on the stand taken by the oil producers.

The increase in the prices, it is explained, is on account of the increased demand for gasoline at practically any price by the warring nations for their trucks, cars and aircraft, the Mexican troubles, which stop the supply from that country, and the slide in the Panama Canal, adding to the cost of transportation from the California wells.

England Threatened by $1 Gasoline

Agitation to Prevent Private Use of Automobiles Grows—Opposition is Very Strong

LONDON, ENGLAND, Feb. 18—The extinction of all private motoring in England is threatened by a recommendation of the National Organizing Committee for War Savings that pleasure motoring should not be indulged in. The Committee states that this is a selfish and thoughtless form of extravagance affecting (1) Ships and men now employed in carrying oil and rubber for automobiles and bicycles; (2) Men at docks and railroads, carmen, etc., employed in handling these cargoes and in work connected with the importation of automobiles and bicycles; (3) Chauffeurs now engaged in driving and looking after automobiles; (4) Men now engaged at garages and shops all over the country repairing automobiles and bicycles; (5) Men engaged in the manufacture and handling of tires used on automobiles.

At present the move is nothing more than a recommendation, but an endeavor is being made to put a stop to all pleasure motoring by reason of a special tax on gasoline. It is hinted that gasoline, which now costs 50 cents a gallon will be raised to $1. Many of the daily newspapers are clamoring for this measure in order to put a stop to what they claim is a useless extravagance. Much use is being made of the claim that pleasure motoring has been forbidden in France and should also be tabood in England. This is quite incorrect, for although nobody can use an automobile in France without a special police pass renewable monthly, this pass is given to everybody of recognized honorability irrespective of what kind of service the car may be intended to perform. The measure is only a precaution against the use of automobiles by spies, criminals or suspected persons.

English motorists are making a vigorous protest against the suggestion that cars are being used to any important extent for pleasure riding only. The high cost of gasoline, the impossibility of obtaining chauffeurs, the general money tightness, have all caused an important diminution in the number of cars in general service. It is difficult to say what is legitimate and what illegitimate motoring, or to devise a scheme which will allow gasoline to be used for the one and to prevent its use for the other. Practically all automobiles in service at the present time are utility vehicles and are used as such for 90 per cent of their mileage. If a remedy is sought by putting an additional tax on gasoline, it will hit hardest at men to whom a car is an absolute necessity. The suggested system of licenses is almost impossible of application, for it would be exceedingly difficult for any body of judges to say in which cases the use of an automobile was justified and in which it was not, or how much useful work must be done by the owner to justify him using the automobile on one occasion for either health or pleasure. In general motorists are of the opinion that the present high cost of gasoline has been quite sufficient to put a stop to all pleasure use of the automobile.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.60	.61	.61	.61	.61	.61	+ .01
Antimony	.43¾	.43¾	.43¾	.43¾	.43¼	.43¼	...
Beams and Channels, 100 lb	2.42	2.42	2.42	2.42	2.42	2.42	...
Bessemer Steel, ton	35.00	35.00	35.00	37.00	37.00	37.00	+2.00
Copper, Elec., lb	.28½	.28	.28	.28	.28	.27½	— .01
Copper, Lake, lb	.28½	.28	.28	.28	.28	.27½	— .01
Cottonseed Oil, bbl	9.86	9.75	9.94	9.96	10.04	10.15	+ .29
Cyanide Potash, lb	.28	.28	.28	.28	.28	.28	...
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl	.23	.24	.24	.24	.24	.24	+ .01
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb	6.50	6.50	6.50	6.60	6.60	6.70	+ .20
Linseed Oil	.77	.77	.77	.77	.77	.78	+ .01
Open-Hearth Steel, ton	38.00	38.00	38.00	38.00	38.00	38.00	...
Petroleum, bbl., Kansas, crude	1.30	1.30	1.30	1.30	1.30	1.30	...
Petroleum, bbl., Pennsylvania, crude	2.40	2.40	2.40	2.40	2.40	2.50	+ .10
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.78	.76	.76	.77	.76	.77	— .01
Rubber, Ceylon, First Latex Crepe	.94	.94	.94	.94	.93	.94	...
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	47.75	47.50	47.00	46.26	46.25	49.00	+1.25
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Texas Trouble Now Settled

NEW YORK CITY, March 4—The several automobile manufacturing companies recently sued in Texas for a violation of the anti-trust law of that State, on the ground that they limited the territory of the dealer, as is common practice throughout the country, have agreed to accept consent injunctions. These injunctions prohibit them from limiting their dealers to definite territory so that the manufacturers are changing their contracts with the dealers to comply with the law. In doing this, however, the manufacturers feel that the dealers, as well as the general public, will not profit by the change since a man may buy a car of a dealer several hundred miles from his home but he cannot expect that the local agent of the same car will give him service on a car bought from another dealer. This is only one example of the disadvantages of the new arrangement, the general tendency being to relieve the dealer of all responsibility as to service, etc.

U. S. Rubber Sales $92,861,015

NEW YORK CITY, March 8—Net Sales of the U. S. Rubber Co., for the year ended Dec. 31, 1915, amounted to $92,861,015, as against $83,678,812 in the preceding year. The net profits before deducting interest charges were $11,486,705, compared with $9,776,873 in 1914. The surplus was $2,882,048 against only $721,951 for the previous year.

Colonel Colt announces that the sales of the United States Tire Co., for January and February showed a very large increase over the corresponding period of last year. The organization of the United States Tire Co. has recently been enlarged and strenghtened. In addition to the distribution of tires through the fifty-one branches of that company, provision has been made for a very much wide distribution through the stores of the U. S. Rubber Co. Colonel Colt added that at no time in the company's history had there been greater activity in its business than now. All the factories, he stated, were working at capacity and steps were being taken to enlarge several of the plants, one of them being the Morgan & Wright factory in Detroit. This work is well under way and when completed will double the capacity of that plant.

Eighth Edition Used Car Report

CHICAGO, ILL., March 4—The eighth edition of the National Used Car Market Report of the Chicago Automobile Trade Association has been issued. In appearance and size it is exactly like its predecessors, the essential difference being in the figures given for the various cars listed. In the seventh edition the figures were given for sales made between June 21 and Sept. 21; the new edition gives figures for sales of used cars between Sept. 21 and Dec. 21. The number of cars listed shows but one change, the Mora failing to appear in the new book. The number of dealer associations and manufacturers supporting the movement also remains practically unchanged.

Thomas Neal Joins Signal Truck

DETROIT, MICH., March 6—Following closely upon the announcement of the increase of the capital stock of the Signal Motor Truck Co., from $85,000 to $550,000, comes the further information that Thomas Neal, former president and chairman of the executive committee of the General Motors Co., has been made a director and elected chairman of the executive committee of the Signal company, but will retain his connection with the Acme White Lead & Color Works.

At the same time Mr. Thomas Neal was elected a director, Myron W. Neal, treasurer of the Acme White Lead & Color Works, Detroit, and W. K. Hoagland of Allerton, Greene & King, bankers in Chicago, were elected to the board of directors. The other members are A. C. Burch, John Squires and Murray Wendell.

The Signal company is to have a new plant on North Jefferson Avenue, near the plant of the Chalmers Motor Co. It is to be big enough to insure an increase of 300 per cent in its production as compared with that of the past year.

Studebaker Raises Some Prices

Small Increases Made on Prices of Passenger Cars—Trucks Unchanged

DETROIT, MICH., March 4— The Studebaker Corp. increased the price of five of its models on March 1. In the four-cylinder class the three-passenger roadster, formerly $825, is now listed at $850; the seven-passenger touring car, which was formerly listed at $845, now sells at $875; the landau-roadster, which was selling at $1,145, now sells at $1,150.

Of the six six-cylinder models, the price of two has been increased. The three-passenger roadster sells now at $1,060 instead of $1,025, and the seven-passenger touring car formerly listed at $1,050 now sells at $1,085. The price of the landau-roadster, $1,350; of the four-passenger coupe, $1,600; of the sedan, $1,675, and of the seven-passenger limousine, $2,500 remains the same. There is also no alteration in the price of the commercial car line, which was published in THE AUTOMOBILE, Feb. 24.

National Gas Assn. to Discuss Tractors

CHICAGO, ILL., March 8—Plans are nearing completion for the annual convention of the National Gas Engine Assn., which will be held at the Sherman Hotel, Chicago, June 27, 28 and 29.

"Tractor and Tractor Engines" will be the subject of one session, during which there will be a number of papers, including "Tractor Engines" by W. J. McVicker of Minneapolis, as well as a paper on "Carburetion," "Traction" and "Tractor Equipment" by well-known authorities, and a general discussion of such matters.

The use of kerosene and "Design of Oil Engines" will be taken care of by Professor Norris of Wisconsin University.

Detroit S. A. E. Meet March 17

DETROIT, MICH., March 4—The next meeting of the Detroit Section of the Society of Automobile Engineers will be held March 17, in the convention hall of the Hotel Ponchartrain. The speaker of the evening will be J. G. Perrin, chief engineer of the Timken-Detroit Axle Co., whose subject will be: "Evolution of the Rear Axle."

$30,000 in Prizes for Chicago Derby June 10

CHICAGO, ILL., March 8—Cash prizes amounting to $30,000 have been offered for the International 300 mile race to be held at Speedway Park on June 10. The race is open to Class E non-stock cars of 300-cu. in. piston displacement or less, with a maximum weight of 2500 lb.

There will be ten prizes divided as follows: first, $12,000; second, $6,000; third, $3,000; fourth, $1,500; fifth, $1,300; sixth, $1,200; seventh, $1,100; eighth, $900; ninth, $800, and tenth, $700. The car leading at 100, 200 and 250 miles, will receive $500 for each distance.

Timken Puts Up Seventh Building

DETROIT, March 6—The Timken-Detroit Axle Co. is now building a large addition which will be the seventh new building put up within the last year. This new structure will be known as the heat-treating plant and will cost approximately $300,000. It will be a three-story building 40 by 330 ft.

The heat-treating department will occupy the entire first floor while the upper floors will be used for manufacturing operations on the stock as it comes from the furnaces. There will be two specially-built rotary furnaces embodying in their design all the new scientific principles required for the heat-treatment of the many grades of steel used by the Timken company. There will be two large electric traveling cranes to handle the stock in the plant carrying it from furnace to furnace and from cooling vat to cooling vat.

The plant will be connected with the large new forge shop recently completed, by a tunnel which runs under the main building of the Timken plant. Through this tunnel, forgings will be brought to the heat-treating furnaces by electrical industrial trucks.

To Develop New Universal

NEW YORK CITY, March 8—J. E. Gramlich, formerly engineer and superintendent of The Chase Motor Truck Co. of Syracuse, N. Y., has severed his connection with that company to become associated with the Thermoid Rubber Co. of Trenton, N. J. Mr. Gramlich will act as engineer for the latter company, giving his time exclusively to the development of the lately patented Thermoid-Hardy laminated disk, for which this company has the exclusive American rights.

Fergus Motors Formed

ALBANY, N. Y., March 3—The Fergus Motors of America, Inc., was incorporated to-day to manufacture the Fergus car, shown in this country for the first time at the recent New York City automobile show. The capital stock of the company is $2,000,000 and the main offices are in East Chester, Westchester county. The directors of the company are C. T. B. Roew of Bronxville, Charles Blandy, Jr., New York City and F. F. Quantrell, Brooklyn.

Factory Miscellany

Canadian Crow to Add—The directors of the Canadian Crow-Elkhart Motor Co., Mount Brydges, Ont., is considering the enlargement of the plant.

Elgin to Build—The Elgin Motor Car Corp., Chicago, Ill., is having plans prepared for the erection of a $50,000 plant, 168 by 272 ft., at Argo, Ill.

Toronto Tire Co. to Enlarge—The Gutta Percha and Rubber Co.'s factory, Toronto, Ont., where Maltese Cross tires are manufactured, on West Lodge Avenue, will be enlarged.

Lane Truck to Build—The Lane Motor Truck Co., Kalamazoo, Mich., has taken temporary quarters in the Frank Burtt Building. A plant will be erected within the next two months.

Bour-Davis Buys Land—The Bour-Davis Motor Car Co., Detroit, Mich., has purchased a tract at Kercheval Avenue and the outer belt railroad, upon which to erect a factory.

Chevrolet Plant in Seattle—The Chevrolet Motor Co. has determined to establish an assembling plant in Seattle just as soon as the plant at San Francisco is completed. The Seattle factory will supply the entire Pacific Northwest.

Rock Island Top Co. Opens Plant—The Motor Row Top Co., Rock Island, Ill., making automobile tops, radiator covers, automobile upholstering and other special work, has opened a plant at 1818 Fourth Avenue. S. P. Pearson is general manager.

Bulkley-Rider to Build—The Bulkley-Rider Tractor Co., Los Angeles, Cal., has announced that as soon as a site can be decided upon, the company will begin the erection of a large factory with a capacity of twenty-five tractors per month. Plans for the factory have already been accepted and several sites are under consideration.

To Make Resilient Wheel—The Willson Resilient Auto Rim Co. will soon be organized at Columbus, Ohio, for the purpose of manufacturing a patented resilient rim, the invention of F. R. Willson, an electrical engineer at the Jeffrey Manufacturing Co. At a recent meeting of the stockholders F. R. Willson was elected president and H. H. Spain, secretary-treasurer.

To Make Tires in Baltimore—The Baltimore Rubber Tire Mfg. Co., Baltimore, Md., has been formed to make automobile tires. No plant as yet has been selected. The name of the tire will be Wil-Lox. The capital stock of the company is $200,000. The officers of the company are G. W. Hahbersett, president; H. M. Rever, secretary-treasurer; A. S. Mauk, vice-president and general manager.

Timken Roller to Build in Canton—The Timken Roller Bearing Co. announces that a new addition, which will give employment to 200 men, will be built by the company on Deuher Avenue, Canton, Ohio. This announcement was made following action by the city council granting the company permission to use a portion of Nineteenth Street. When it was reported that the new addition would be erected at Detroit, where another branch of the company is located, the city council granted the permission desired.

Watertown Co. to Make Tractors—The John Dornfeld Co., Watertown, Wis., machine shop, structural iron, boiler and tank works, has entered into a contract with the Brillion Implement Mfg. Co., gasoline engines, Brillion, Wis., for the joint manufacture of a general utility farm tractor and truck. The Brillion company will manufacture the engines and the Watertown firm the chassis complete. The product will be distributed and marketed from Watertown. The tractor is a Brillion design and arranged for manifold purposes. About seventy-five men will be added to the Dornfeld payroll at once.

Janesville Workmen to Build Tractors—Union workingmen of Janesville, Wis., seeing the possibilities of the gas tractor business, have organized the Janesville Tractor & Engine Co., Janesville, Wis., to engage in the manufacture of a general utility tractor for agricultural purposes.

The Automobile Calendar

March 4-11.......	Boston, Mass., Car and Truck Show, Mechanics Bldg.
March 8-11.......	Davenport, Iowa, Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile rade Association.
March 8-11.......	Mason City, Iowa, Show, Armory.
March 8-15.......	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
March 9-11.......	Kenosha, Wis., Show, Kenosha Retail Assn., Kenosha Farmers' Session.
March 14-17......	Springfield, Ill., Show.
March 15-18......	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 18-25......	Pittsburgh, Pa., Twelfth Annual Show, Automobile Dealers' Assn., Motor Square Garden.
March 20-25......	Twin Falls, Idaho, Show, Oliver Tabernacle.
March 21-25......	Deadwood, S. D., Show, Auditorium. Deadwood Business Club.
March 22-25......	Lexington, Ky., Show, Woodland Auditorium.
March 25-April 1..	Wheeling, W. Va., Show, Market Auditorium.
March 27-April 1..	Danville, Ill., Show, Eastern Illinois Dealers.
March 27-April 1..	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3..	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 1-8.........	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 8...........	Corona, Cal., Race.
April 10-15.......	Seattle, Wash., Show, Arena.
April 15..........	Altoona, Pa., Pennsylvania State Motor Federation.
Apr. 26-May 6....	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show, Automobile Industries Assn.
May	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6...........	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13..........	New York City, Sheepshead Bay Speedwav Race.
May 20..........	Chicago Non-Professional Speedway Race, Western Interclub, Speedway Park.
May 26-27.......	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30..........	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30..........	Indianapolis Speedway Race.
May 31..........	Minneapolis, Minn., Speedway Race.
June 10.........	Chicago Speedway Race. International 300 - Mile Race, Speedway Park, Speedway Park Assn.
June 28.........	Des Moines, Iowa, Speedway Race.
July 2-6.........	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4...........	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4...........	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4...........	Minneapolis 300-Mile Speedway Race.
July 4...........	Sioux City Speedway Race.
July 15..........	Omaha, Neb., Speedway Race.
Aug. 5...........	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 18-19.......	Elgin Road Race.
Sept. 4..........	Des Moines Speedway Race.
Sept. 4..........	Indianapolis Speedway Race.
Sept. 16.........	Providence Speedway Race.
Sept. 30.........	New York City Sheepshead Bay Race.
Oct. 7...........	Omaha Speedway Race.
Oct. 14..........	Chicago Sneedway Race.
Oct. 19..........	Indianapolis, Ind., Race, Indianapolis Motor Speedway.

The Week in the Industry

Smith Goes to Edison—G. D. Smith, for the past two years supervisor of agencies for the General Vehicle Co., Inc., has been appointed special assistant to H. G. Thompson, vice-president and general sales manager, Edison Storage Battery Co. Mr. Smith will make his headquarters at the factory and main office, Orange, N. J.

Hupp Appoints New District Managers J. G. Painter and W. J. Walker have been appointed district managers by the Hupp Motor Car Corp., Detroit. Mr. Painter has had charge of the technical service department at the Hupp factory. He will have charge of the important territory of Ohio, Michigan, Northern Indiana and a portion of West Virginia. Mr. Walker, with headquarters in Winnipeg, will cover Alberta, Manitoba, Saskatchewan and Western Ontario.

Dealers

Wis. News Items—W. L. McLaughlin, Algoma, Wis., operating under the name of Algoma Tire Repair Co., opened a vulcanizing and tire store at Steele and Fourth Streets on March 1.

Schueler Bros., 247-249 Milwaukee Street, Milwaukee, operating a large painting and trimming shop, have been appointed distributers of Hood and Puritan tires for the State of Wisconsin.

The K. W. Battery Co., Milwaukee, has established a factory and repair shop for storage batteries at 1702 North Avenue, Milwaukee. The firm is composed of F. Kruschka, president; C. Jurss, secretary, and C. Weidler, treasurer. The company will manufacture batteries as well as rebuild and repair cells. An elaborate recharging outfit has been installed.

Harry Newman, Inc., 701-707 Grand Avenue, Milwaukee, distributer of the Chalmers in Wisconsin, upper Michigan and adjacent territory, announces the addition of two former Studebaker men to his Milwaukee staff, viz.: H. H. Batcheller, formerly of the Chicago Studebaker branch, and L. S. DeLand, since 1910 sales manager of the Studebaker for Wisconsin in Milwaukee. Both men will travel through the Newman territory and co-operate with Chalmers dealers.

The Wisconsin Aluminum Foundry Co., Sixteenth and Franklin Streets, Manitowoc, Wis., is having plans prepared for a 75 by 145 ft. addition, to be used for foundry and machine shop purposes. The present plant was erected only three years. The business for 1915 showed an increase of more than 50 per cent.

Motor Men in New Roles

New Men for Vim Truck—The Vim Motor Truck Co., Philadelphia, Pa., has added T. E. Cathcart, W. L. Kroneberger and Howard Hewitt to its force. Mr. Cathcart was formerly with the standard Roller Bearing Co. in charge of sales. Mr. Kroneberger was with the Curtis Publishing Co. in its circulation department and Mr. Hewitt was factory service manager of the Morgan Dean Rapley Co., Hamilton, Ont.

Daniels Heads Springfield Chalmers—The Chalmers Motor Co. of Illinois has leased the building at 408-412 East Monroe Street, Springfield, Ill., and makes this the distributing center for central Illinois. H. B. Daniels has been engaged as resident sales manager and will have a staff of assistants. The plant just leased will be enlarged and improved for sales and storage purposes.

Chapman Resigns—H. O. Chapman, in charge of the Packard agency at Dubuque, Iowa, has resigned to become sales manager for the L. J. Theiss Co., Rockford, Ill.

Duggan Takes on Dort—The Dort distributing agency for Colorado and adjacent territory is now in charge of George A. Duggan, located temporarily at 1528 Broadway, Denver. C. Mark Hanna, formerly associated with him, is his sales manager.

Johnson Returns to Toronto—D. F. Johnson, former Canadian and European agent of the Stewart-Warner Speedometer Corp., has returned to Toronto from San Francisco, where he had charge of the coast business of the company. The company will establish service stations throughout Canada and has appointed Johnson director and sole Canadian distributor of the Stewart-Warner products. The head office of the chain of service stations will be the Toronto depot at 486 Yonge Street.

Allen Goes to Detroit—C. M. Allen has left for Detroit in the interest of promoting the sale of the Heath carbureter, manufactured by the M. K. Bowman-Edson Co., New York City.

Pollock Detroit Rep.—P. J. Pollock has been appointed a sales representative of the Detroiter Motor Car Co., Detroit, Mich. He will travel through Ohio.

Ranney Columbus Firestone Sales Mgr.—G. E. Ranney, formerly of the Chicago branch, has been made manager of the Columbus branch of the Firestone Tire & Rubber Co., to fill the vacancy caused by the promotion of G. E. Richards to the management of the Pittsburgh branch.

Sehl Joins Studebaker—J. P. Sehl, who was commercial body designer of the Pierce-Arrow Motor Car Co., Buffalo, is now a member of the body-designing department of the Studebaker Corp., Detroit, Mich.

Shafer Takes Standard in Los Angeles—C. C. Shafer has been appointed southern California and Arizona distributer of the Standard "8" line with headquarters in Los Angeles. The agency is housed at Eleventh and Olive Streets recently vacated by the Goodrich branch which is now in the seven-story Goodrich building on South Broadway.

Dealers

Burd Opens New Offices—The Burd High Compression Ring Co., Rockford, Ill., announces the opening of two additional sales offices during the past week. E. C. Fish was appointed manager of the new Rochester office, which is located at 558 Lyell Avenue, and the new Pittsburg office will be under the management of E. J. McClees at 904 East End Trust Bldg. H. F. Belcher, who has been working out of the Chicago office of the company for some time, has been transferred to the Peoria, Ill., territory. L. G. Rasmussen, for a number of years with the Woods Vehicle Co., has joined the selling organization of the Burd company, and will be attached to the Chicago office, covering the Northern Illinois territory outside of Cook County.

Denver News Items—The Chandler Auto Co. is the name of a new Colorado distributing agency for the Chandler just opened at 1518 Broadway, Denver.

Mulnix & Rarie, Colorado and Wyoming distributors for the Grant, have bought out the Pathfinder distributing agency from the Charles F. Cole Corp. and moved from 17 East Colfax Avenue, Denver, into the Cole quarters at East Colfax Avenue and Lincoln Street.

The J. S. Morrison Auto Co., 1528 Broadway, Denver, has turned over the Dort to another distributing agent and is now handling the Oakland exclusively.

The Federal Rubber Mfg. Co. has discontinued its Denver branch, and arrangements have been completed with the Federal Rubber Tire Works Co., a Denver concern, to act as Federal distributor for Colorado and adjacent territory. The president of the new distributing firm is E. R. Cumbe.

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The AUTOMOBILE

Vol. XXXIV,
No. 11

NEW YORK, MARCH 16, 1916

Ten cents a copy
Three dollars a year

That Dirty, Grimy Hood

of yours can be made just like new—you can easily do it yourself and save the cost of refinishing—all you need is Johnson's Cleaner and Johnson's Prepared Wax.

JOHNSON'S CLEANER

entirely removes all stains, discolorations, scum, road-oil, tar and grease from body, hood and fenders. Even those spots that are ground in—mud freckles—and surface scratches which you thought were permanent—will disappear like magic under Johnson's Cleaner. And it doesn't injure or scratch the varnish—simply cleans and prepares it for a polish with Johnson's Prepared Wax. This treatment will keep your car like new indefinitely.

Read What Users Say

"Far superior to oil polishes."—*H. Y. Waterhouse, 525 Boylston St., Boston, Mass.*

"You would think the car was newly enameled."—*Harry C. Freeman, Box 182, Port Jefferson Sta., L. I., N. Y.*

"The Cleaner and Wax made it look like a new car."—*Clayton Wren, Munday, Texas.*

"It is certainly wonderful stuff."—*Dr. W. J. Berringer, Council Bluffs, Ia.*

"Saved me quite a sum of money. It worked wonders on that car."—*James M. Christian, 115 Rutledge Ave., E. Orange, N.J.*

"The Cleaner has taken off spots from my car that I thought would never come off."—*John B. Rozzini, 1897 Summit Ave., St. Paul, Minn.*

"I was surprised at the cleansing and polishing powers of your products."—*Oral Pirkey, Balker Apt. 8, Vancouver, Wash.*

S. C. JOHNSON & SON, Racine, Wis.

I enclose 10c for a trial can each of Johnson's Cleaner and Johnson's Prepared Wax.

Name ....

Address ....

City and State..

My Accessory Dealer Is..

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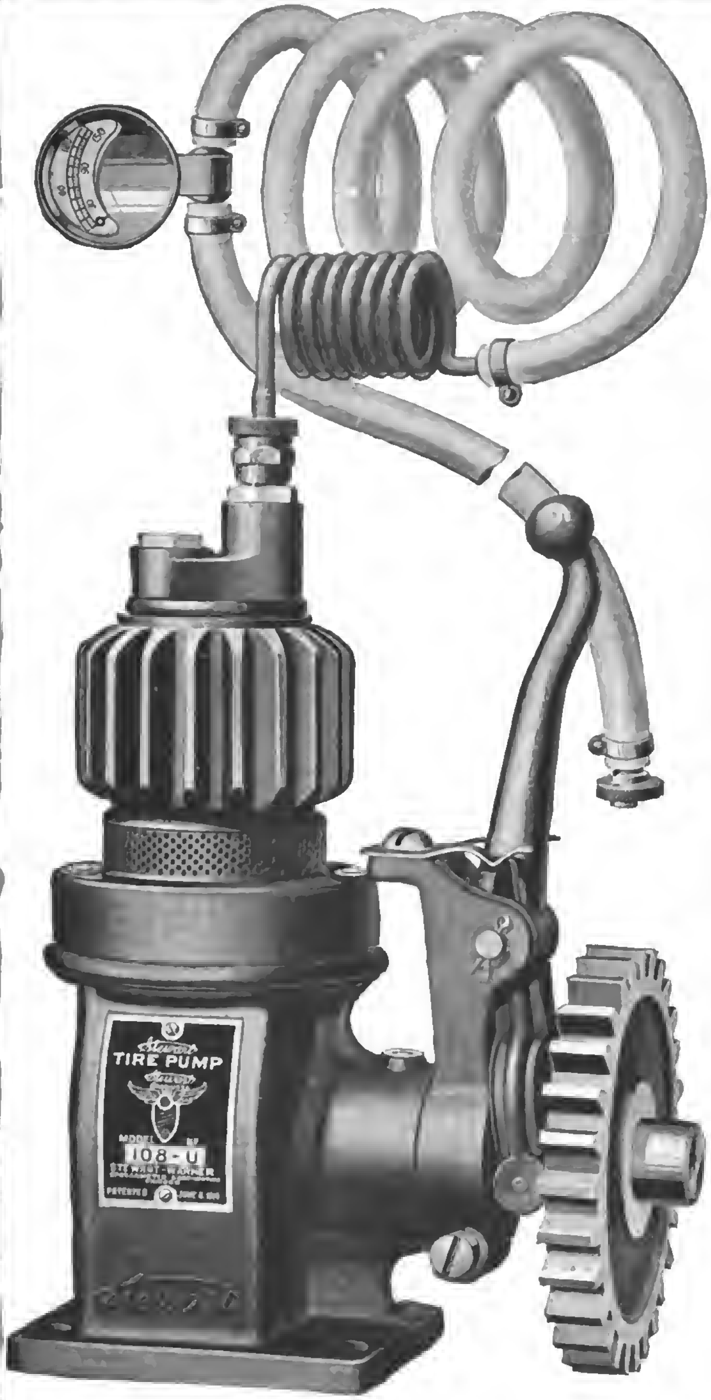
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STEWART-WARNER

Vol. XXXIV New York—Thursday, March 16, 1916—Chicago No. 11

The Automobile

Custom-Built Bodies Grow in Popularity

This Branch of the Automobile Industry, Until Recently Comparatively Insignificant, Promises Soon To Assume National Proportions

By Donald McLeod Lay

ONE of the most important tendencies brought out at the recent national automobile shows is a strong movement toward body improvement and development, as evidenced by the increasing demand for custom designs. At these shows there were exhibited many more special bodies, or constructions in which the aim was to get away from the hidebound conventionality of the stock type, than were on display at any show of recent years. These attempts to strike a note of individuality, while preserving the best features of modern coachmaking, may be characterized as the forerunners of a more widespread adoption of the ideas which prompted their creation.

The art of the coachbuilder, far from being on the decline, as some of the devotees of the "good old days" would have us believe, is still a long way from the attainment of its highest development. But it is not the further refinement of the horse-drawn vehicle which will be responsible for its progress in the future. The coachbuilder's interest in this field of his work will shrink to comparatively small proportions beside the more attractive opportunities in the increasing demand for smart, distinctive and comfortable automobile bodies.

A typical custom-built body. This is a convertible roadster-coupé mounted on a Locomobile chassis

There is a large class in the United States that prides itself upon its fastidious tastes in every phase of existence. It aims to be distinctive, individual, and to have everything in life to correspond. Clothes must be smart, elegant and well tailored; homes must be artistic backgrounds for personalities; food must be dainty and delicately prepared and must represent the most exquisite dishes money can buy; and so throughout the establishments, everything must be in keeping with these standards.

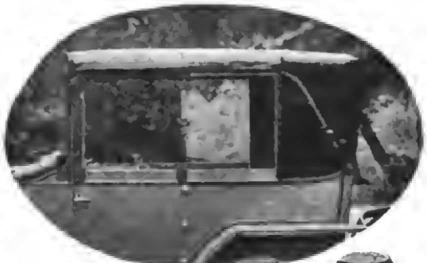
Want Something Different

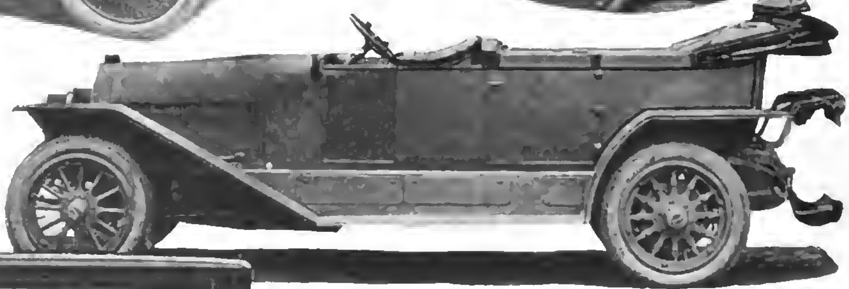
In other words, people of this class are not usually satisfied to accept the stock bodies sold by the American automobile manufacturer. They want something different, and as the number of cars in use increases each year, so will this demand for specially-designed and built bodies grow larger and larger as more car purchasers adopt the custom construction.

There are thousands of people throughout the country who, though not rolling in riches, are sufficiently prosperous to be able to afford the additional expense entailed by satisfying their sense of the fitness of things as re-

Some Custom Designs of

A four-passenger sporting body with Victoria top mounted on Lancia chassis. Note oval fenders, absence of running board and mounting of spare wheel



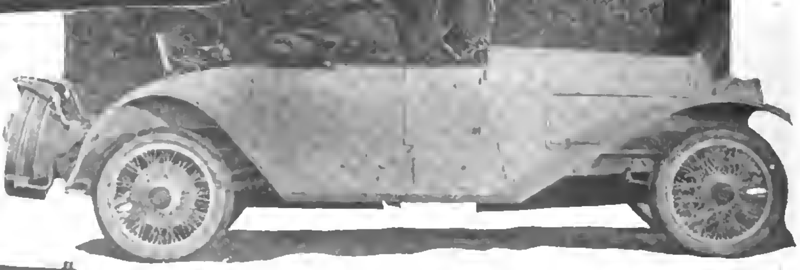


A special collapsible design produced by Locomobile. Below it is illustrated with top and sides folded and above with the top raised although the side windows are lowered

A permanent top product by Locomobile which may be quickly converted into an open body by lowering the windows

A four-passenger roadster with folding rear seat mounted on an Owen Magnetic chassis.

View of the body outlines and seating arrangement in a special Locomobile job exhibited at the National shows



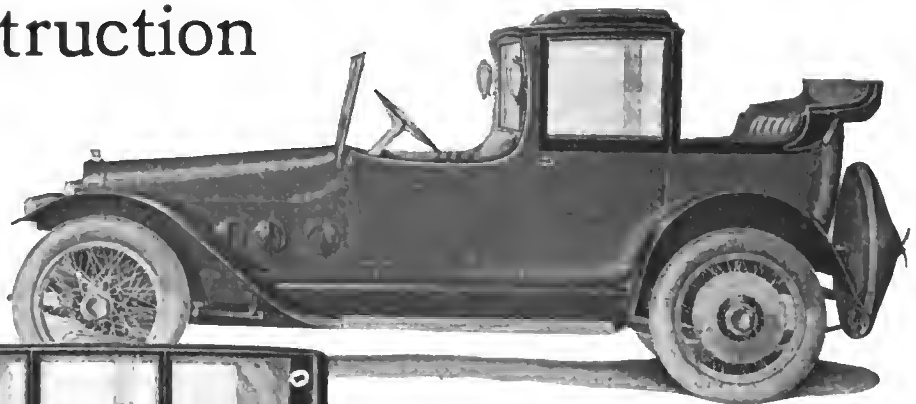
Another excellent example by Locomobile of the latest four-passenger body construction in which the rear seat disappears in the turtle back

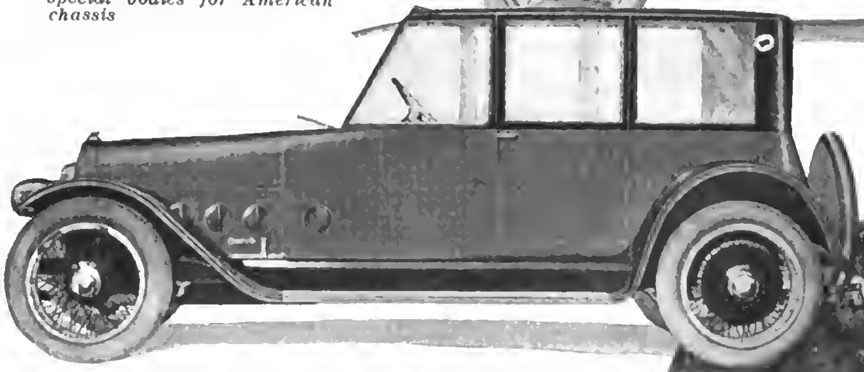
Aquatic touring body by Holbrook. The general lines are like those of a boat. It is mounted on a DeDion-Bouton chassis

Distinctive Construction

At the right is a special brougham with landaulet top designed by C. T. Silver for an Overland, Willys-Knight or Peerless chassis

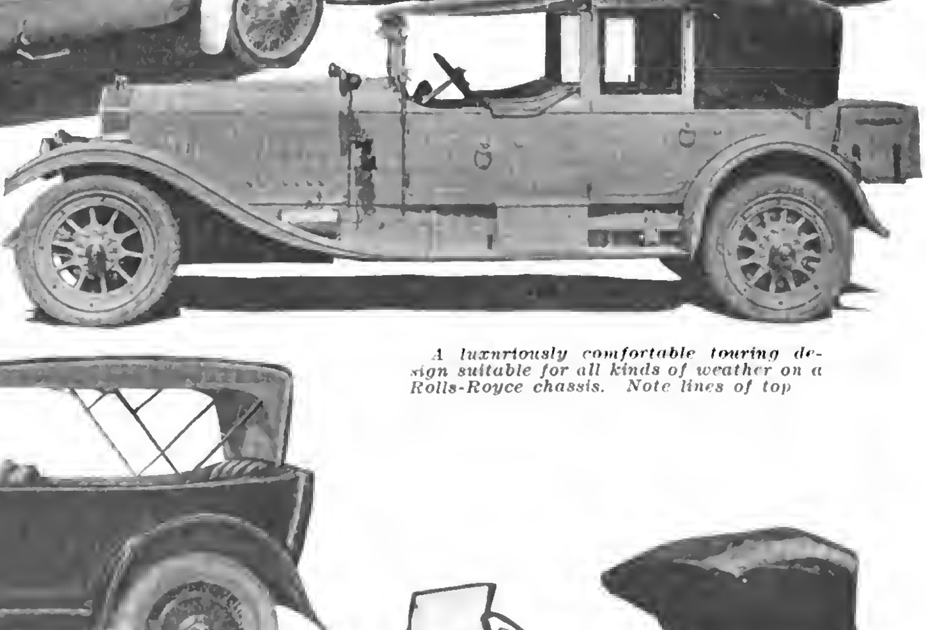
Below is a four-passenger sedan designed by Mr. Silver for the same chassis. Mr. Silver represents these cars in the Metropolitan district and is a pioneer in designing special bodies for American chassis





Below is illustrated Mr. Silver's masterpiece, the Silver Bird, a design in which the boat idea is carried to the extreme, every detail from the anchor bumper to the nickel propeller at the rear being in keeping

A torpedo-style four-passenger sporting type with folding rear seat and two windshields mounted on a Singer chassis



A luxuriously comfortable touring design suitable for all kinds of weather on a Rolls-Royce chassis. Note lines of top

A streamline Bender & Robinson design on a Singer chassis. Note the extremely smooth lines which are unimpaired when the top is down, as it folds into the body

An attractive streamline touring body with Victoria top designed by Holbrook. It is mounted on a Cadillac chassis gards the comfort and appearance of their cars. To-day most of them take the stock bodies without comment because they have had no opportunity of seeing what the expert coachmaker can do to express individual ideas and tastes. But when the wave of custom body design, which now seems to be gathering momentum in the East, begins to spread over the land, these people will be the first to take advantage of the new trend.

New York the Fashion Center

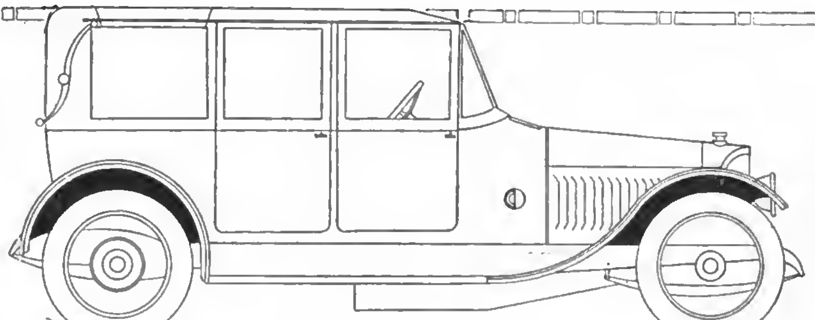
Of course New York City is the great center for the custom body trade in America to-day. Ever since the first days of the automobile industry, when the majority of the cars in New York were of foreign construction, European influence has been more strongly felt in that city than in any other section of the country. It was not many years before the wealthy families who were recognized as the leaders of fashion began to import chassis either separate or fitted with a specially-built body, designed to order by one of the celebrated coachmakers of Paris or London. This vogue, however, grew but slowly, because an imported chassis and body were not within the reach of many, even of the more prosperous classes, in those days. More recently, of course, foreign-built cars and bodies have become less a rarity then formerly, but it was apparently some time before anyone thought an American-built chassis was worthy of carrying a custom body.

Still, the fact that special automobile bodies were a distinction possessed only by members of the Four Hundred, set the fashion for the élite, the would-be-élite, social climbers, nouveau riches, etc. All set about procuring something distinctive, striking and frequently conspicuous, when the purchaser's taste was not as highly developed as it might be. Most of them, of course, bought European-made chassis on which to mount the new body, but some were not disposed to go to such expense and invested in an American machine, hoping that the body would disguise it sufficiently to prevent it being recognized as a domestic product.

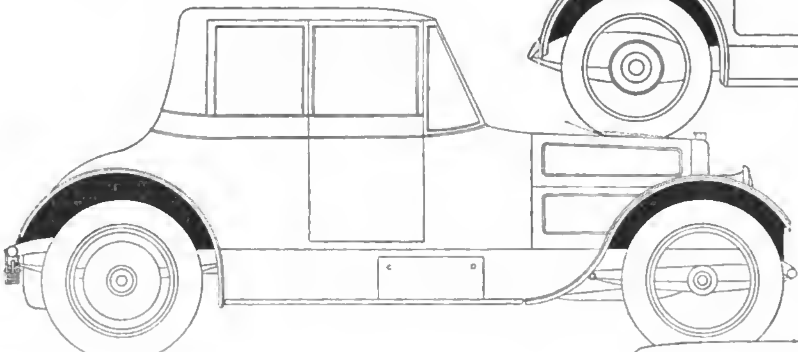
Thus the custom-designed body increased in popularity year by year, the types built by New York coachmakers to the orders of customers ranging from the most unpractical and freakish offsprings of an untrained imagination to the most comfortable, luxurious and highly refined examples of the art ever turned out. More and more people saw these special creations running about the streets or along country roads and became imbued with the desire to own cars having the same distinctive qualities. The most enterprising dealers recognized this growing demand and proceeded to prepare special designs applicable to the chassis of the cars they handled, and thus was the American custom body industry inaugurated.

To-day the number of firms designing and building bodies especially for the custom trade is growing almost from day to day. New concerns are springing up in all parts of New York City and neighboring districts, while the old established coachmakers find that the equine phase of their business has

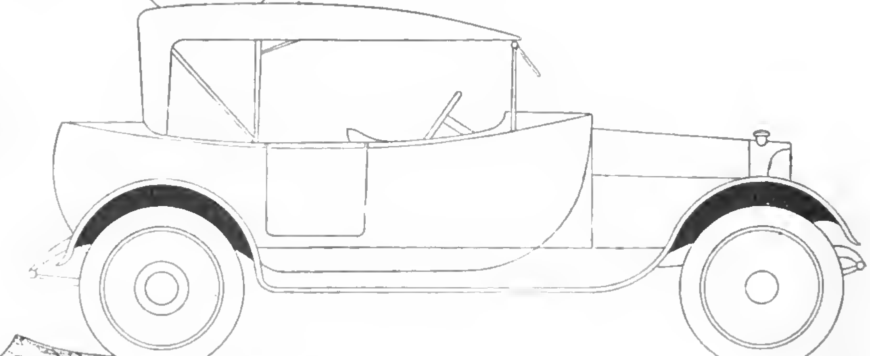
All the bodies illustrated on these two pages, 488 and 489, are reproductions from drawings of special custom designs by the George P. Harvey Co., New York City

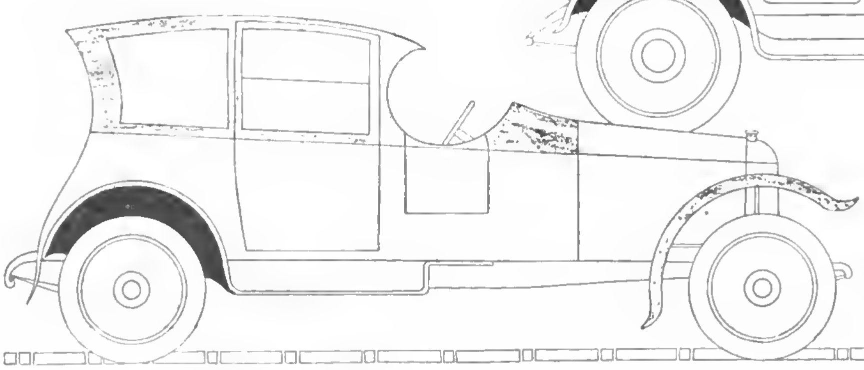


Above is what may be termed a landau-sedan, the top folding neatly down at the rear. This design was based on a customer's suggestion

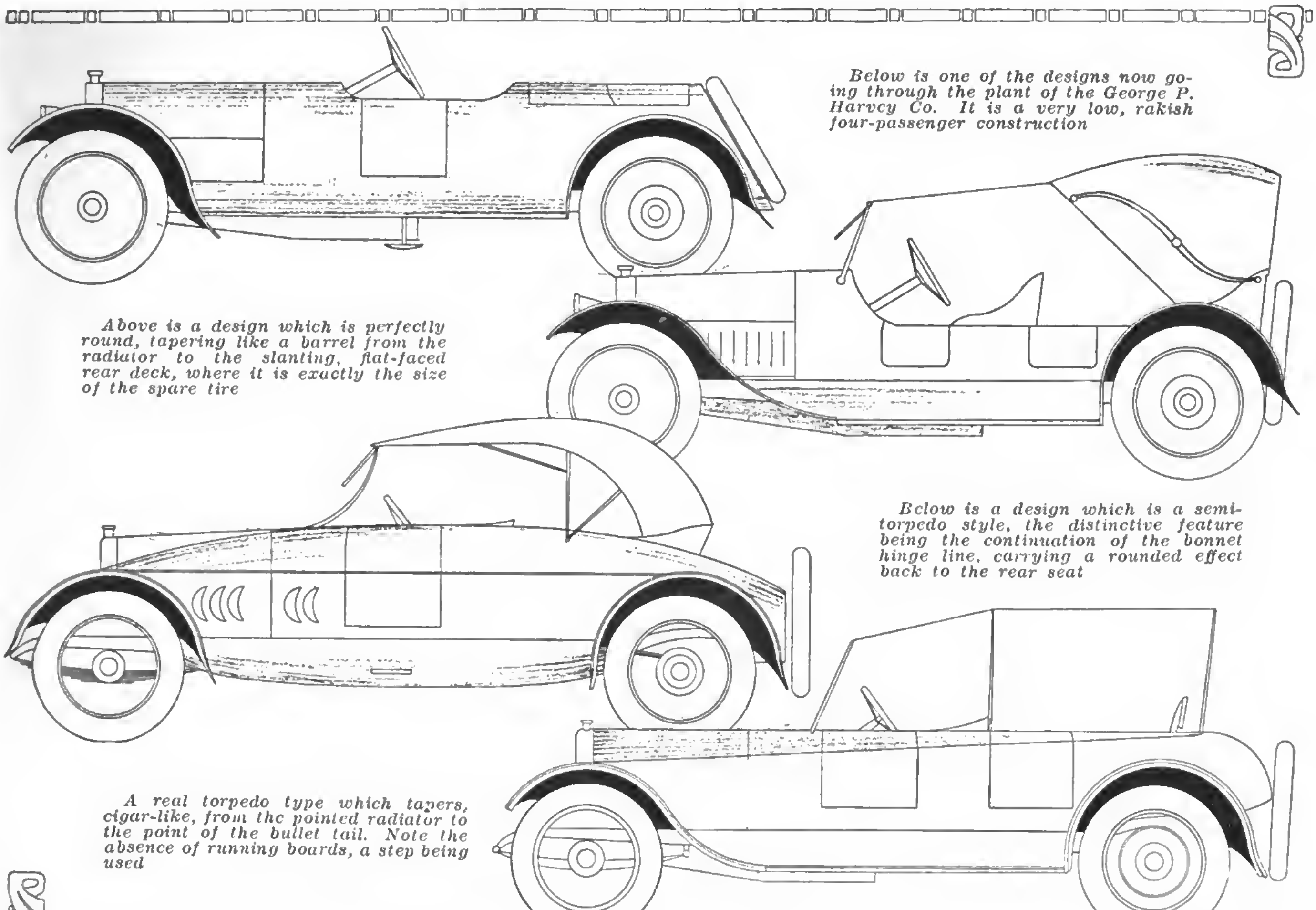


A coupé of unusual and distinctive lines. Note the slope of the top which merges gradually into the rear deck and the triangular window beneath the slanting windshield





Above and at the left are two designs which might be classified as freaks. The boat body was built to meet the fancy of a New York theatrical manager and the job at the left was conceived merely with the idea of attracting attention



Below is one of the designs now going through the plant of the George P. Harvey Co. It is a very low, rakish four-passenger construction

Above is a design which is perfectly round, tapering like a barrel from the radiator to the slanting, flat-faced rear deck, where it is exactly the size of the spare tire

Below is a design which is a semi-torpedo style, the distinctive feature being the continuation of the bonnet hinge line, carrying a rounded effect back to the rear seat

A real torpedo type which tapers, cigar-like, from the pointed radiator to the point of the bullet tail. Note the absence of running boards, a step being used

dwindled to almost insignificant proportions, the bulk of their trade now being in special bodies for automobiles. And all these companies are having no difficulty in obtaining business; in fact, most of them have more work on hand than they will be able to complete for some time. It looks as though the coachbuilder has come into his own, so far as the eastern section of the country is concerned.

New York is the great fashion center for body design just as it was in the early days of the industry when the only basis for these fashions was furnished by the products of European designers. The growing vogue of the custom-built body is bound to spread to other cities; in some of them, Boston, Chicago and Philadelphia for example, its influence has already been felt, and during the coming season it should become more and more a factor with the car-buying public, not only of the large cities but also of the smaller communities. Even the small towns of but a few thousand inhabitants each have several families sufficiently opulent to be attracted successfully by the advantages and attention-compelling qualities of special bodies for their cars.

A National Field

This opens up a vast field which should be developed during the coming years. The new ideas and the refinements in material, construction and design, brought out by the demand for the unusual, the beautiful and the durable in body work are bound to produce a marked effect on the stock body which the American automobile manufacturer will furnish with his car. It may be that more manufacturers will establish custom body departments as some of the high-priced car manufacturers have already done. It may be that stock bodies will be developed which may be changed readily in almost every respect to meet the requirements of the car buyer. The possibilities of the changes which may be thus indirectly brought about are so boundless that speculation is useless.

From present indications it would seem that the American custom body trade is graduating from a mere local occupation of negligible importance to a branch of the great automobile industry which will be national in scope, and involving thousands of men and immense capital. This will be the logical result of the formative conditions prevailing during recent years and at the present time. The demand is there, and where there is demand supply is usually forthcoming. The accelerated activity in the custom body field in New York City is significant of what may be expected, though probably in a lesser degree, first in the other large centers of population and later in the smaller communities.

Car dealers, particularly the more progressive, are featuring the attractions they are able to offer in the way of furnishing their customers with special bodies which will incorporate any of the car-buyers' ideas regarding appearance, comfort and construction, although most of the dealers are far-sighted enough to point out the impractical side of any suggestion which would be likely to result in ultimate dissatisfaction to the purchaser. Many employ designers especially to carry out the ideas of prospects desiring special bodies while others maintain close relations with coachbuilders, permitting them to furnish everything from drawings to the complete body.

Illustrative of the value of suggestions made by car-buyers to the body builders, and frequently these car-buyers know practically nothing of automobile construction, one coachmaker declares that he secures far more original and practical or near-practical ideas from his customers than from all of his competitors combined. And all report that customers are more numerous than ever before, because of increased prosperity and a wider recognition of custom bodies.

Analyzing Engine Cooling

An Accurate Determination of the Factors Affecting Cylinder Cooling and a Quantitative Examination of Air and Water Cooling Comparatively

Results of F. W. Lanchester's Researches Reviewed by A. Ludlow Clayden

PROBABLY no automobile engineer in the world has a greater reputation for originality than F. W. Lanchester of England. Mr. Lanchester was one of the first people to build an automobile in England and adopted an air-cooled engine. After using this for some years difficulties commenced, and a water-cooled motor was substituted. For the last five or six years Mr. Lanchester has not been connected actively with his original company, but has been doing consulting engineering and has given much time to original research.

In December, 1915, he presented to the British Institution of Automobile Engineers a paper dealing with cylinder cooling both by air and by water. This paper is of immense length, containing ample matter for a fair sized text book, and in it the mathematics of the subject are considered in a clear and fairly simple manner. The object of the whole investigation was to determine the relative advantages of air and water cooling in absolute terms.

Mr. Lanchester showed and proved that; weight being of primary importance in the automobile and more strongly still in the aeroplane, air cooling is the lighter system up to a certain cylinder size above which it ceases to save weight. The exact quantities of water and air to give theoretically correct cooling are determined in the paper and an examination made afterward to gage the relative weights.

Anyone deeply interested in the design of light engines could not fail to find this paper of real value, but it is much too long for it to be possible to reproduce it in THE AUTOMOBILE. In the following pages just the highest spots are brought out, and the mathematical proofs are omitted.

All Engines Air Cooled

In the paper it was first pointed out that automobile engines are all air cooled since the water in the ordinary cooling system merely acts as a carrier which can transfer the heat to the atmosphere. In pointing out the importance of having the greatest possible surface in a radiator in proportion to the volume of water carried, the author stated that a ¾ in. pipe will contain 1 lb. of water per square foot of surface, whereas in a properly designed honeycomb radiator the weight of water need not exceed 2 or 3 oz. per square foot surface. The object of emphasizing this point was to bring home the fact that the purpose of the radiator is to transfer to the air the heat which it is necessary to dissipate. The surface of the tubes in a radiator acts in precisely the same way as the surface of the gills on an air-cooled cylinder and the purpose of the water is to transfer heat from the small area of cylinder wall to a much larger area in the radiator, since the water is only a carrier it is obvious that the larger the radiator surface per pound of water the less water shall be required to insure effective cooling. We may now proceed to quote from the paper concerning Mr. Lanchester's first design for an air cooling engine.

Complementary to the problems associated with water circulation the automobile constructor from the earliest time has had to face the question of the circulation or free flow of the air.

The most prevalent defect or difficulty to-day, as concerning the flow of air, is the restriction commonly experienced in getting the air away from the bonnet. Thus large apertures beneath are inadmissible as admitting dirt and mud in quantity; ventage in the top is out of the question, and the rear is choked with mechanism. Louvres at the sides offer an obvious solution, but these are generally speaking banned as unpopular.

When we turn from cooling by water circulation to direct air cooling we encounter at once the main difficulties of the problem in an aggravated form. The motor cycle, especially the bicycle, is to some extent under the same conditions as the flying machine—it always operates between certain maximum and minimum speed limits, also the motor is rarely or never required to run with the machine standing. The motor cycle, however, is not so favorably situated as the flying machine inasmuch as its cooling may be seriously interfered with by a following wind.

As regards the air cooling of the full weight motor car, the author believes he can claim to have been responsible (in England at least) for the only serious attempt at air cooling on a commercial scale, namely in the Lanchester 10 and 16 hp. cars manufactured between the years 1900 and 1904.

In the design of his first air-cooled car, the author made very careful calculations of the jacket conductivity and surface required, but at that date, 1895, he had not at his disposal a reliable estimate of the total heat to be carried away, neither had he developed at that time the theory of surface cooling on the lines of his more recent work.

In the first experimental engine the gills were of copper, cast with a small percentage of zinc in order to secure fluidity; the conductivity was carefully calculated. The data for the calculation of the surface required were non-existent, and in this respect also the author had to rely upon some rough experiments conducted on his own account. Ultimately the total surface was regulated by the fact that it was found impossible with cast copper gills to get too much; the gills were therefore cast as separate plates as thin as possible and were spaced 5/16 in. pitch; the necessary air-way was calculated on the same basis as in the present paper. In other words, the total cross section of air-way in the jacket was designed to pass an ample volume of air under the available fan pressure; the fan was of centrifugal type formed by vanes on the flywheel rim. It should be noted that the centrifugal fan acted by pressure, the air being collected in an expanding conduit and delivered to the jacket at a pressure of about 1 in. water gage above atmosphere.

Certain improvements were effected in the jacket detail; spun or pressed sheet copper plates of light gage and pitched closely were substituted for copper castings. Cast aluminum gills were also tried with apparently equal success. Data as to these jackets are given in Figs. 1 and 2. Fig. 1 is a section of the jacket in which the gills are of cast aluminum, and Fig. 2 the alternative construction, in which 24 s.w.g. sheet copper is employed. In the two arrangements discussed, the author considers he had reached a high standard of efficiency in direct air cooling; the difficulties seemed to be virtually conquered. Unfortunately, in remodeling the design with a view to convenience in manufacture, concessions were made in the cooling arrangements in order to facilitate production. Thus the pressure fan was found to be very difficult to embody in the design, and eventually a suction fan was substituted. Again difficulties arose in the design of a cylinder and valve gear which would permit of the attachment of the copper gills, and probably the author committed an error of judgment in allowing himself to employ cast iron, that is to say, to substitute motorcycle practice for the practice which he had developed himself and which was undoubtedly far more efficient. The type and general arrangement of the centrifugal fans with friction drive as fitted in the later models (the 10 hp. and 16 hp.) are clearly shown in Fig. 3; this figure is self-explanatory, a comparison with Figs. 1 and 2 will show the extent of the sacrifice made to facilitate manufacture.

Suction Fan Bad

The suction type of fan also is bad; firstly, it is far less efficient, owing to the fact that no use is made of the velocity of the air leaving the fan. Secondly, as the jacket gets hotter the fan pressure gets less owing to the lower density of the heated air. When the first few cars were put on the road with these modifications a tendency to overheat was at once evident and it became necessary to greatly increase the draught. To this end frictionally driven fans were fitted in the place of the fan flywheel, and although by this means the cooling was rendered possible, the consumption of power became serious.

Having thus reviewed the subject in a general way, the author next proceeded to discuss the quantity of heat which it is necessary to dissipate.

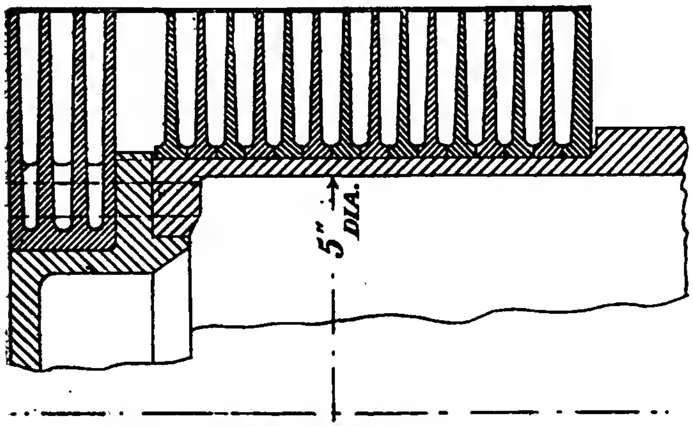


Fig. 1—Air cooled cylinder with cast aluminum gills

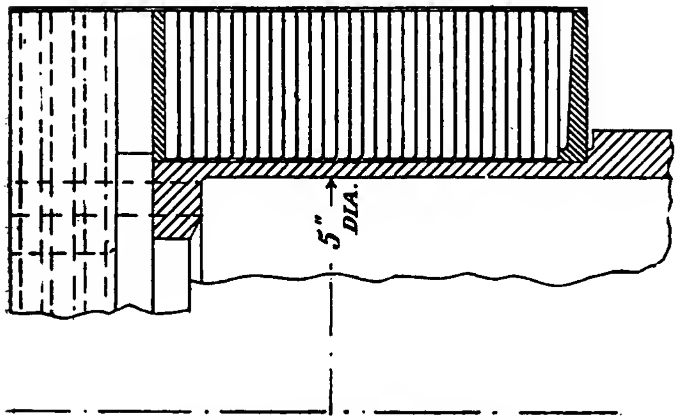


Fig. 2—Cylinder with sheet copper gills

From the practical side, modern experiment appears to show that the total jacket loss for any given engine:

(1) Is not (at full load) constant with regard to revolution speed, but increases as the speed increases but not in like ratio. Thus it is neither constant as an *amount of heat* lost nor as a *percentage of the total fuel heat*, it is something between the two. It may be accounted for approximately on the basis of a portion being a constant loss, and the remaining portion a constant percentage of the total heat. The heat loss may be represented by a diagram as in Fig. 4. This diagram has no pretensions to minute accuracy since much depends upon the design; it does, however, represent as near the truth as can at present be expressed in general terms. The upper of the two diagrams, Fig. 4a, gives the relative jacket heat loss for variations of piston speed. The lower, Fig. 4b, gives the jacket loss expressed as a percentage of the total heat value of the fuel. Abscissæ give the *cylinder diameter × mean piston velocity;* the units are the foot and the second.

(2) The jacket heat loss within ordinary limits is independent of the compression ratio.

(3) The jacket heat loss appears to vary approximately as the square of the strength of the mixture, or the heat loss expressed as a *percentage* varies directly as the strength.

(4) In an engine governed by throttle the *percentage* jacket heat loss is greater at low power than at full load.

(5) If the timing of the ignition be varied the *percentage* heat loss is greater when the timing is early than when late. Expressed, however, *in terms of the power developed,* the loss to the jacket is least when the ignition timing is *a little later* than that of maximum torque. This aspect of the subject is important; the question, in the case of an engine tending to overheat, is commonly the performance of a given task. Thus an automobile is less liable to boil its water when hill climbing, if the ignition is *very slightly* late.

Rule for Heat Loss

Thus we have the following rule for the expression of the heat loss:

The mechanical equivalent of the heat lost to the walls of the cylinder and combustion space in an internal combustion engine of ordinary type, may be expressed as equal to one-tenth of the mechanical equivalent of the heat value of the fuel consumed, plus 1 hp. for every inch of cylinder diameter.

The part of the heat loss which is a constant percentage of the total (*i.e.* mainly that lost as internal radiation) may alternatively be expressed as a percentage of the engine power, since this bears a fairly constant proportion to the total: it is roughly equal to one-half to one-third of the indicated horsepower, according as the thermal efficiency is about 20 per cent or 30 per cent.

Where a multi-cylinder motor is in question the diameter measurement will be the sum of the diameters of all the cylinders in inches.

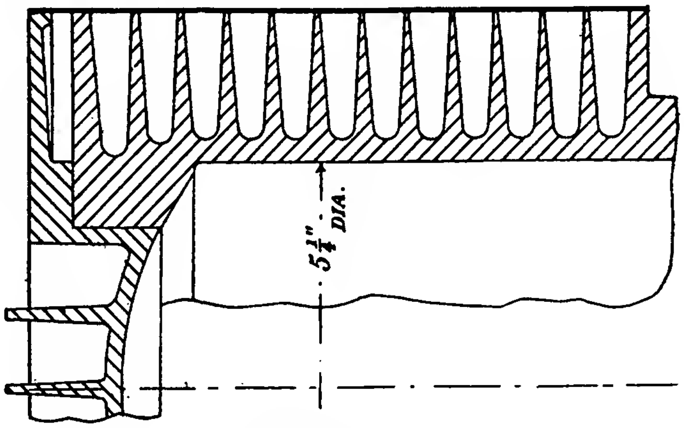
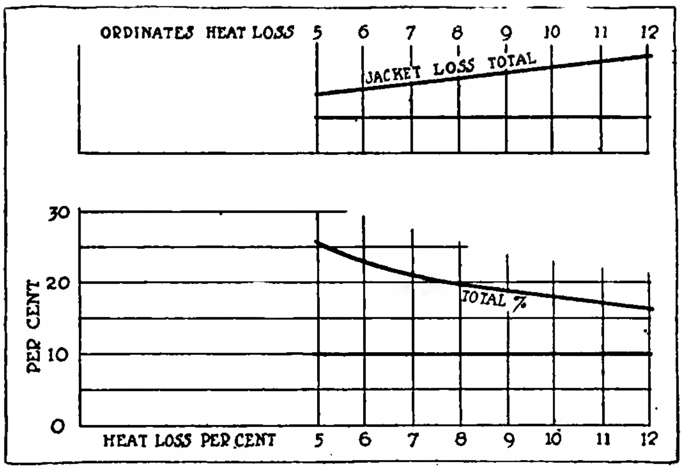


Fig. 3—Cylinder with cast iron gills



Diagrammatic Heat Loss Curves

It must be clearly understood that the foregoing does not include the heat discarded beyond the exhaust port; heat imparted to the exhaust pipe, if it is to be provided for in the jacket system, must be counted as extra.

It is also important to make it clear that the "radiation losses" discussed in the present section are not the same radiation losses as those sometimes referred to in works on the subject. The losses with which we have been concerned are those due to the radiation *from* the incandescent gases *to* the cylinder walls, whereas radiation losses are frequently spoken of as the radiation *outward* from the piston, jacket, and other portions of the engine, more especially as affecting the heat account when that is determined by experiment.

It will be found on applying the rule to actual examples that it frequently gives results slightly above those measured; possibly the allowance per inch of cylinder diameter is somewhat higher than it should be; however, the round figure 1 hp. per inch diameter is quite near enough for practical purposes.

Cases also occur in which the measured jacket heat is considerably greater than given by the rule, but in all these cases it will be found that exhaust heat, that is to say heat from the exhaust pipe, port, etc., is being included in the jacket loss. Either the water jacket extends around the valve box and branch, or a great deal of heat is communicated from the exhaust passages to the water jacket by conduction.

It will be shown later that when we come to the consideration of the problem of direct air cooling it is convenient to express the heat passing into the cylinder walls in terms of either *heat units* or *horsepower per unit area.*

Thus, for example, in the case of a cylinder 4 in. diameter by 6 in. stroke developing 12 hp. on a consumption of 8 lbs. gasoline per hour, the waste heat will be the equivalent of $6 + 4 = 10$ hp. Now the cylinder and compression space wall of such a cylinder would total up to about 0.75 of a square foot, so that we may express the heat loss as having a mean value of 13 *hp. per square foot* or 2.5 *calories per square centimeter per second.* The distribution of the heat loss, however, varies considerably, it is far higher in and near the combustion space than in the cylinder wall proper. The continuation of this discussion takes its place later in the paper.

Conduction Through Cylinder Wall

The passage of heat through the cylinder wall is controlled by the conductivity of the latter. The scientific basis by which the conductivity of a material is defined is the measure of the parallel flow of heat through a given sectional area of the substance for some stated temperature gradient. Thus employing C.G.S. units the area of cross section taken is one square centimeter, the gradient is 1 deg. C. per centimeter, and the quantity of heat transmitted, in (gram) calories per second, is the measure of conductivity. In other words, if we imagine a one centimeter cube of metal, of which two opposite faces are maintained at a difference of temperature of 1 deg. C., then if the amount of heat flowing through the cube under these conditions is sufficient to raise 1 gram of water 1 deg. C. per second, the conductivity of the said metal will be unity. This is approximately the conductivity of pure copper. The conductivity of copper and of other of the metals commonly emloyed by the engineer is as below:

Copper	0.9 to 1.0
Aluminum	0.5
Brass	0.25 to 0.3
Iron or Steel	0.15 to 0.2
Cast Iron	0.11 to 0.12

The conductivity of heat through the cylinder walls is one of the factors by which the maximum size of cylinder which can be employed (in an internal combustion engine) is ultimately limited. For a given number of heat units per unit area transmitted to the cylinder walls it is clear that the *temperature gradient* will be constant, and thus the difference of temperature between the inside and the outside of the wall of the cylinder and combustion space will vary directly as the thickness. The result of this is that, whatever the material employed may be, sooner or later a limit of thickness is reached at which the stresses set up in the material due to inequality of expansion result in its disruption.

If the relative conditions are to remain constant for variations of size, the conductivity of the material needs to be increased in proportion to the linear size. There is no way by which this can be practically effected.

As an example, the temperature gradient within the cylinder wall based on the mean value of heat flux above given (= 2.5 calories per square centimeter per second) may be given. Assuming the conductivity of cast iron $k = 0.11$, we have, *gradient* $= 2.5/0.11 = 23°$ C. per centimeter.

(b) *Conduction by Gills; and*

(c) *Heat Transference from Gills to Air.*

In a direct air-cooled engine the function of the gills is to carry the heat from the outside of the walls of the cylinder and combustion space and convey it by conduction radially outward, and eventually to give it up to the surrounding air. Thus the surface of the gills requires to be of sufficient area to dispose of the heat to the air, and the section through the gills, that is to say, the sectional area of metal taken normal to the heat flow, must be sufficient to transfer the said heat by conduction without too great a temperature gradient.

Thus the calculations of the gills involve two distinct problems: (1) the problem of the conductivity as in the case of the cylinder wall; (2) the problem of the surface disposal of heat, that is to say, the passage of heat from the surface of the conducting metal to the surrounding air.

Stated briefly, a definite relation is established between the velocity of the air over the surface, the temperature difference, and the rate of heat loss. In addition to this the power *necessarily* lost in cooling is also established in relation to the other quantities. The results of the investigation may be expressed either in diagrammatical form, or in the following equations:

If θ = temperature difference (degrees F.) between hot surface and atmosphere, and

V = velocity of air; ft./sec.

$\frac{\theta V}{15{,}000}$ = hp. equivalent of heat dissipated per sq. ft. of surface.

and

$\frac{V^3}{100{,}000{,}000}$ = hp. expended per sq. ft. in skin friction, representing the theoretical minimum work done in cooling.

(To be continued)

Results from a Special Spring Suspension Developed for Brewery Trucks and Applicable to Automobiles

Increased Load Capacity Gained by Larger Flexibility and Range of Action—Stability Secured by Coupling Auxiliary Coil Spring for One Wheel with That for Its Mate—A New Factor in the Coupling

Data from an Exceptional Installation Which Has Been Tried with Modifications for Several Years, the Effects Being Noted in Operative Results as Well as in the Upkeep Accounts

By Marius C. Krarup

GREAT reluctance against employing a very flexible spring suspension for heavy, load-carrying commercial motor vehicles is commonly observed among both makers and users and is probably mainly due to four factors: (1) The stability of the load suffers, (2) jolts are aggravated under certain conditions (two potholes in quick succession and similar causes) unless suitable shock absorbers are used, (3) the spring dampers or shock absorbers in the market are not robust enough for heavy loads supported on very flexible springs and (4) a flexible suspension of good quality costs more than a stiff suspension. On the whole, while the waste of power and wear on tires and mechanism due to the toss of the body and load over a set of stiff springs are aggravated for the average running, acute troubles are more liable to occur with flexible springs, unless a reliable system is devised for managing the flexibility automatically in a way that is suitable for all—ALL—road formations and vehicle speeds that must be contemplated as possible. Such management has not so far been found practicable for heavy vehicles, especially not for those made topheavy by their loads and calling for strong forces to oppose rolling and pitching. The majority will rather take their chances with a stiff suspension—one stiff enough to keep all irregular movements of body and load within a small range of action, even if the shocks causing such movements are received on one side of the vehicle only—than with any proposed remedy for the brutal shocks, harmful vibrations and relatively high operating and upkeep cost inseparable from its use. The troublesome steering usually associated with a flexible front suspension also has to do with the preference for small spring action and must be remedied before the benefits of a higher degree of flexibility can become wholly acceptable.

Relief is sometimes sought in flexible tires or spring wheels — whose spring action does not affect the steering perceptibly—but it is too often overlooked that any tire or spring wheel which flexes considerably under the load it carries consumes a large share of the power used for propulsion and that the power so wasted in the useless continuity of flexing incidentally wears out the tire or spring wheel itself, thereby causing additional expense. Only when roads are uniformly rough and the vehicle speeds are high is the account balanced, as between gain and loss from springs of the rotating type—elastic tires and spring wheels—the gains in that case coming from their prompt interception of shocks an instant before the leaf springs are attached, the flexibility which they add to the total suspension and the well-known special advantages of pneumatic tires in absorbing small obstacles without vertical rebound. But even these advantages are not under all road conditions compatible with the stability required for high loads.

Five-ton High Cab "76" with Williams suspension, carrying 6 tons

A Useful Paradox

A high degree of flexibility should therefore preferably be secured through the spring suspension proper for all relatively slow vehicles, and not be derived to any considerable extent from the tire equipment, whose proper function here becomes that of securing friction for traction and of reducing noise and vibration. But such flexibility must be reconciled with stability, which means the avoidance of pitching and rolling, lurching and teetering, the management of load-toss, rebound and oscillations and also the safety of steering. In its briefest form the problem of good "springing" is simply that of COMBINING FLEXIBILITY AND STABILITY. Even the quality of spring material, guaranteeing against sag and variations of tension, may be included under the term of stability, to give full breadth to this useful definition.

Every known method for combining stability with flexibility involves some reduction of the flexibility for severe jolts and much guiding of it into narrow paths of action. The damping of rebound is always included in some degree, if only incidentally, but is not always systematically controlled. Its effectiveness is at all events limited, being greater in proportion as the running-gear is heavy. Pitching is mainly reduced by using flat springs and checking the rebound.

A Brave Departure

While many pleasure cars have had the flexibility of their suspensions very materially increased by means of the Westinghouse air spring equipment and a much larger number of them are fitted with auxiliary coil springs, which provide a short range of flexible spring action especially adapted for coping with the small rugosities of paved city streets, a case in which five-ton trucks have been operated for years with a suspension about twice as flexible as that provided by the manufacturer is so exceptional as to deserve more than passing attention, for the sake of the vital principle it illustrates as much as for the details of the construction employed. Such a suspension is that provided for two Ebling brewery trucks in New York City by Mr. W. R. Williams. Its history and characteristics are given in the following, and it will be noticed that the principal means employed for keeping the truck body and load on an even keel consists in compelling every one-sided jolt to take effect upon the supplementary helical springs on both sides, so that not only is the suspension less flexible for jolts that strike one wheel only than for those striking a pair of wheels squarely, but a certain action is communicated from the side where the jolt is received to the other, tending to extend the leaf spring on this other side, against the gravitation of the axle, but at the same time tending to compress the supplementary helical spring on the same side. This action seems in practice to have a tendency to make the frame on that side follow the vertical movements of the frame on the side where the jolt is received. The complication of factors at work is considerable—too considerable for safe reasoning with different road formations in mind—and the results obtained in practice therefore become so much more interesting.

The Latest Actual Construction

The construction of the Williams spring suspension actually in use on Ebling brewery trucks does not correspond fully to what the designer would consider ideal arrangements, as the installation had to be adapted to the original equipment of the two 1910 Mack trucks to which it is applied and some changes in the shapes and heights of attachment of the front leaf springs might be desirable, but, such as it is, it has given the results referred to later. It is shown in detail in Fig. 1, giving the rear suspension, and Fig. 2 for the front suspension. It will be noticed that in both places the rear end of each leaf spring supports the frame of the vehicle through the intermediation of a large supplementary helical spring, of the railroad truck spring variety; that the movements of the leaf spring, as well as of the coil spring, are guided by means of a 15 in. lever, by bar and shackle connection, and that these levers on opposite sides of the vehicle are made integral with a cross-bar and therefore with each other, the cross-bar forming the pivotal axis for the turning movement of the two parallel levers.

The helical springs at the rear are within the frame lines and extend from the top level of the frame down, while those in front bear against projecting ends of angle irons secured under the frame, their low position being due to considerations of accessibility with regard to the motor and other parts. Though these details in the actual arrangements influence the flexibility for one-sided shocks slightly, they can be compensated in the choice of the spring dimensions and do not greatly affect the practical results, as the cross-bars almost equalize the forces acting upon the two helical springs of a pair, whether they are at the ends of the cross-bar or closer together. Theoretically, if the cross-bar were absolutely rigid against torsion and bending as well as in its bearings, one helical spring of double strength could take the place of the pair of them without changing the effects. The different positions of the helical springs in front and rear are perhaps mainly of interest to show the adaptabilty of the whole plan to different truck designs; the cross-bar, in addition to its main function, giving considerable freedom with regard to the location of the auxiliary coil springs.

The supplementary helical springs add of course greatly to the flexibility of the suspension, as compared with the original leaf spring equipment. With a range of action in one of these coil springs of 6 in., the additional range of action produced at the axle is about 3 in., if the axle is about at the middle of the leaf spring, and the slight angularity of the whole spring movement, especially in front, modifies this relation only a trifle. In the appended table giving the

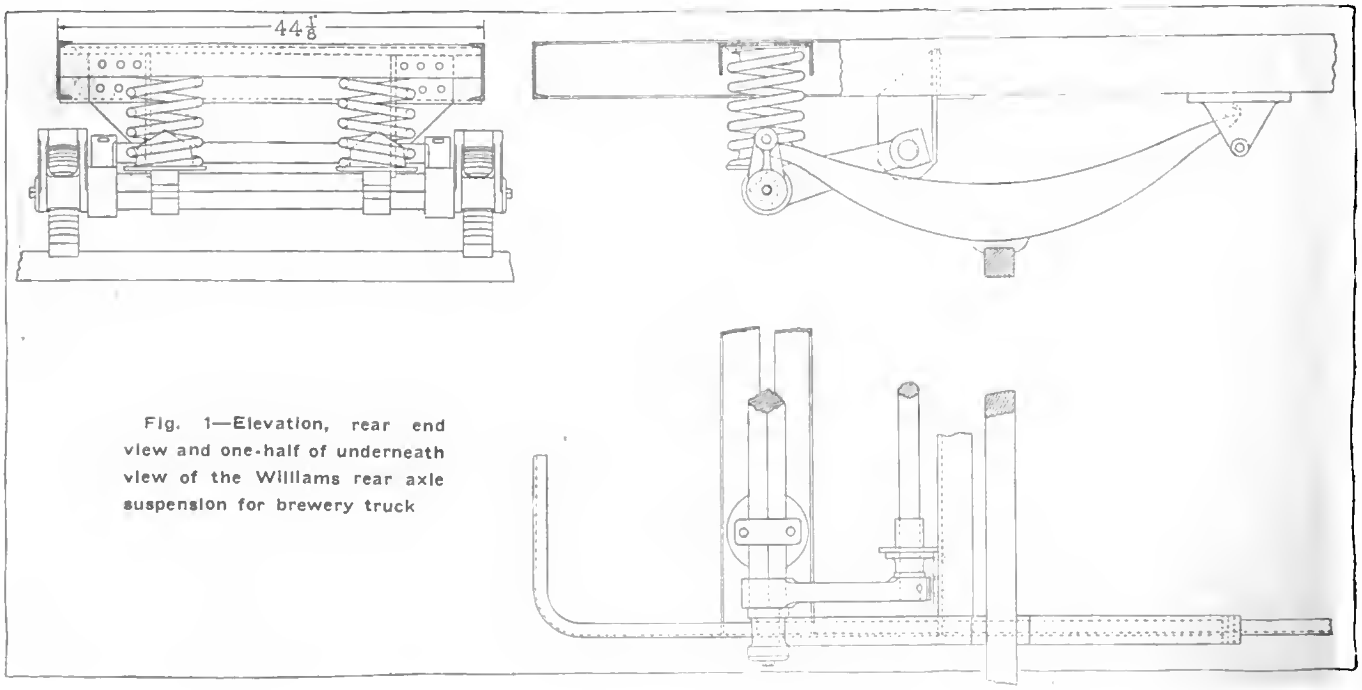


Fig. 1—Elevation, rear end view and one-half of underneath view of the Williams rear axle suspension for brewery truck

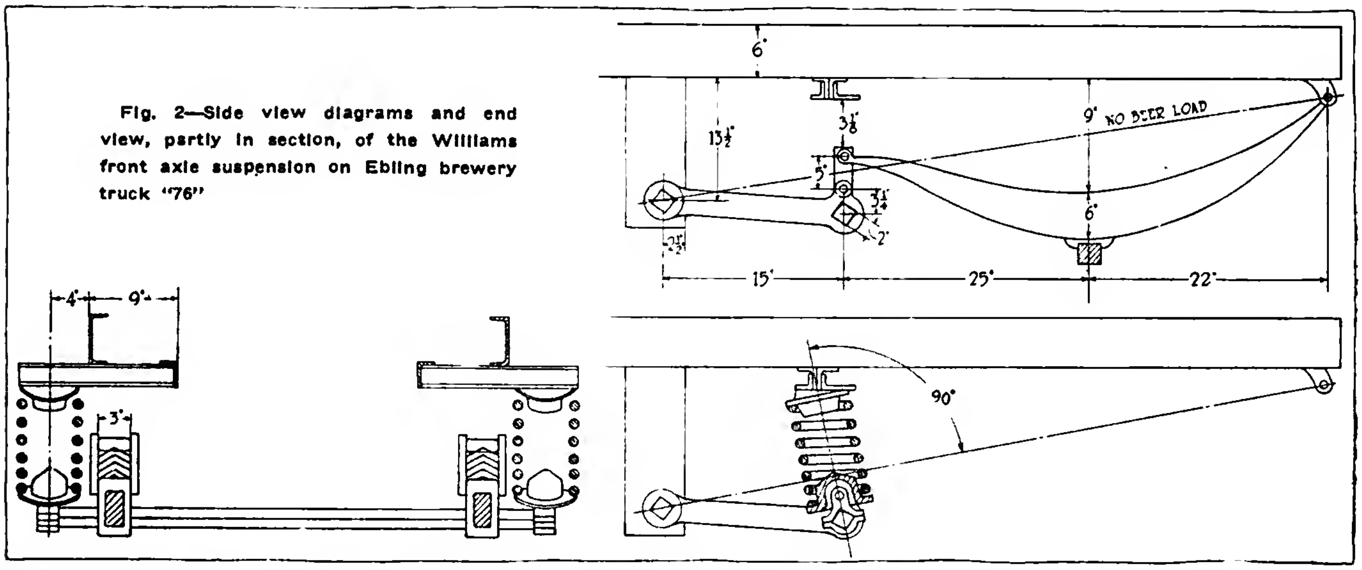


Fig. 2—Side view diagrams and end view, partly in section, of the Williams front axle suspension on Ebling brewery truck "76"

flexibility of the different elements in the suspension, the radical change which is brought about in the relative mobility of the running-gear and the truck body with its load can be followed up in its details. It is so considerable that the question of the means for producing the required stability at once arises. What is there to prevent the body and load from settling down sharply upon the springs on one side of the vehicle, while extending those on the other side, and causing the high load to tip dangerously, and perhaps to oscillate from side to side in a manner that is wholly unacceptable and may set up incalculable forces making for the overloading of the springs on either side and for the breaking of things in general? What, further, is there to prevent the rear end of the load from pulling the rear springs up in the air and pitching forward against the front springs, if the truck is stopped suddenly by the brakes or receives a sudden check from the road, as when it strikes level ground after coming downhill at the rate of speed in which some truck drivers are prone to indulge at times?

If plain leaf springs of a flexibility corresponding to that of the Williams suspension were used, it is known that the results, so far as these undesirable large movements are concerned, would be unacceptable—not to mention what would happen if rolling and pitching were combined, as when a topheavy load coming downhill swings to one side the moment the level is reached and throws the momentum of all the straying forces upon the front wheel and springs at the peak of the turn.

Three Factors for Stability

The provisions which guard against rolling in the Williams suspension comprise three main factors. The cross-bar against which bear the lower ends of each pair of helical springs forms a very rigid rectangle in conjunction with the two guide levers and the other cross-bar, already mentioned, which consolidates these two levers, and, as the four bearings in which the rocking movement of the rectangle take place are also very substantial, this movement cannot depart measurably from verticality in relation to the truck frame, and the greater the tendency is to depart from this desired direction of the movement the greater is the restrictive friction produced in the four bearings of the rectangle. The rolling permitted is therefore no greater than that which could occur with an equipment of stiff leaf springs alone, and, as shall be seen directly, it may be less. The second factor—which is in reality the first and most important one in the origin of the design, working farther back in the chain of causes and effects—does not only resist a tendency to rolling, as the first-mentioned factor does, but obviates such a tendency before it is born. It consists in the action of the united guide levers to compel the helical spring on either side to follow the flexions of its mate, directly actuating it to that effect. By this action every one-sided shock has a less flexible suspension to deal with than a shock of twice as great force which is evenly divided between both wheels of a pair. In other words, the shock which would tend to cause a rolling movement of body and load is more stoutly resisted than one which is squarely received, and, particularly, that part of the spring action which affects the helical springs (as well as the spring reaction, which is frequently more important in affecting the body movements than the first action) is equal on both sides and develops no tendency to roll. The stouter resistance may not be an advantage, but the equalization of movement is.

The square shock on the other hand, receiving the benefit of the full flexibility, develops less tendency to up-and-down tossing of the load at the first impact than would be experienced with a stiffer suspension, while the numerous friction elements introduced in the Williams design must also have a marked damping effect on rebound and oscillations, though apparently not one which has been systematized any more thoroughly than is the case with similar desirable effects produced incidentally, but in lesser degree, in other constructions.

New Effect from Compensating-Bar

The second factor, considered only as the equalizing of the auxiliary spring movements on both sides of the vehicle, is almost identical in effect with that produced under the A. A. Remington patent for Wolseley cars to obviate the roll with cantilever springs—and, according to Mr. Williams, the system in this respect dates back to the buggy age in this country—but the third factor for guarding against roll with the Williams suspension is special and has apparently been incorporated in the design without deliberate intention. The designer does not emphasize it, but it is discernible in the construction. It is hard to trace its exact mode of action under all different conditions of spring and vehicle movements, but it is easy to see that it is present under all of these conditions and to believe that it may be responsible for some of the good results obtained in practice. This factor is the one mentioned at the outset; namely, the arrangement by which the guide levers enter between the two spring elements on each side in such a manner that a compression of both leaf and coil springs on one side causes only the compression of the coil spring on the other side but not that of the leaf spring—on the contrary tending to extend the latter. With the Remington construction the equalizing bar, when turned by a compression of the cantilever spring on one side, transmits a compression movement to the entire spring on the other side, and, as there is no obstruction in the road on that side to cause the wheel and axle to be raised, the tendency is to lower the body on that side, since the distance between body and axle is reduced by the equalizing-action. With the Williams suspension, on the other hand, whenever the acting forces come from the point of ground contact of the wheel they act alike on the leaf and on the coil spring most directly affected, compressing both; likewise, when the forces affecting the springs arise from movements of body and load, they either cause the compression of both leaf and coil spring or the extension of both of them. But, on the opposite side of the vehicle, and whenever there is question of forces transmitted through the equalizing cross-bar and taking effect at the free end of one of the guide levers, then the coil spring directly affected by these transmitted forces is compressed and the leaf spring is extended, or else the coil spring is extended and the leaf spring is compressed. In all cases, however, some modifications in results are due to the facts that the weight of the body and load is superior to that of the running-gear and that the front end of the leaf spring is attached directly to the vehicle frame.

Without attempting to follow the effects of this third factor in all their ramifications, throughout the complicated oscillation and rebound forces which may arise, it is clear that this factor may be a new and useful one in the art of "springing" a vehicle.

Pitching and Steering

With regard to provisions against pitching and excessive rebound it does not seem to the writer that the construction in itself offers all the safeguards that may be needed, but an examination of the illustrations will show that the usual precautions are observed; that is, there is little opportunity given to the body and load for moving forward with relation to the running-gear or for the transformation of such a tendency into a rebound movement of the rear springs coupled with a compression movement of the front springs. And the obviation of roll also tends to reduce pitching, the consolidation of the springs on the two sides rendering it necessary to overcome a greater resistance to the starting of a pitching movement than would be encountered with an ordinary suspension if it happened that one spring in front and one in the rear were already in a position favorable to a pitching movement, as they may easily be with a heavy load, a bad road and a frame possessing that capacity for torsion which now by many is considered preferable to any attempted rigidity of the frame, which after all cannot be absolute.

It should be added that the designer, Mr. Williams, would prefer to use leaf springs with considerable less curvature than is shown in the illustrations, and such almost straight springs would give additional security against pitching.

There remains to be mentioned the steering. After certain changes had been effected in the proportions of the steering linkage of the original trucks, the steering has been found satisfactory despite the greatly increased flexibility of the front springing, and with the use of nearly straight leaf springs the designer estimates that all "kick" can be eliminated. The changes made in the original steering arrangements of the trucks are illustrated in Fig. 3 and described in connection with that of other steps in the development of the whole system.

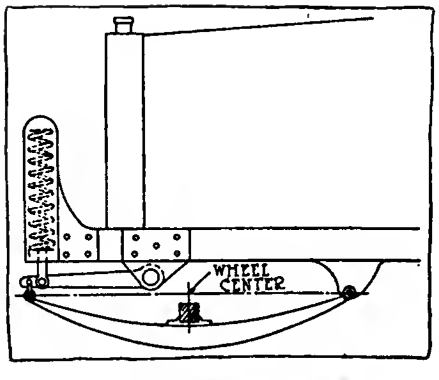


Fig. 4—Williams suspension applied to front of pleasure car

Results in Practice

The results accomplished with the Williams suspension in its progressive stages of development were attested on Jan. 5, 1915, by H. Mehlhop, superintendent of the delivery department of the Ebling Brewing Company, in the following terms:

> "These installations have been very satisfactory.
>
> "The tire mileage is increased about 50 per cent and the trucks will run about one-half longer without overhauling. The suspension is mechanically satisfactory, requiring very little attention or repairs.
>
> "About six months ago we equipped one of the trucks carrying your suspension with a heavier rear axle and springs, and since that time this truck has been carrying 60 to 65 halves. This has been so satisfactory that we intend equipping two more trucks with your suspension this winter, and finally, to equip all our trucks with it."

Though no new units with the improved suspension have as yet been added to the Ebling installation, Mr. Mehlhop recently confirmed in person the estimate of its practical value contained in his letter of fourteen months ago. By "halves" is understood half-barrels of beer, each weighing 200 lb. The load carried on truck "76," which is the one shown in the accompanying halftone illustration, has thus become regularly 6 to 6½ tons instead of 5 tons, and occasionally, it is stated, it carries 6 8/10 tons, which is the limit of its volume capacity in half-barrels. Another 5-ton Mack truck, "75," originally similar in all respects, but not provided with the new suspension, is only allowed to carry a maximum of 5 6/10 tons, in view of the company's accumulated experience with regard to tire wear and repairs of the whole truck mechanism. As in the brewery trade it is reckoned that a rated 6½-ton truck, where it can be used to advantage in the routing of the vehicles, has a 30 per cent higher earning capacity than a 5-ton truck, with only a 10 per cent higher operating cost, the economical importance of improved spring suspension is strikingly illustrated in the present instance, since here, according to the testimony of the truck operators, the improved suspension has brought about the higher loading and earning capacity, while the operating and general upkeep cost is reduced, instead of being increased 10 per cent.

As the Williams system in truck "76" adds rather more than 1000 lb. to the weight of the vehicle, the upkeep economy is so much more surprising. The empty truck originally weighed about 5 tons and carried 5

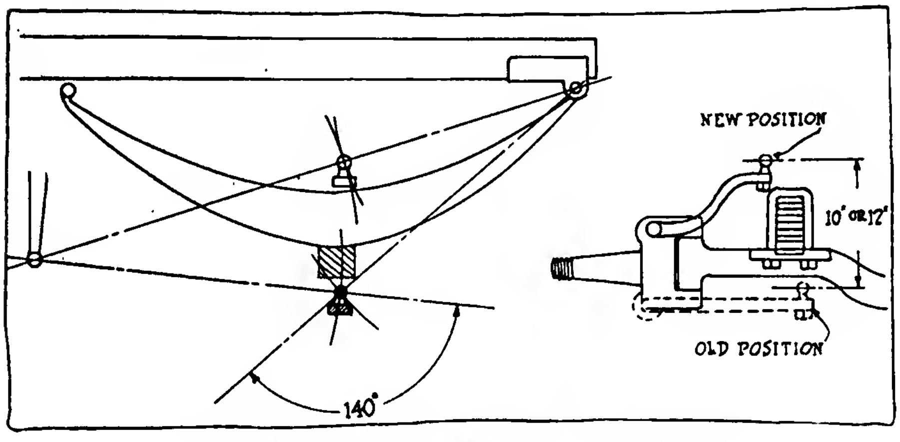


Fig. 3—Illustrating changes made in original steering linkage

tons. With the addition of ½ ton to its weight it carries 1 ton more of useful load. While the added weight cannot be looked upon as an advantage, it may thus be said, as the designer suggests, that the new suspension feature does twice as good work in the matter of carrying loads as the original construction. All the four Mack trucks among which the comparison is established are, however, from 1910 and have all been in brewery service since that year. No. 76 has been operated with the Williams suspension about three years.

Some notes with regard to the earlier stages of the Williams suspension are of interest, showing the growth of the idea and the modifications which have been found desirable. They are here given substantially in the words of Mr. Williams and upon his authority.

Earlier Installations

"The initial truck installation, which was necessarily crude, was applied to a 5-ton Low Cab Mack truck, "79," replacing another special suspension, and remained thereon about three years. This construction, which is not now followed, practically entirely obviated friction for the whole range of helical spring action when the truck stood on a level. The pressure of the little finger would set the front end of the truck in vertical motion, and a stronger finger would do the same at the rear. Four helical springs were used in front.

"After reconstruction, a rear arrangement similar to that on High Cab "76" was installed, but installation of the improved front suspension, with only two helicals, has been deferred, owing to construction difficulties with this type of truck.

"I was forced, however, to correct in "79" certain peculiarities in the steering gear design, which became defects and very noticeable with the mounting of the helicals and the higher flexibility (and which have also been changed in later Mack output)."

The changes made are illustrated in Fig. 3.

"Thereafter the only steering defect in "79" was the difficulty experienced in bad going and in turning wheels when going slowly or at a standstill. This was due entirely to decreased leverage, enforced by the limitations incidental to the change of design. In explanation of the sketch (Fig. 3) I will state that, on looking over a layout of the original front construction of the Low Cab, I find that a 2-in. deflection of the leaf spring produces a horizontal movement of the knuckle-arm ball-end toward the steering-arm ball-end of 1 7/16 in. Evidently, very little action was demanded of the springs. The relation of the three points—steering-arm ball-end, knuckle-arm ball-end and front spring eye—formed an angle of, roughly, 140 deg.

"In the reconstruction the right and left knuckles were exchanged and inverted, and the knuckle-arm ball-end was raised to a point in a straight line with the front spring eye and the steering-arm ball-end. The difference in height of the old and new positions was from 10 to 12 in.

"On the other hand, the somewhat similar action on High Cab "76," to accommodate the entire action of both leaf and helical springs, is about 1/16 in., or less than the play in the gear."

Applications to Pleasure Cars

The very first application which Mr. Williams made of his system for a spring suspension, before it had been developed to its present form, was to a Panhard landaulet to which semi-solid tires had been fitted on the rear wheels, taking the place of 5-in. pneumatics, in the hope of reducing tire expense.

At present he contemplates to apply the improved system to pleasure cars in the form which, so far as the front springing is concerned, is indicated in Fig. 4, while the rear suspension, it is understood, may take either a similar appearance or be patterned more closely after that used for the Ebling trucks.

Conclusions

In reviewing this account it cannot but occur to the reflecting mind that, in order to reach final conclusions, it would be desirable to compare the practical efficacy of the Williams suspension with that of other suspensions in 1915 or 1916 trucks, and to have the comparison of operating and upkeep cost accompanied by such definite data on the tire equipment, repairs and gasoline consumption for each of the compared vehicles as would establish an indubitable equality in the test conditions on the most essential points. Notwithstanding these reservations which may be called academic, as equality of conditions is never maintained for a couple of years in truck practice, or duly recorded, and a margin is always left for surmise on one point or another—it may be said that the Williams suspension makes out an excellent case for High Flexibility plus Stability by Special Means, and presents a realization of such special means which is extremely interesting and worthy of the closest investigation in theory as well as in practice; for pleasure cars, where the construction can be much lighter, as well as for trucks.

Data for Comparison of the Flexibility of the Williams Suspension and the Original Spring Equipment in Two Types of Trucks, the Working Results with Both Suspensions in Both Types Being Known

(All Measurements by Mr. W. R. Williams)

				DEFLECTION UNDER LOAD, IN INCHES, MEASURED AT AXLE						
					LEAF		HELICAL		TOTAL	
	Notes on Equipment	Vehicle Weight	Load Distribution	Load	Front	Rear	Front	Rear	Front	Rear
"78" 5-ton Low Cab (unchanged)	Platform and "helper" or overload spring on rear end.	About 5 tons	1 to 9 on front and rear	5 tons	3/16	2⅞	....	....	3/16	2⅞
"79" 5-ton Low Cab with Williams Suspension	New rear semi-elliptic leaf springs. Four helical springs at front, each of flexibility 100 lb. per inch, 4-inch coil diameter, 12 inches long, 7/16 inch round steel. Two helical springs at rear, each of flexibility 650 lb. per inch, 8-inch coil diameter, 15¾ inches long, 1 inch round steel.	About 5½ tons	1 to 9 on front and rear axles	Body only	....	....	1⅞	15/16	....	....
				5 tons	7/32	2¾	15/32	1⅝	11/16	4⅜
				Reserve	....	....	21/32	9/16	....	....
				Maximum			3	3⅛		
"75" 5-ton High Cab (unchanged)	Platform spring on rear end	About 5 tons	1 to 3 on front and rear axles	5 tons	⅝	3⅜	....	....	⅝	3⅜
"76" 5-ton High Cab with Williams Suspension	All 4 original leaf springs reinforced with 2 additional leaves. Original rear axle replaced by heavier one. Two helical springs at front, each of flexibility 360 lb. per inch, 6-inch coil diameter, 12 inches long, ¾ inch round steel. Two helical springs at rear, each of flexibility 680 lb. per inch, 8¾ inch coil diameter, 15¾ inches long, 1 1/16 inch round steel.	About 5½ tons	1 to 3 on front and rear axles	Body only	....	....	1 7/16	0.64	....	....
				6¼ tons	1 3/32	1.47	1⅛	2.03	2 7/32	3½
				Reserve	....	....	7/16	0.77	....	....
				Maximum			3	3.44		

NOTE—Leaf spring reserve remains after helical maximum is passed. NOTE:—Actual deflections of the helical springs are about double those measured at axle.

Detroiter Six Has Cable Brakes

Simple Chassis with Continental Engine Latest Detroiter Model

THE new Detroiter Six-45 is the latest model of the Detroiter Motor Car Co., Detroit. Built upon a chassis of 118 in. wheelbase, this six utilizes the slanting frame, the unit attachment of motor and gearbox and the Hotchkiss type of drive through the semi-elliptic rear springs, which are hung under the axle. The motor is a standard Continental block-cast type with the cylinder head detachable.

Cylinders are 3¼ by 4½ in., giving 25.39 hp. by the N. A. C. C. rating, although the power is said to come to 38 on the block at 2000 r.p.m. The displacement is 223.95 cu. in., and the stroke-bore ratio 1.38. The cylinders and upper half of the crankcase are cast in one piece, valves are on the right and, of course, completely housed in, but the carbureter is bolted high on the left center of the casting, so as to make it easy to get at and simplifying the control. Nothing else is placed on the left except the starting motor and the breather and oil gage. On the right are the exhaust manifold, the generator and the water pump.

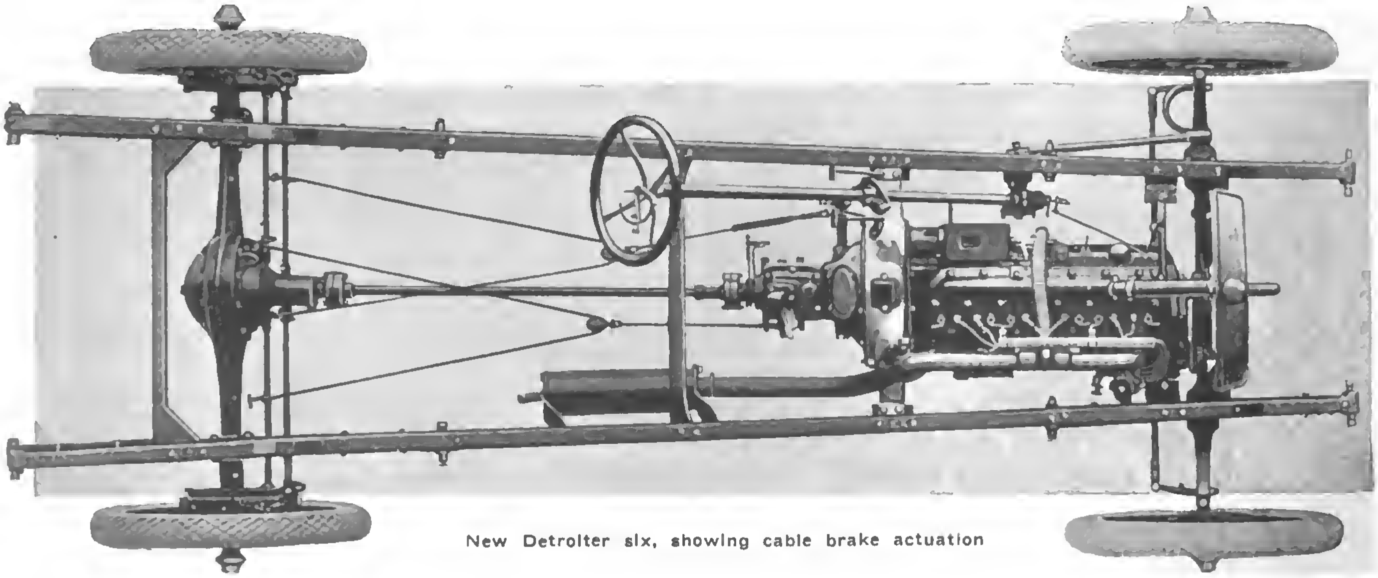
Auto-Lite Equipment Fitted

The Ball carbureter is used, and the fuel is drawn from an 18-gal. tank suspended at the rear of the chassis and delivered by the Stewart vacuum feed apparatus. Connecticut battery ignition is another feature, the distributer being mounted on the right forward side of the engine. Auto-Lite starting and lighting have also been well-applied, the starting unit hugging close to the flywheel housing on the left and connecting to the flywheel teeth by the Bendix scheme for automatically meshing and demeshing. The generator is driven off the end of the centrifugal pump shaft through a coupling that is designed for silence at all times. The electric system is of the single wire type with grounded return circuit.

From the figure mentioned above, it will be noted that this engine is of the moderately high-speed type, and throughout the internal construction this idea has been carried out by balancing the rotating and reciprocating parts and making them as light as possible for the work they have to do. The crankshaft is a three-bearing type that has 2⅛ in. main bearings and 2¼ in. crank-pins. The rods are long and drop-forged from 0.35 carbon steel and they attach to light iron pistons that are fitted with two rings each. In the valve system, the passages have been made of a generous size to prevent any restriction of gas flow, as is evidenced by the valves having a clear opening of 1⅝ in. They are made with nickel-steel heads welded to stems of carbon steel. Timing gears are helically cut, and the timing gear is made of specially prepared silk to insure quiet operation—a refinement that has been very quietly developed by motor engineers and which does much for the cause of silent motor operation.

Clutch and gearset assembly are compactly arranged to bolt to the flywheel housing by a regular form of bell construction, and they are designed in conformity with good and conservative practice. Five driving steel plates and six driven plates that are faced with Raybestos make up the clutch assembly, which requires no lubrication save at the bearings. The gears have a ¾-in. face, and are made of crucible nickel steel, case-hardened, heat-treated and ground.

It is doubtful if greater simplicity could be worked out in the construction of the chassis back of the power unit than has been found possible in this Detroiter. This is especially due to the elimination of either a torsion tube or torque rod by the use of the Hotchkiss drive. Thus simply a plain drive shaft, fitted with a universal at either end, spans the distance from gearbox to rear axle. Even the conventional brake equalizers are absent, a unique adaptation of pulleys and steel cables taking their place. The top view of the chassis will show this feature clearly. Running part way back from the foot brake and hand lever are two rods that terminate at pulleys through which the steel cable passes. The ends of the cable attach to the levers on the brake-operating rods that are attached to the axle housing. Pressure on the brake control, therefore, is transferred through the rod to the pulley, and thence delivered equally through the cable to the service or emergency pair of brakes, as the case may be. This is about as simple as a braking system could be made, and yet it is strong and positive in its action and should be noiseless. Needless to say, there is an adjustment in both sets of



New Detroiter six, showing cable brake actuation brake connections to take up any slack in the cables. The brake drums are 12 in. in diameter and have a 2⅝-in. face.

Springs Are Extra Long

A pressed-steel housing, ribbed at top and bottom externally, is used in the construction of the floating rear axle. The axle gears are of the spirally-cut variety now so universally used, and the whole differential unit operates on ball bearings, with roller bearings in the wheels. The rear cover is made as large as possible, so that it is easy to get at the gears for adjustment or other purposes. In order to be amply strong, especially in the case of the rear set which has to take the drive and torque, the springs are made of chrome-vanadium steel. Riding qualities are fostered by making them long and flat, the rear pair measuring 52½ in. and the front 36 in. The rear pair are substantially hinged to frame brackets at the front end, and are shackled at the rear to the bent-down back ends of the side members of the frame. Although underslung from the rear axle, the car nevertheless has a road clearance of 10 in.

Detroiter Six-45

At the present time, only the five-passenger touring body is offered, and it carries complete appointments and equipment in every respect. The upholstery is leather, and the tires are 33 by 4 in. all around, the rear set being of the non-skid variety. Special fittings, such as a tonneau windshield, Motometer or wire wheels, can also be furnished, though at extra cost.

Exhaust Turbine Drives Generator

WHAT may prove to be a valuable development and a new use for the wasted exhaust pressure, is the turbine operated generator. The turbine is driven from the exhaust gas. The idea was suggested to two employees of the Old Dominion Copper Co., Phoenix, Ariz., Charles W. Shepard and Harry W. Payne. The copper smelter is illuminated by a generator driven by a turbine which secures its power from exhaust steam.

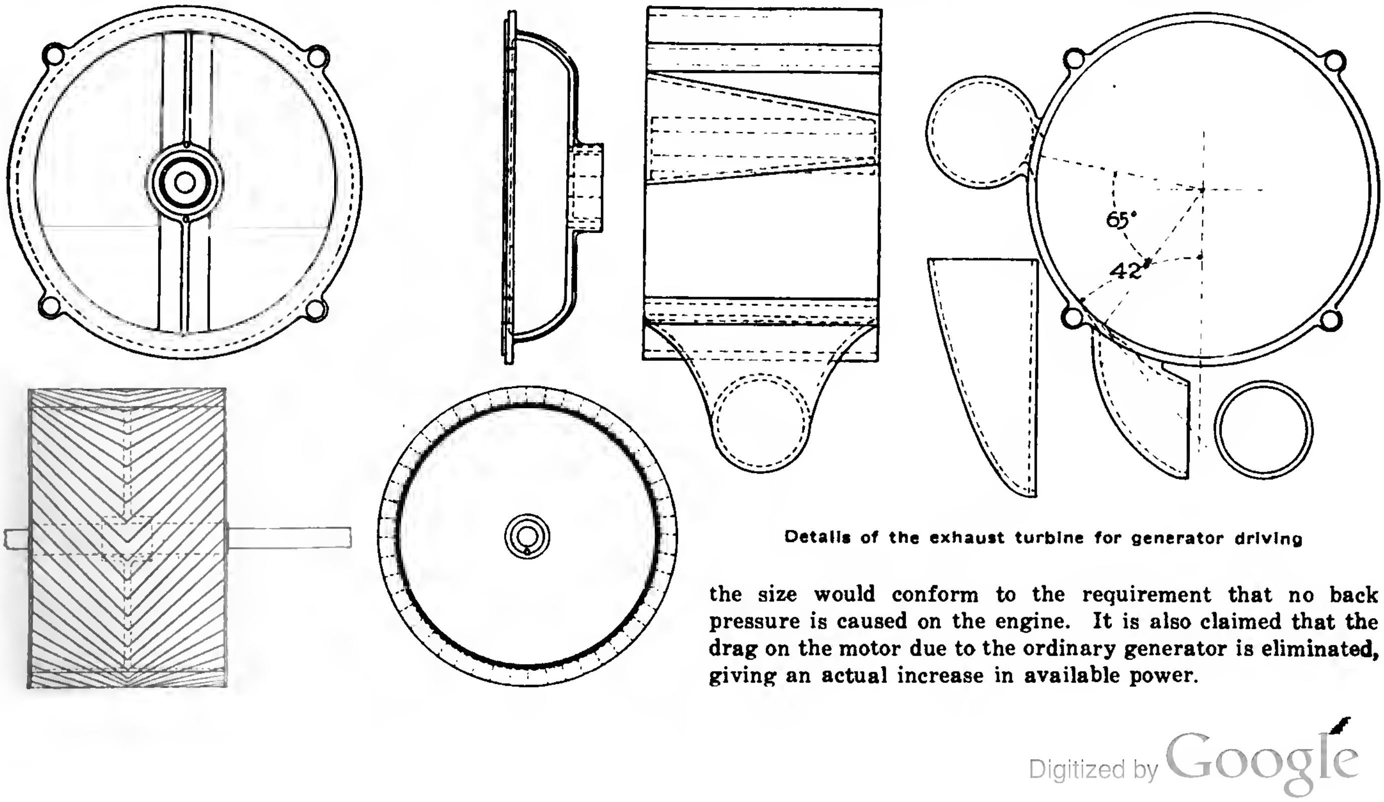
In converting this idea to one which will be practical in automobile usage, it is the plan of the inventors, who have taken out a patent covering the idea, to do away with the muffler. The turbine in its present form weighs eight pounds, being made from aluminum, and is comparatively inexpensive.

The inventors state that the turbine has not as yet been perfected, but that they are actively engaged on the device. The patent was taken out after it was seen that such a machine may develop into a practical attachment. The illustrations herewith show the device in its latest form. It will be noted that the turbine wheel bearings are on a projection from the head of the casing, thereby avoiding the bad effects of direct heat.

The turbine wheel has the vanes set at a 90 degree angle, the object being that the exhaust from the engine enters the casing on a line parallel to the shaft and at all times five blades are receiving the force of the flow, retaining it for 65 degrees or over one-sixth revolution.

The drawings shown were prepared to make the installation on a Ford car, and the device is to be placed on the left side of the engine, under the hood. From the experiments noted, it would seem that the generator would be geared about 1 to 3 to the turbine. In experiments made so far the inventors claim to have driven the turbine at 1200 r.p.m. while the engine was idling and with plain bearings on the turbine. It is planned to use a centrifugal governor on a cut-out if too much speed is developed, although this and other details are to be the subject of further experiment.

On the present device the nozzle through which the gas enters the casing is ⅛ in. wide, this size being used so that the size would conform to the requirement that no back pressure is caused on the engine. It is also claimed that the drag on the motor due to the ordinary generator is eliminated, giving an actual increase in available power.



Details of the exhaust turbine for generator driving

Good Cooling Features New Rotary Valve

Kline Patent Discloses Some New Ideas in Rotary Valve Construction

OF the great multitude of rotary valve motor patents, that just granted to H. J. Kline appears to be one of the most promising that has been seen for some time. In designing a rotary valve the problem to be mastered is to keep the valve gas-tight and properly lubricated, to compensate for wear and to prevent dirt and foreign matter that would score the valve and its bearings from coming in contact with these parts. It is also necessary to keep the valve at as low a temperature as possible, at the same time holding the temperature constant for all loads and speeds, if such is possible. By this application the fit of the valve will not vary as much, nor will the lubricating oil carbonize and become gummy. It is also possible by this application to so construct the valve and its related parts that a minimum pressure will be exerted on the valve due to the force of the explosion. In short, the problem is to use what is commonly known as a balanced valve. This can be accomplished in part by limiting the exposed valve area to as small a surface as practical conditions will permit.

The Kline valve was designed to meet these requirements as far as possible. By using an automatic auxiliary exhaust valve, in conjunction with the main or rotary valve, the former, controlled by the piston, may be so designed that it will carry away a large part of the heat of the exhaust. At light loads, when the throttle is slightly open, the exhaust pressures within the cylinder are such that the automatic valve is supposed barely to lift. At full loads, where the exhaust pressure is very high, the valve should be forced wide open, so that the larger part of the exhaust gases and consequently the major portion of the heat, would be carried out at the lower end of the cylinder. Thus the heat carried past the main or rotary valve would be more or less uniform and the temperature be practically constant for all loads. If this is so, the expansion of the valve should vary its size but little.

It is also a necessary deduction from these facts, that temperature will be lower. This condition is conducive to proper maintenance and life of the moving parts.

There are several factors that assist in maintaining a low-operating temperature of the valve and its bearings, aside from the auxiliary exhaust. One is the proximity of the intake manifold, which will absorb a great deal of heat. A second is the fact that the valve is hollow and may be either water- or air-cooled, and the third is the full water circulation around the valve casing.

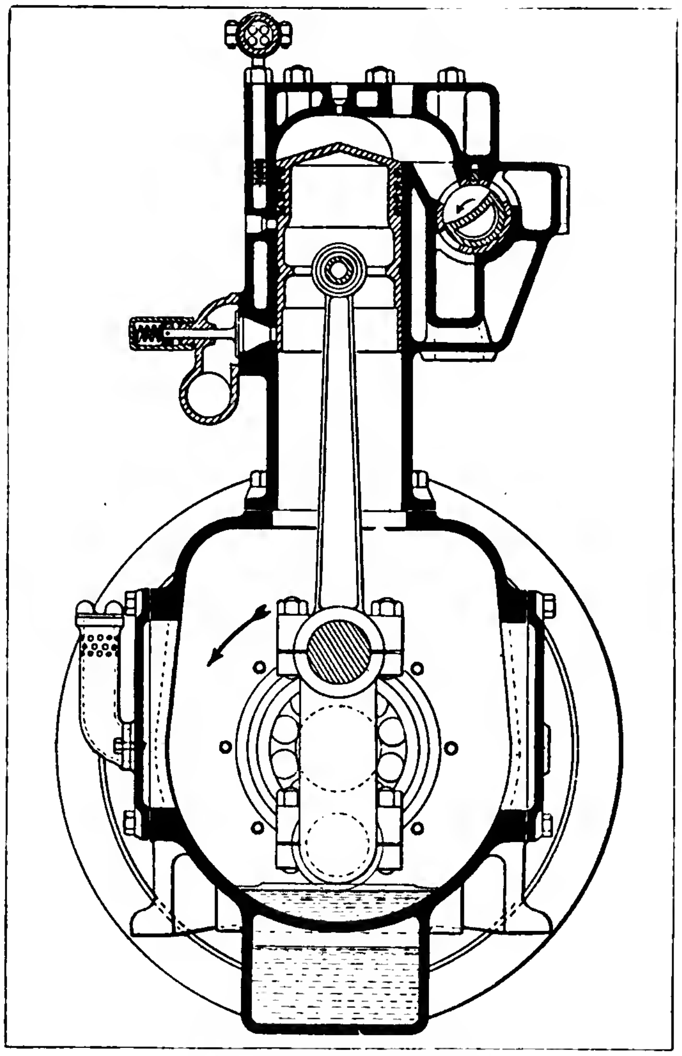


Diagram of Kline rotary valve engine

In order to secure a proper fit of the valve and to maintain a gas-tight joint after some wear has occurred, a further problem arises. The location of the exhaust and inlet manifolds in respect to the valve is one of the factors in keeping the valve tight. The Kline valve rotates *toward* the cylinder, so that when pressure is applied, by way of the ports leading to the combustion chambers, the valve will be forced against the opposite side of its casing.

The inventor claims that, as the valve rotates under this pressure, it tends to pivot or roll toward the cylinder, and keeps this side sufficiently tight to form a gas-tight joint.

Packing Only a Safeguard

When the valve is new, it should be so tight that packing would be unnecessary, providing, of course, that the fit is quite close and the valve temperature will not vary to any great extent above or below the normal operating condition. To compensate for the wear of the valve, there are packing rings and a packing strip. This strip bears on the rings, so that when new, it will not touch the valve at all, simply conforming to the bore of the casing.

The packing rings do not revolve with the valve, but creep slowly around, due to the cylinder pressure forcing them against the side of the grooves in the valve. This creeping action, it is claimed, will slowly wear the ends of the packing strip so that it will gradually settle as the valve wears and will still continue to keep this point sufficiently tight.

Lubrication of the valve is accomplished by forcing oil to the bearing surfaces between the cylinders, inclosed by the packing rings. The oil film thus created is expected to carry the valve so that the portion opposite each cylinder will bear but very little load. Theoretically, these portions are free of the bore.

The oil is fed from a duct above the valve, and after flowing around the bearings, is gradually drained out at the bottom by another duct below the valve, which carries it back to the original source of supply.

Kerosene Engine of Simple Design

Duplex Exhaust and Intake Manifold Employed for Fuel Vaporization

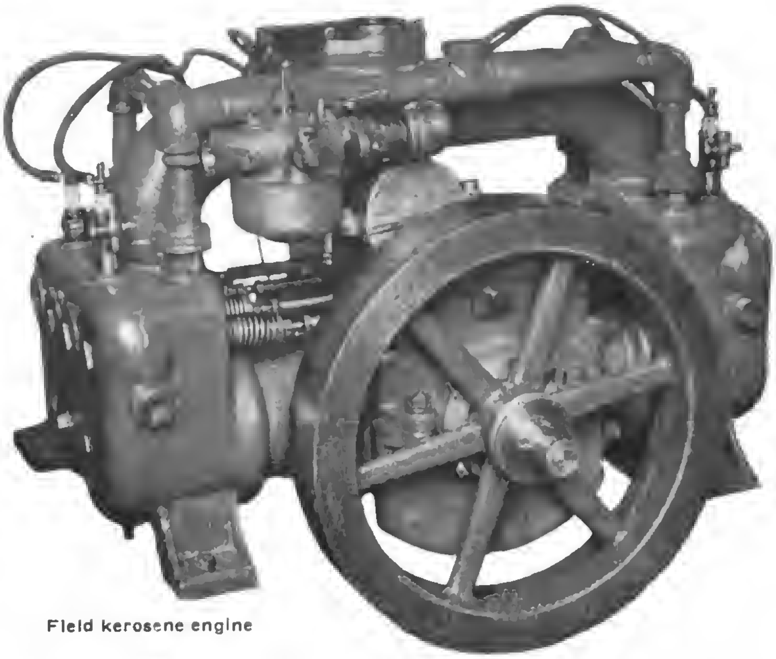
THE Field Motor Co. of Grand Rapids, Mich., has begun the manufacture of an engine different from any other type on the market. It is a horizontal motor, directly opposed, and it is said to run on gasoline, kerosene and distillates. It has but two cranks and two connecting-rods for four pistons which gives such a compactness of construction that it occupies a space only of 11 by 23 by 14 in.

The pistons and the tie rods are made from one piece of steel, the tie rods being flush on the crankshaft, although permitting plenty of space for operation. This gives practically a continuous piston from side to side. The tie rods which connect the pistons have sliding fits on each side of the crank webs and also on the top and bottom of each crankshaft bearing.

Uses Any Carbureter

Any standard carbureter may be used with the Field motor. The secret of its success in burning low-grade fuel is the fact that all charges are preheated. The carbureter, unlike all other engines, is above the cylinders and the charges gravitate down to the manifold. One manifold supplies all cylinders and it is so arranged that the exhaust heat affects the charges from the carbureter preparing them for a perfect explosion in the cylinders. The arrangement of surfaces and valves controlling the exhaust has not been patented.

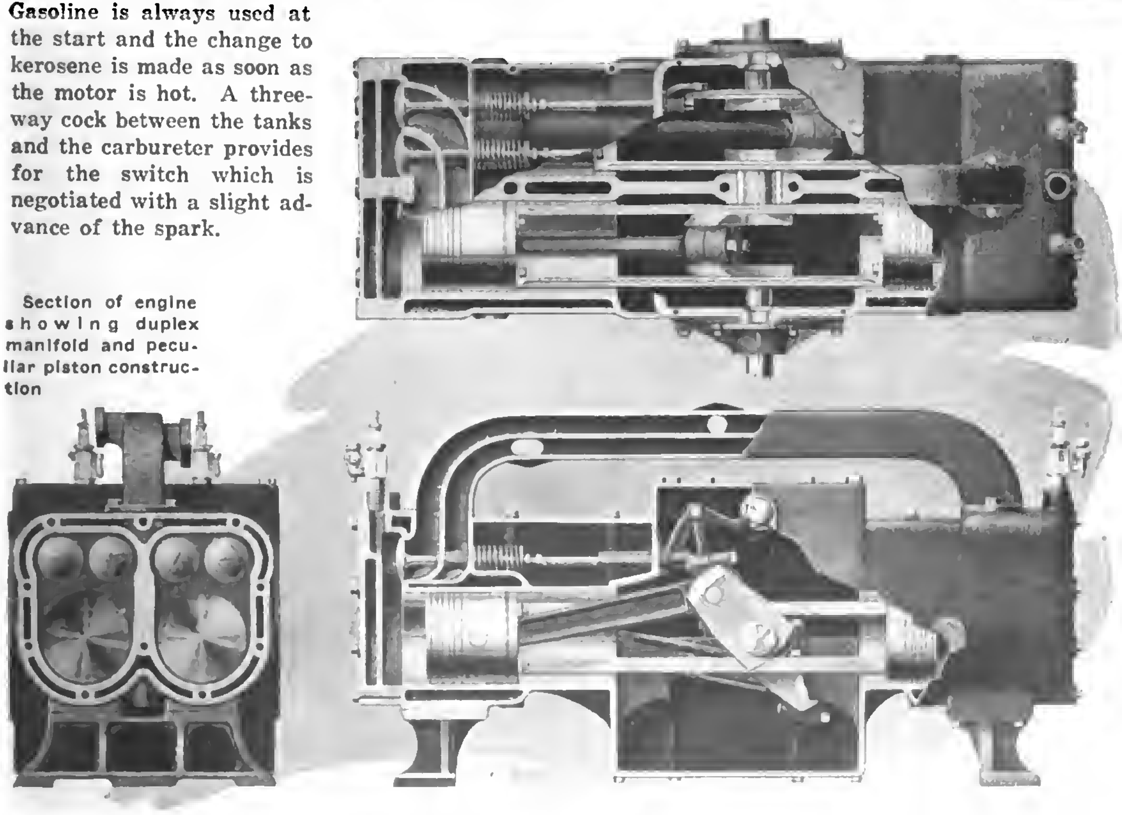
It is claimed that no adjustment of the carbureter is necessary in switching from gasoline to kerosene. Gasoline is always used at the start and the change to kerosene is made as soon as the motor is hot. A three-way cock between the tanks and the carbureter provides for the switch which is negotiated with a slight advance of the spark.



Field kerosene engine

Because of the compact style of construction the motor consumes but very little space and is claimed to be adaptable to airship use. Its simple construction also makes it adaptable to tractors and motorboats. But three operations are necessary to expose the interior of the engine, and it can be held in position with four bolts to the frame. The accessibility is one of the cardinal features. The motor is block-cast with removable heads, the cylinders being bored in line, with one boring bar. The ends are milled and squared at the same operation. All parts are inclosed. With the pistons carrying the connecting-rods lubrication of the wristpins is excellent.

A set of inclosed spiral gears operate the camshaft and magneto. An adaptable governor, attached by a simple operation, will permit the engine to be used for stationary purposes.



Section of engine showing duplex manifold and peculiar piston construction

The Sizes of Motors for Trucks and Outline of British Practice in This Field

By W. D. Williamson

Part 2—Outline of British Truck Motor Design

(Continued from page 477, issue of March 9)

CRANKSHAFT BEARINGS—In several engines of the three-bearing type the middle bearing is the same size as the big ends, and this may offer manufacturing advantages and seems to be satisfactory in service. In the way of standardization and reduction of spare parts, some makers also have the front bearing of the same dimensions. The average lengths, however, for the three bearings, taking the length of the connecting-rod big end bearing as 1, are 1.21 for the front, 1.17 for the middle, and 1.48 for the rear.

Setting down average surfaces as found from the engines examined, where $D =$ cylinder diameter, we have:

Big end:—Average pressure, 765 lb.
Big end area = piston area, 2.73
Diameter of crank pin $= 0.4\,D + \frac{1}{4}$ in.
Gudgeon pin:—Average pressure, 2100 lb.;
Gudgeon pin area $= D^2$: 9.6
Diameter of piston pin = big-end diameter — 1 1/32 in.

Main bearings have the same diameters as the crank pin, and the lengths are respectively 1.21, 1.17 and 1.48 times the crank pin length.

These dimensions are put forward, not as being the ideal, but as representing current practice as shown by the engines of which the requisite data were available.

Only two prominent builders of commercial vehicle engines use ball journal bearings for the crankshaft, as in Fig. 7.

Valves and Valve Setting

With the exception of the Daimler vehicles, all British commercial vehicles have engines of the poppet valve type. These valves are usually of 3 per cent or 3.5 per cent nickel steel with seats at 45 degrees. The London General Omnibus Company, after experimenting with other materials, standardized mild steel valves suitably case-hardened and ground to overcome the difficulty of wear in the stems. Where trouble has arisen due to excessive wear or pitting of the face, nickel chrome steel has been used with advantage, while one maker has found a remedy in a return to cast-iron heads.

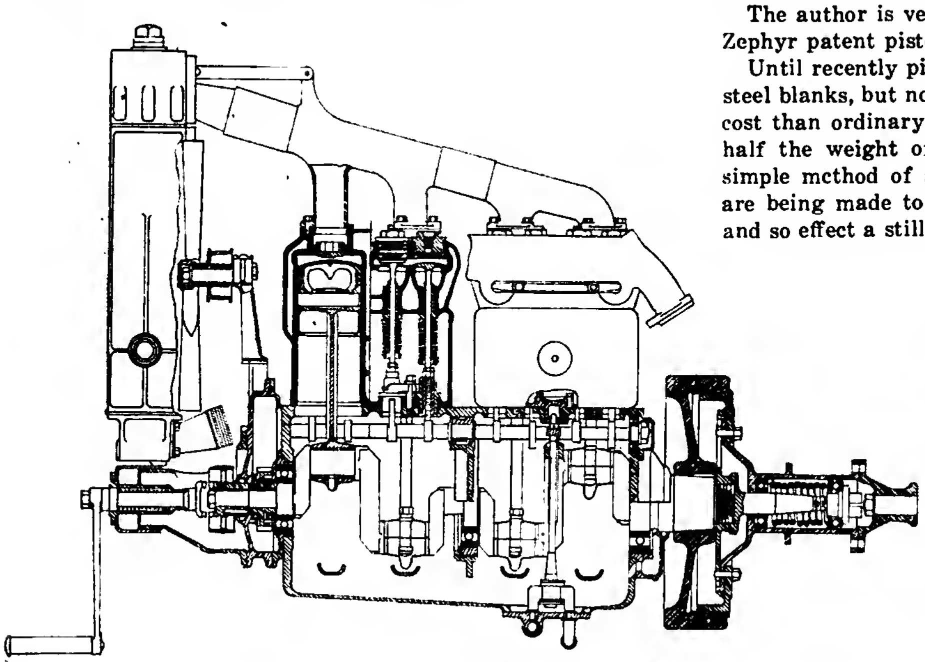


Fig. 7—Commer Car with ball-bearing crankshaft

Examination of a number of engines showed an average of:

Opening in valve seat = 0.46 cylinder diameter.
Valve lift = cylinder diameter: 12
Effective area of valve opening = cylinder area: 10

Valve tappets adjustable by set screws at the upper end and fitted with rollers at the lower end are standard. Figs. 8, 9 and 10 show care to insure ample wearing surface in the tappet guides with tappets as light as possible.

The average taken over a number of valve settings is shown as a diagram in Fig. 11.

Pistons

Except in one or two cases, no great effort has been made for obtaining very light pistons. General practice favors three rings above the gudgeon pin. The Dorman engine is a notable exception, being fitted with a special type of compound ring which gives excellent results. The usual method of securing the gudgeon pin is by one set screw, which must be securely locked. Where two set screws are used for this purpose, it is found difficult, even by the use of jigs, to insure that the holes in the gudgeon pin and bosses are drilled exactly the same distance apart, and the smallest error may cause piston distortion. Two or three makers use a ring for retaining the gudgeon pin, and also use a fifth ring acting as a scraper.

The author is very strongly impressed by the claims of the Zephyr patent piston shown in Fig. 12.

Until recently pistons of this design were turned from solid steel blanks, but now they are made in cast iron at no greater cost than ordinary pistons. Pistons of this design are about half the weight of the ordinary type and allow of a very simple method of securing the gudgeon pin. Arrangements are being made to produce these pistons in aluminium alloy and so effect a still greater saving in weight.

Lubrication

Some form of pump for oil circulation is practically always fitted. The type most in favor is the gear pump, which answers the purpose extremely well for oil, although not so successful when, as in the past, it is used for circulating jacket water. Oil is usually fed under pressure to the main bearings and through the crankshaft to the connecting-rod bearings. Cylinder walls and gudgeon pins are lubricated by splash. Excess oil is directed to the timing gears in the Dorman.

The ideal would appear to be some combination of a forced system with the trough system as used in Daimler engines, the two systems being independent, so that in case the forced system fails the bearings are not endangered. There should be no ill results due to the increased supply of oil, so long as efficient means are provided to prevent over-lubrication of the piston.

The Wolseley has a notable arrangement of oil collecting galleries, and the Albion (Fig. 8) has thrower rings arranged on the crank webs for the lubrication of the big ends.

More consideration might be given in many cases to the position of the crank chamber filling orifice. It should allow of a large tin being up-ended over it without fouling other parts and without wasting oil. It should be provided with a filter.

In Wolseley and Leyland engines these points have received attention. In the Dorman the oil is introduced through the top of the fan bracket. (See Fig. 18).

Drive for Timing Gears

With a few exceptions, notably the London General Omnibus "B" type (Fig. 13) and the White and Poppe (Fig. 10) fitted to Dennis lorries, poppet valves are arranged on one side. The chief disadvantage would appear to be that it necessitates somewhat small valves or gives greater overall length to the engines.

For the camshaft drive the usual practice is to have two helical gears of steel, the pinion being hardened and the wheel, to insure quiet running, being of a steel giving the requisite wearing properties without hardening.

In the larger motors these gears usually have teeth of 8 in. diametral pitch and 1¼ in. wide.

Silent chains are used in the Daimler (Fig. 14), Wolseley, and Tilling Stevens.

Belsize engines have ⅝ in. pitch roller chain drive, which appears to be quite satisfactory as regards both silence and life.

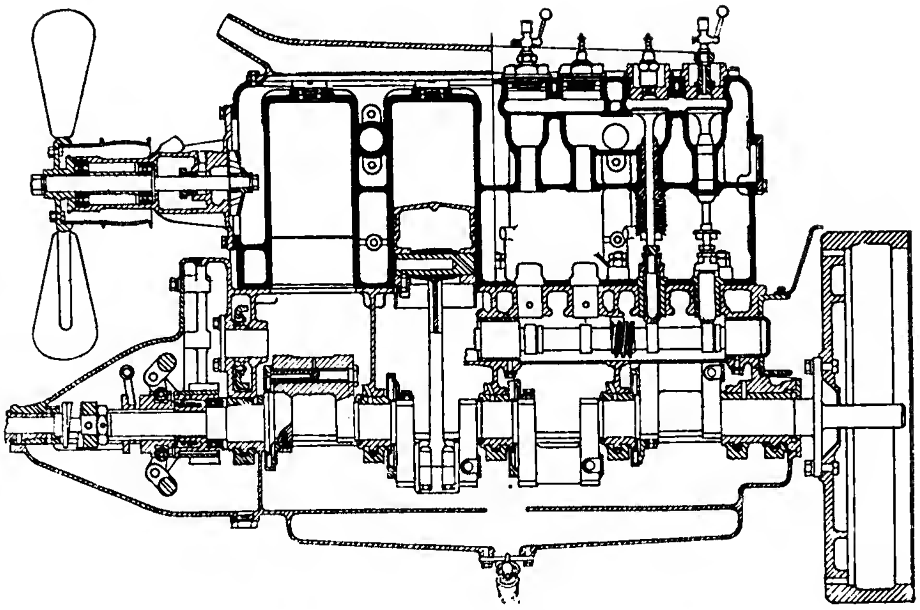


Fig. 8—Albion truck motor, lubrication notable

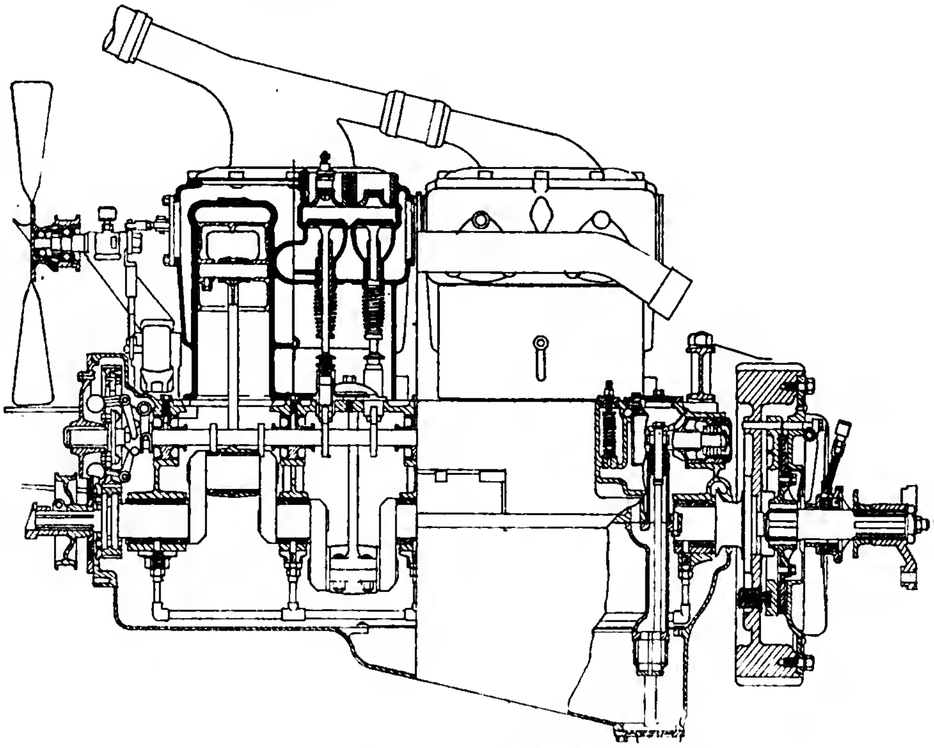


Fig. 9—Napier motor, a representative design

Drives for Pump and Magneto

Pumps should be easily accessible for repacking of the glands, and the contact breaker should be in such a position that it is not only accessible to the hands, but also so placed that the mechanism can be seen when the cover is removed.

These conditions are obtainable most readily by the fitting of a cross-shaft over the timing case.

In in the Pagefield arrangement (Fig. 15) this cross-shaft is set at an angle so that the pump is thrown down in line with the outlet from the radiator, and the contact breaker is lifted up to become quite the most accessible part when the bonnet is lifted. In this arrangement the angle of the helical gears is modified to allow of the spiral gear on the cross-shaft engaging with the wheel on the camshaft.

The Halley, Leyland, Tilling Stevens, Tylor and White and Poppe are other engines where the cross-shaft is adopted, and only one gland is required for the pump. The White and Poppe arrangement is shown in Fig. 16. The Napier (Fig. 9) and the Dorman are typical examples of the arrangement where pump and magneto are placed in line alongside the engine.

The Albion arrangement of pump drive (Fig. 8), where the cylinder jacket serves as the pump casing, is an entire departure from common practice, and possesses distinct advantages in the way of simplicity.

Governors

Whether or not a governor should be fitted has not been settled satisfactorily. In ordinary commercial service a governor should provide a means of insuring that the vehicle is not over-driven when light. On the other hand, a vehicle with a governed engine is not as nice to drive, the power of accelerating beyond normal speed in an emergency is absent, and gear changing is, perhaps, not quite so easy. The type of governor most popular with the ordinary driver seems to be the one that is most easily put out of action.

It is difficult to arrange for the governor to combine accessibility with simplicity, but the Daimler (Fig. 14) and the Pagefield are worthy of note in this respect. The latter is entirely inclosed.

The practice followed in some cases of arranging the governor to act on the carbureter throttle valve is not calculated to give the best results in fuel consumption. In the case of a carbureter with a throttle valve shaped to give a rich mixture at very small openings, for easy starting, the throttle may assume this position on a favorable gradient at high engine revolutions, and the mixture taken into the cylinders may consequently be much too rich.

Half Compression and Starting Devices

The author is of the opinion that for the larger engines a simple arrangement for releasing compression for starting purposes is a decided advantage for lorries that are parked in the open or for vehicles, such as furniture removers' vans, that may have to stand for some hours in the coldest weather. If it becomes necessary to have female drivers for the heaviest vehicles, anything that helps to ease matters for them will find favor, and it may be that the self-starter proper will find advocates. For the present, the fitting of self-starters to commercial vehicles has not been attended with success. They have been tried with the idea of saving fuel by encouraging the driver to stop his engine at every halt, but the saving effected has not been all that was expected.

(*To Be Continued*)

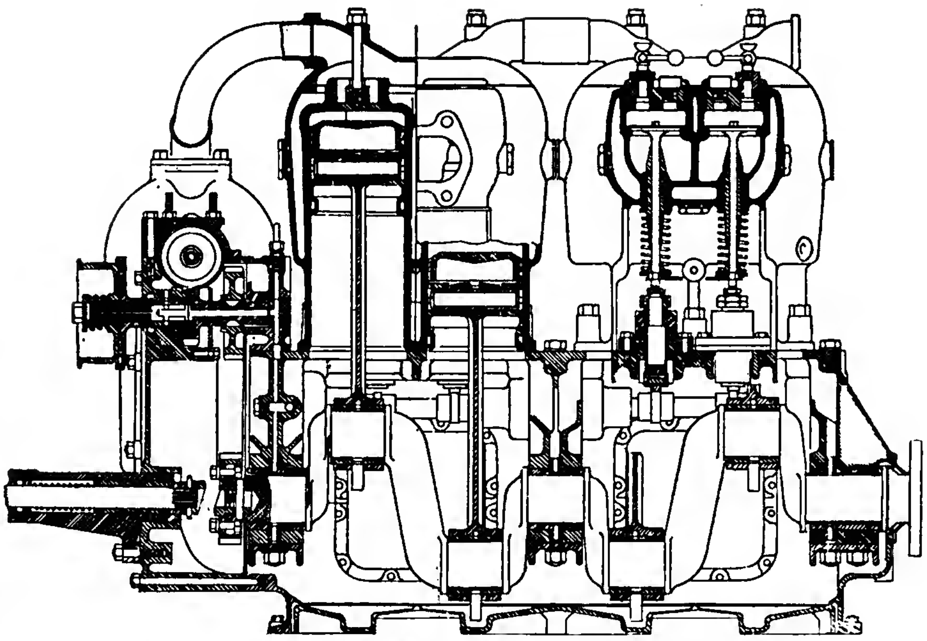


Fig. 10—White & Poppe engine, one of the few T designs

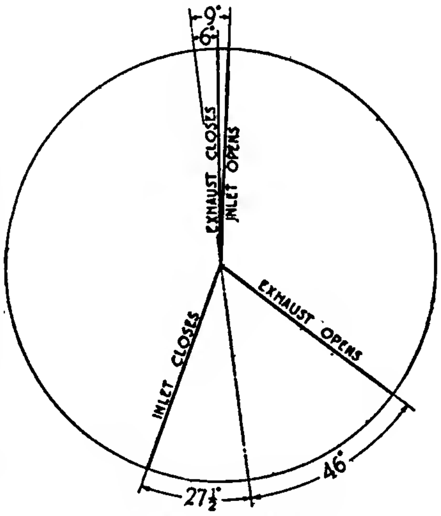


Fig. 11—Average Valve Timing

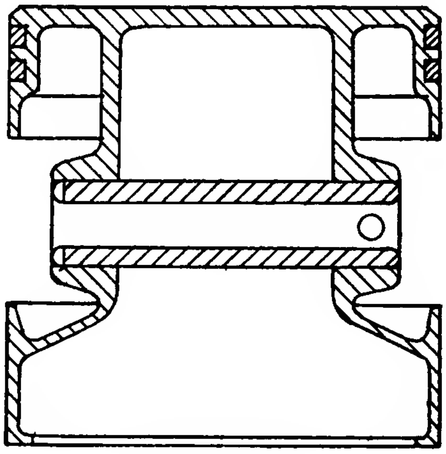


Fig. 12—Zephyr piston

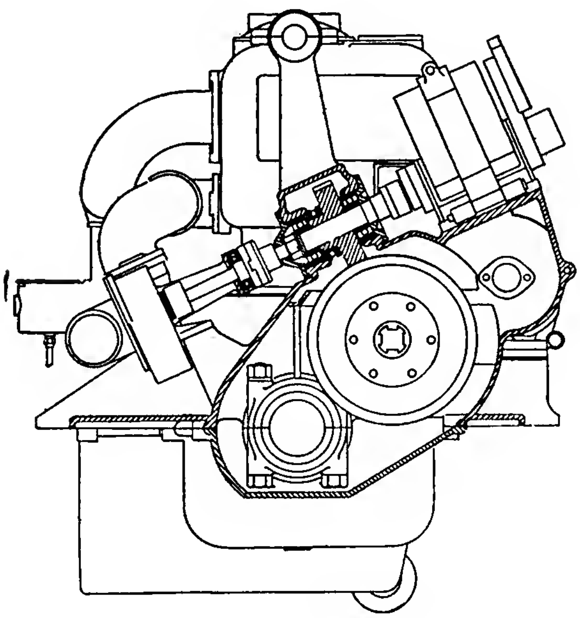


Fig. 15—Cross-shaft pump drive in Pagefield motor.

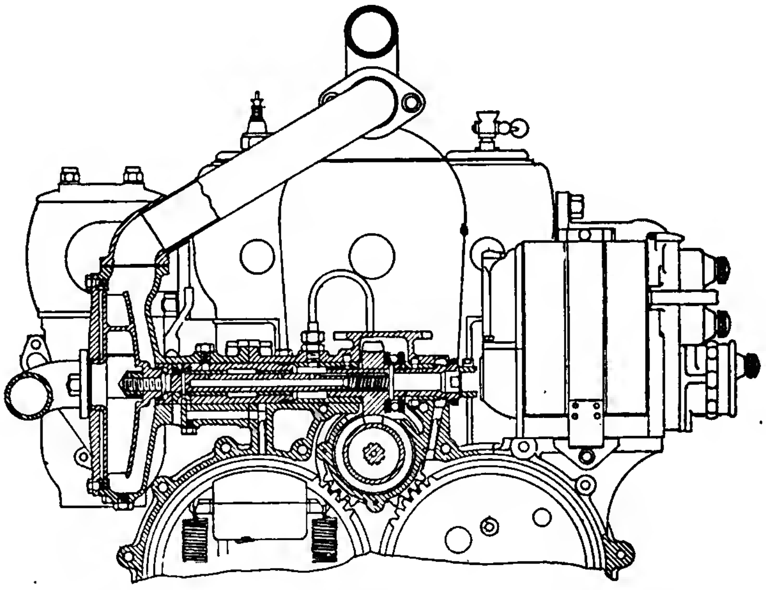


Fig. 16—Cross-shaft drive in White & Poppe motor

The FORVM

DORT CAR NEAR IDEAL DIMENSIONS — STEERING WHEEL POSITION HIGHLY IMPORTANT — AN AMATEUR'S IDEAS OF COMFORT AND HOW THEY WORKED OUT

Dort Dimensions Close to Ideal

By E. Planche

(Chief Engineer Dort Motor Car Co.)

REGARDING the article by Mr. J. E. Schipper on the subject of body proportions to give comfort to the driver of ordinary height.

We have made a drawing of the body following the same lines of a sketch published in your estimable paper and besides the figures you recommend, we have put the figures that we have in our Dort car and in the third column the dimensions that we think would be the ideal from our own point of view.

You will please notice that for a small car the Dort comes very close to the measurements you recommend, and we must say that from our own experience in this car, when driving under all kinds of conditions of weather or road, we have found the sitting conditions for the driver very pleasing and not such as to place any undue strain on his nerves.

Thinks Steering Wheel Position Most Vital

By A. A. Bateman

(Jackson Automobile Co.)

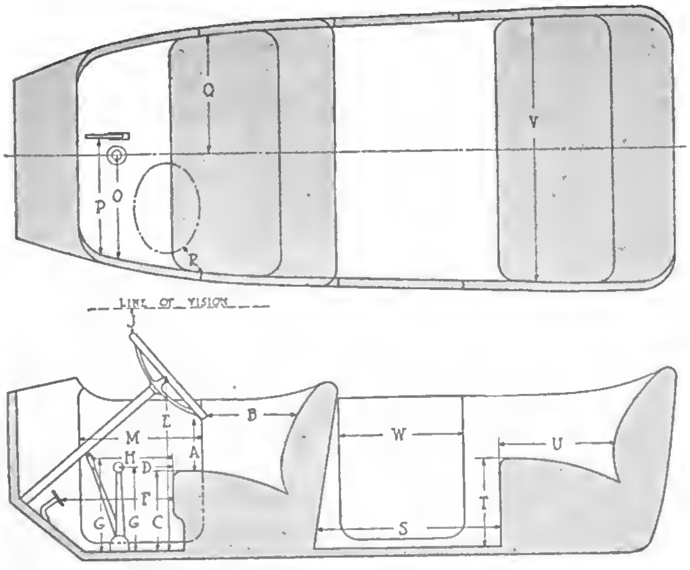
I WISH to compliment Mr. Schipper on the able manner in which he has handled a very important subject. However, there are some points which I think are slightly overdrawn. For instance: the heading of the article "Driver's Lot 99 Per Cent Discomfort." This, no doubt, is to attract attention to the article. It certainly is not intended as data from such a reliable source. I believe that the comfort and convenience of the driver has not been entirely neglected by the majority of designers. By careful survey of the hundreds of accessories that are made and applied to the automobile of to-day a very large per cent are designed with one purpose, namely, for the convenience and comfort of the driver.

Owners' Views Differ

Regarding the height of seat, steering gear, etc., also distance from the back of the seat to the steering gear, there are a great many things that have to be taken into consideration before a definite dimension can be used to satisfy even the average driver. The height of the seat, for instance.

I note that the dimensions on the car mentioned run from eleven to sixteen inches. Will venture to say that the manufacturers have been asked by purchasers to make their seat just a little higher than the highest and likewise some will want the seat lower than the lowest. This also applies to the height of the wheel at the distance from the back of the seat to the wheel.

I have noticed in a great many instances, and I think many who have made a like observation will agree with me that a car which has just the proper location of the wheel for any particular driver who, when sitting in his natural position, either erect or slightly reclining, will be in such a position that a line drawn at right angles of the column through the rim would intersect with the hip pockets of the driver and at a height when the driver's hand is on the center of the wheel the forearm will be on the same line. This, of course, would necessitate a greater or less distance from the back of the seat to the wheel, depending upon the size and build of the



Dort standard touring car dimensions

Dimensions of Standard Dort Touring Car

	Dort	Recommended by AUTOMOBILE	Recommended by Mr. Planche
A	8½	9	9
B	16	16	16
C	14½	14	14½
D	7¾	6	8
		Dort gives more room to pass by	
E	27½	27	27½
F	18	19	18½
G	16	19	17
H	None	12	10
		Dort foreign is 12	
J	5½	Over	Over 5½
K	No	No	No
L	None	No	No
M	19½	19½	19½
N	Note	Note	..
O	17½	18	17½
P	None	20	21
Q	19½	18	20
R	10½	11	10½
S	25	27	25
T	14	14 to 17	14
U	19	21	20
V	45½	46	48
W	19½	21	19½

· Note—Drivers not quite erect.
K—Must one lean to shift gears.
L—Must one lean to apply emergency.

driver. I think the greatest cause of fatigue after a long drive is due more to the unnatural position of the steering wheel than the shape of the seat or hack.

As to position of the shifting levers, care must be taken not to get them too close as to interfere with the driver getting out of the right side of the car, as at least 50 per cent of the entrances are made from the curh.

Also the brake levers should he so placed in such a position that they will not he much hack of an upright position, as thereon the angle becomes so great that very little power can be applied.

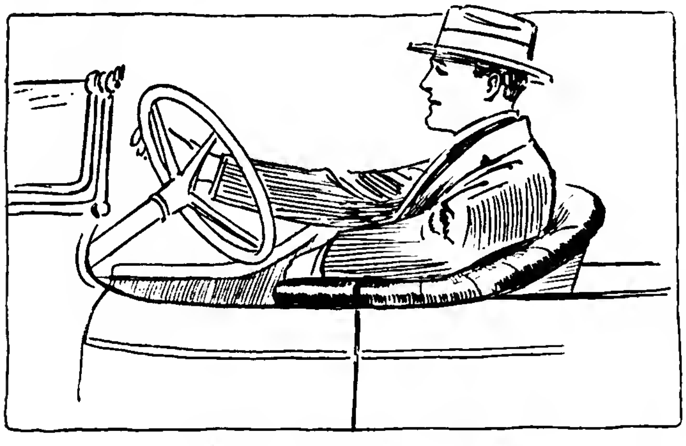
The possibility of establishing a limit for the location of a steering wheel is practical, but as to the location of the doors, shape of the back of the seat and the amount of room in the tonneau enters into each individual design. I believe the solving of this problem will eventually be adjustable driver's seat, both as to height and fore and aft. Also the steering gear and pedals so constructed that they may he easily changed to suit any particular driver.

How to Make a Stock Car Comfortable

By C. A. Du Bois

BEING an owner-driver, I have taken great interest in Mr. Schipper's article on Driver's Discomfort, in your issue of Feb. 3, and agree with him in his remarks. Would say in addition to his comments that I think that the proper height of the cushion should he from 13 to 15 in. from the floor for the average driver, or so that his feet should rest squarely on floor board. This height and position of feet gives him a chance to raise his body when taking bad spots in the road and relieves the strain on his back. It also makes it easier to leave seat, as you are not ohliged to grab hold of steering wheel with one hand and pull yourself up at the same time giving yourself a push with the other hand on back of seat. In entering you do not have to drop into seat. If this were not true why did not the wagons and carriages of the past have their seats as low as 6 or 8 in. as they had the advantage of easier springs. I find that the driver in most cases when he has a guest sitting by his side is obliged to leave car on driver's side, as very seldom do you see guest leave car before the driver; as levers are in the way it is doubly hard to leave car and climh over guest, therefore, it does not make much difference whether levers are bent or offset.

Last year I had a demonstration of three cars of the $1,100 to $1,300 class with the intention of huying, and after driving all three purchased the one that was most comfortable in regard to height of cushion from floor, although the other two cars had hetter engines. On both of the rejected cars I could not drive over rough roads without hitting the steering wheel.



C. A. Du Bois' padded door edge

Changes That Made Comfort

While the car I purchased was not all that I desired in comfort, I immediately started in to make it so. I placed on the front doors of the car 8 by 2-in. cushions to correspond with the upholstery of the arms or side of the car in the rear. My idea in doing this was because the end of the upholstery came where I naturally would rest my left elbow. As far as appearances go it is not noticed except when door is left open. Next I placed a sliding steering wheel on the car, which gave me 16 in. between the steering post and the edge of door frame to enter car. When wheel is open it gives me an opportunity to enter the car in a standing position and adjust my clothes before sitting.

When changing gears I had to lean forward about 12 in. to go into second speed, and when I did I usually hit my knuckles on the bottom of the dash cowl. To eliminate this I made a 3½-in. offset extension of 4-in. on the gear lever that gives me now an opportunity to make changes with very little motion and very much easier as on account of the extra leverage I can change by using thumb and finger only. I placed extensions on foot pedals of 3 in. and made a foot throttle that fastened on side of gear lever box that has a side motion rather than the up and down or hutton kind. Was unable to reach with comfort the throttle that was fitted to the car originally.

This side motion throttle has the added advantage of smoother action when riding over bad spots and quicker acceleration and gear changing as the throttle is at side of you, when in natural position, on floor of car.

Am now making a driver's cushion that slides on a frame so that when in right position can be clamped in place. The cushion at driver's back is to be separate and fastened at bottom on hinges that are adjustahle forward 3 in. and up or down 3 in., the space at top being inclosed in the bellows type of upholstery, so that it would not interfere with lines and appearances of car.

A Lazy Man's Ideal

By making these changes you see I have the ideal lazy man's car and at the end of a day's run am not fatigued as I would be if I were using a car in the condition that it was when purchased. I think that the future ideal car will have two doors only, one wide door at driver's side and an ordinary door on opposite side in rear, giving the tonneau passengers an opportunity to enter at curh. The front seats to be divided with 10-in. passageway and driver's seat and back to be adjustable. With this arrangement you have less door rattle and it is possihle for driver to enter at curb.

McIntyre Axle Resists Side Shocks

With reference to the description of my front axle in THE AUTOMOBILE for Jan. 27, you have not given this device full credit, as I notice that you have made the statement that no road shocks barring a glancing blow will deflect the steering. You have cut out the hest portion as this device is especially designed to take care of the glancing blow from the unevenness of the road, such as getting out of car tracks and ruts in the road.

For your information will say that one of the tests made with this axle is that you can drive the car, say, at an angle of 45 deg. so that when the front wheel is about to strike the curbstone or a similar obstruction, you can let go of the steering wheel and the car will mount over it. The same applies to striking an unexpected ohstruction on the road; the steering wheel will not be jerked out of the driver's hand as there are no shocks transmitted to the steering wheel in either case. ELMER E. MCINTYRE.

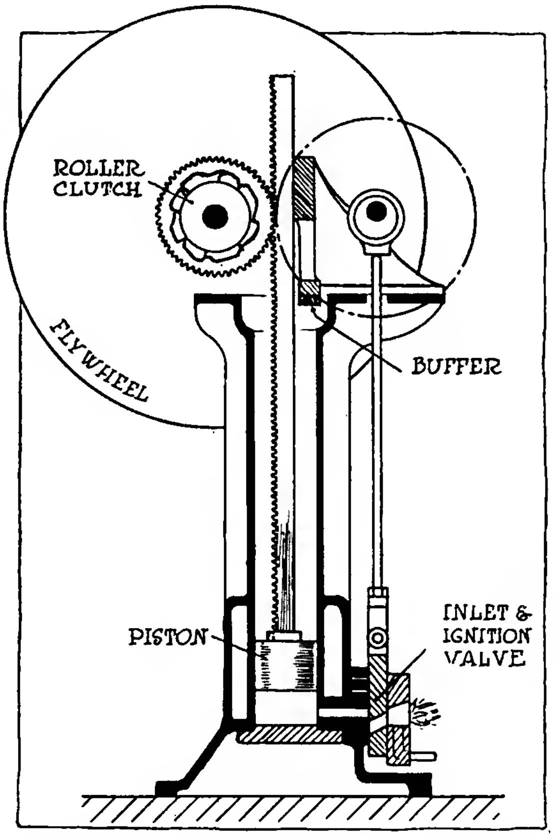
The History of the American Automobile Industry—21

Langen and Otto's Experiments with an Engine Having a Free Piston—Working Stroke Atmospheric and Power of Explosion Only Partly Utilized—Noise and Vibration Were Troubles

By David Beecroft

WITH the last two instalments of this history the work of Stuart Perry in America and Lenoir in France was reviewed. Both these inventors took the steam engine as their model, to a considerable extent, and tried so to alter it that it would operate with a different working medium. Coming to more recent years we see a notable change, in that the steam engine type was largely abandoned and totally new constructions made the subject of endeavor.

Within the next half-dozen years, after Lenoir's first patent, a half-dozen gas engine inventors appeared. Siemens and Hugon patented engines using platinum ignition the same year, 1860. W. E. Newton in a British patent of 1861 describes an engine employing pressure, or compression, which he secured by a second cylinder and piston, much like a modern two-cycle, and using jump spark. F. H. Wenham in 1864 patented a free-piston engine, Hugon in 1865 an improved form with flame ignition, and following these Otto and Langen brought out their patent in 1866. This device was much better worked out than preceding ones, and more nearly in accordance with the theoretical requirements laid down by Rochas a few years before. The cylinder was vertical with admission valve at the bottom, and means for igniting when the piston was near the lower, or head, end of the cylinder. No exhaust valve was used, but the piston was freely permitted to rise on the exploded charge until it reached the top of the cylinder and the charge exhausted freely into the air. The piston at once fell back, and turned a shaft by a rack, pinion and ratchet. The condensation or cooling of the gases in the cylinder permitted the atmospheric pressure to drive the piston downward in addition to its own weight, and also introduced the new charge below it. When the piston had compressed the new charge enough to support its own weight, ignition again took place, and the action was repeated. These engines were very noisy because of the free exhaust, they caused considerable vibration, owing to the violence of the upward piston movement with no means for balancing or counteracting it, and while better than their predecessors, were still far from being perfect. A goodly number of them were made, however, and put on the market for public consumption.



Section of Otto and Langen engine with free piston. The explosion threw the piston to the top of the stroke, the rack revolving a free wheel clutch. Atmospheric pressure then drove the piston down again, the clutch gripping and turning the shaft

A non-compression engine using flame ignition was patented by W. H. Laubach in January, 1868, and there was some activity in engines of this type about this time, largely because of the introduction of petroleum following the boring of the first, or Drake, oil well in 1859. In July, 1868, B. T. Babbitt, since celebrated as a soap magnate, patented a multi-cylinder engine with electric ignition for compressing air, and in 1871 C. P. Leavitt was granted a patent on an engine of the Brayton type.

Other Patents

In 1854 and also in 1857 Barsanti and Mattenci took out English patents on a gas engine of the free-piston type in which they used electric ignition and a make-and-break mechanism with a storage coil or "multiplier" of the De la Rive type. The drawings of this ignition system are not very plain, but it seems to be a wipe spark secured by a revolving part.

Michigan's 1915 Registration Analyzed

Over 400 Car and Truck Manufacturers Represented

OVER 400 automobile and motor truck manufacturers are represented among the 112,953 passenger and commercial cars registered by residents of Michigan during 1915. The remaining 1892 vehicles reported in the total given by the Secretary of State are registered by residents of Canada, etc. They were included in his total because they are actually registered and in use in Michigan.

A great many of the cars found in this analysis of the registrations by Michigan people were built by manufacturers who have either failed, merged with other companies, or been absorbed. Included in the general total are 902 cars and trucks classed as miscellaneous since they are on record merely as "assembled," "own make," or under freak names.

Of the 112,953 vehicles registered, 111,177 are gasoline cars and trucks and only 1776, or less than 2 per cent are electrics. There are 108,102 American-built gasoline passenger cars and forty-three foreign cars. There are 3150 commercial vehicles, or less than 3 per cent of the total registration, 3032 being gasoline and 118 electrics.

In the analysis it is brought out that 44,113, or over 40 per cent of the 108,102 American-made gasoline passenger cars are Fords. Buick is second with 7749, then comes Overland with 7425, Studebaker with 5014, Reo with 4863, Maxwell 3218 and Cadillac with 2987.

Gasoline Passenger

Car	No.
Abbott	387
Aerocar	15
Allen	44
Alpena	68
Alter	123
Anhut	21
Amplex	7
American	129
Apperson	74
Argo	43
Auburn	234
Aurora	1
Austin	26
Badger	2
Baines	1
Bates	2
Benham	6
Bergdoll	4
Bimel	2
Black Crow	2
Blomstrom	25
Briscoe	157
Brownell	1
Brush	624
Buick	7749
Busser	1
Cadillac	2987
Cameron	10
Campbell	1
Carhartt	21
Carnation	37
Cartercar	885
Case	104
Chalmers	1260
Chandler	145
Chevrolet	955
Clark	25
Clermont	1
Cleveland	7
Coey	1
Colby	1
Cole	291
Columbia	40
Cooley	1
Corbin	9
Cornelian	11
Courier	23
Crescent	10
Crow	146
Croxton	1
Cunningham	16
Cutting	240
Dalton	1
Davis	4
Dawson	1
Day	3
Doyton	8
Deal	6
Deere	1
De Luxe	2
Demot	20
De Tamble	30
Detroit-Chatham	5
Detroit-Dearborn	19
Detroiter	452
Diamond T.	4
Dodge	1174
Dolson	7
Dort	132
Downing	2
Dragon	2
Elkhart	41
Elmore	102
E-M-F	1030
Empire	83
Enger	6
Everitt	140
Ewing	1
Fall	1
Firestone	1
Fisher	1
Flanders	132
Ford	44,113
Franklin	245
Frayer-Miller	1
Fuller	5
Garford	20
Gaylord	4
Glide	22
Grant	260
Great Western	9
Halladay	27
Hartford	1
Havers	51
Haynes	171
Henderson	12
Henry	60
Hercules	3
Herff-Brooks	14
Herreshoff	145
Hollier	2
Homer	1
Holsman	4
Howard	2
Hudson	1565
Hupmobile	1955
Huron	8
Ideal	1
Imperial	458
Inter-State	23
Jackson	979
Jeffery	399
Jewett	1
Johnson	1
Kath	1
Keeton	11
Kenmore	3
King	327
Kisselkar	158
Knight, Silent	1
Knox	5
Krit	878
Kron	1
Lambert	124
Lexington-Howard	58
Lion	153
Little	190
Locomobile	58
Lozier	198
L-P-C	39
Marathon	25
Marion	54
Marmon	30
Marquette	37
Marquette	1
Marvel	4
Mason	7
Matheson	6
Maxwell	3218
Maxwell	466
McFarlan	5
McIntyre	7
Melbourne	1
Mercer	16
Meteor	4
Metz	365
Metzger	183
Michigan Auto	26
Michigan Buggy	133
Michigan Motor	163
Midland	4
Middleby	1
Millercar	36
Mitchell	662
Moline	27
Monarch	49
Monroe	233
Moon	17
Mora	7
Mt. Pleasant	7
National	47
Nichols	1
Northern	62
Northway	2
Northwestern	1
Norwalk	1
Nyberg	18
Oakland	2008
Ohio	3
Oldsmobile	1035
Orient	2
Orion	1
Overland	7425
Owen	18
Packard	619
Paige	1424
Palmer-Singer	8
Partin-Palmer	10
Parry	14
Pastora	1
Paterson	550
Pathfinder	6
Peerless	126
Peninsular	2
Perfection	1
Petrel	2
Pierce-Arrow	159
Pilgrim	1
Pilot	3
Pioneer	2
Pope	116
Pratt-Elkhart	7
Premier	25
Princess	7
Pullman	50
Punchs-Finch	3
Puritan	2
Rainier	18
Rambler	2
Rayfield	1
R-C-H	551
Read	12
Regal	982
Remington	1
Reo	4863
Ross	6
Royal	8
Ryder-Lewis	9
Saxon	1193
Schacht	31
Scripps-Booth	103
Sears	40
Selden	8
Simplex	12
Speedwell	24
Sphinx	4
Springfield	1
Stanley	34
Stover	4
Stearns	25
Stevens-Duryea	89
Stewart	1
Stoddard-Dayton	108
Studebaker	5014
Stutz	23
Suburban	11
Sultan	1
Templeton	1
Triumph	1
Thomas	99
Valey	8
Velie	53
Victor	1
Vulcan	12
Wahl	8
Warren	443
Wayne	48
Welch	78
Westcott	30
White	124
Whiting	1
Winton	866
Wolverine	8
Zimmerman	10
Miscellaneous	822
Total	108,102

Gasoline Passenger Foreign

Car	No.
Benz, German	5
Berliet, French	2
Bianchi, Italian	1
Brennabor, German	2
Bugatti, German	1
Clement-Bayard, French	1
Darracq, French	2
De Dion-Bouton, French	1
Daimler, English	2
Fiat, Italian	4
Hispano-Suiza, Spanish	1
Hotchkiss, French	1
Mercedes, German	2
Mors, French	1
Napier, English	1
Panhard, French	1
Renault, French	12
Rolls-Royce, English	2
Wolseley, English	1
Total	43

Gasoline Trucks

Car	No.
Admiral	2
Aetna	3
Alco	3
Atlas	2
Atterbury	1
Avery	2
Autocar	57
Bale	3
Boyden	1
Beyster	12
Cass	30
Chase	39
Clark	2
Commerce	143
Commercial	6
Crown	2
Dart	1
Day	1
Deal	1
Decatur	3
Denby	14
Detroit	6
Dowagiac	1
Dudley	1
Duplex	15
Enterprise	1
Falcon	2
Federal	281
Flint and Best	91
Flint Wagon	8
F. W. D.	5
Gaeth	2
Galloway	1
G. M. C.	302
Gaylord	16
Grabowsky	70
Gramm-Bernstein	21
Hall	1
Hazard	1
Hewitt	2
Horner	42
Huron	2
I. H. C.	869
Indiana	2
International	23
Johnson	2
Kalamazoo	22
Kelly-Springfield	63
Kiblinger	2
Knox	8
Kohnsh	1
Koehler	2
Kosmath	11
Krebs	1
Lauth-Juergens	4
Lippard-Stewart	2
Little Giant	21
Logan	2
Mais	4
Menominee	35
Mercury	1
Modern	1
Mogul	2
Monitor	1
Motor Wagon	2
O.K.	3
Oliver	17
Packard	142
Parcel Post	11
Paulding	1
Peerless	29
Pierce-Arrow	20
Plymouth	1
Poss	30
Pull-More	1
Randolph	9
Rapid	65
Reliance	15
Reo	144
Republic	159
Sampson	62
Schmidt	1
Seitz	13
Selden	6
Service	3
Signal	34
Soules	1
Standard	59
Star	29
Stegeman	5
Sterling and Sternberg	10
Stewart	1
Streator	8
Superior	3
United	25
Universal	174
U. S.	5
Van	5
Van Dyck	13
Vim	9
Vulcan	1
Wagenhals	10
Ward	2
Weier-Smith	2
White	44
Wichita	1
Wilson	8
Wisconsin	1
Miscellaneous	75
Total	3032

Electric Passenger

Car	No.
Argo	46
Babcock	11
Baker	117
Borland	2
Broc	10
Century	91
Chicago	2
Church-Field	33
Colonial	2
Columbus Buggy	34
Detroit Electric	670
Eagle	1
Flanders	22
Fuller Buggy	23
Grinnell	154
Hupp-Yeats	59
Milburn	8
Ohio	58
Phipps-Grinnell	5
Rauch & Lang	174
Rex	3
Standard	9
Storms	1
Walker	15
Waverley	4
Woods	104
Total	1658

Commercial Electric

Car	No.
Baker	24
Champion	3
Couple-Gear	9
Detroit	50
G. V.	16
M. & P.	3
Walker	2
Miscellaneous	5
Total	118

Grand total 112,953

The Rostrum

80 Per Cent of Fuel Not Vaporized

I HAVE just read with unusual interest the question of A. I. A., in your issue of March 2, 1916, on page 422, subject, "Piston Displacement per Mile Measures Consumption."

The writer of that apparently simple question has outlined what in my opinion is the only method the engineers designing gas engines in the future can use if they wish to intelligently ascertain just what the fuel economy of any engine really is, and how far short the actual road performance of the average American motor vehicle is of the practicable and possible miles per gallon, for any given piston displacement, load to be carried, etc.

A. I. A. says his Oakland, model 50, Northway engine has a piston displacement of 346.4 cu. in., etc., and figures the total displacement of gas is 242.65 cu. ft. per mile traveled of his car.

It is true that his engine does actually use the amount of gas he states for each mile traveled regardless of the speed. But one must consider that it takes a gas rich in oil vapor converted into a homogeneous mixture with air, and then transformed into gas, either in the carburetting device itself, or partially therein, partially in manifolds, valve chambers and in the cylinder under the heat of a former charge, the heat of compression, and the heat generated by the spread of flame after ignition. He makes the mistake, however, of assuming that one gallon of gasoline makes but 25 cu. ft. of vapor.

A gallon of 61 deg. Baumé gasoline, at 60 deg. Fahr., either in the laboratory or in a proper gas generator for motor vehicles, will make approximately 240 cu. ft. of oil vapor at approximately 8 in. water tension.

That amount of vapor, mixed with approximately 22 parts air by volume, will, when converted by heat properly applied so as to convert the mixture of vapor and air into dry gas at a temperature higher than the highest boiling point of the heaviest hydrocarbon in the gasoline, give approximately 5500 cu. ft. of gas mixture, having the highest explosive combustibility, under the average compression in the model of engine he mentions, when the engine speed is approximately that able to drive his car at the rate of 20 m.p.h. on relatively level roads.

This, provided the intake manifold and valve chambers are properly designed so as not to waste any of the gas power between the gas generator and the intake valve by expansion. A superheated gas as herein contemplated performs work by mere expansion in the manifold and valve chambers, also in the intake stroke of piston in cylinder, just the same as superheated steam performs work when it expands in the high pressure cylinder of a compound engine, etc.

Now, A. I. A. can readily figure for himself, that his car should run on the piston displacement basis at 20 m.p.h., on fairly level roads, 22.3 m.p.g. At 30 m.p.h. he should run approximately 18 m.p.g.

To give A. I. A. some idea of the power that gas would have, it is enough to say that his car should accelerate from 5 to 30 m.p.h. on high gear in 10 sec.

The gas does not get richer as the speed of the engine increases. But the horsepower to produce the speed increases, so that if a carbureter or gas generator at 800 r.p.m. uses say 55/100 lb. of gasoline per horsepower hour, to develop a certain power to drive the car at that speed, at 30 m.p.h. the horsepower would be considerably greater, but the fuel consumption per horsepower hour would be approximately the same. The difference being in road work, in using more mixture in less time to secure the higher speed than the lower speed.

The trouble with motor cars to-day in the hands of the public, using low volatile gasolines, is that but 10 per cent of the gasoline used is vaporized, 10 per cent partially atomized and 80 per cent of the liquid actually goes into cylinders as raw liquid. There is not time in high speed engines for all this liquid oil to be transformed from liquid to vapor, or gas, before the dead center of the piston, and any flame which develops after the piston starts to fall, adds little if any power to the crankshaft, although it does burn up the oil. To that extent it is wasting valuable fuel oil, due to the low volatility of oils of to-day being used in engines designed for highly volatile oils.

New York. W. P. D.

Two-Cycle Problems

Editor, THE AUTOMOBILE:—Was there a patent ever granted on the two-cycle 2 dia. piston motor? If so, to whom?

2—Would not the two-cycle motor be as efficient as the four-cycle if the cylinder was scavenged with air before admission of mixture, assuming the air to be forced in by some mechanical means?

3—Does THE AUTOMOBILE know of any experiments along this line? The writer has been advised that the Elmore 2 dia. piston motor was a failure, owing to leakage by the piston from the larger diameter to the smaller.

4—Did the Elmore motor have packing rings inserted in the small cylinder to pack against the compression of the larger bore? C. H. P.

Jefferson, Ohio.

—There have been innumerable patents granted to two-cycle two-diameter piston motors. It would be impossible to give a complete list.

2—There is no fundamental reason why this should not be the case.

3—There have been innumerable experiments by a great number of inventors. The majority of two-cycle engines have been lacking in some way because their inventors tried to make them too simple.

4—There were rings on both the large and the small diameter parts of the piston.

Four Most Economical

Editor THE AUTOMOBILE:—We Americans are the greatest automobile manufacturers in the world, but are we the makers of the best automobiles? In my opinion we are not. The tendencies in design on both continents are radically different. Abroad the manufacturers have stuck by the small high-speed four-cylinder engine. Why do the manufacturers in this country build six-, eight- and twelve-cylinder motors? The experts here claim that the high price of fuel abroad is their reason for using the four-cylinder motor. The price of gasoline to the European is of little consequence, for there only the wealthy own machines. You say the public demanded a smooth-running car in which one did not have to change speeds. There is the whole problem. The transmissions in American automobiles are abominable. The slogan of many cars is that we do not have to change speeds. They could not build a gearbox to shift speeds satisfactorily so they stuck on more and more cylinders until shifting was unnecessary. The question is this: Would you prefer two-, four- or eight-cylinders to one more speed in the transmission properly designed?

2—What clearance has the new Marmon between cylinder and piston?

3—What clearance have the Peugeot racing cars between cylinder and piston?

4—What clearance would you advise when fitting aluminum pistons to a small high-speed motor to be used for high-speed work?

New York City. S. G.

—Undoubtedly the four-cylinder car of high-speed type is the most economical if the driver is prepared to shift gears frequently. There seems to be a difference between the characteristics of European and American drivers. The former have no objection to gear shifting while the latter do not like to have to do it.

2—Approximately 6/1000 of an inch.

3—Ten to 12/1000 of an inch.

4—About 2½ thousandths per inch of diameter.

Timing for High Speed

Editor THE AUTOMOBILE:—I have a four-cylinder water-cooled motor 2½ in. bore by 4-in. stroke. I have cleaned and overhauled it this winter. In checking up the timing of the valves I noticed the intake valve remained open until the piston was half way up on compression stroke, so I changed it so it will close when the piston is about ¼-in. past lower dead center. After doing this the valves all seemed to be correct, that is, exhaust opening just before lower dead center and closing just before dead center. Intake opening about ⅛ in. past top dead center and closing at ¼ in. past lower dead center. Now my trouble is this, although the exhaust valve opens before lower dead center on the explosion stroke just as it opens there must be a very large vacuum or something in the cylinder because there is a very small back suction through the exhaust pipe. I have only noticed this in turning the engine over by hand perhaps when she gets to working the explosion will stop this back suction. The intake is a continual suction, no back blow. Perhaps you could give me the exact timing by diagram if this timing is wrong. The motor in high speed is supposed to develop 15 hp. but of course only figures 10.

New York City. S. A.

—Probably the original timing was correct for your engine. Many high speed motors operate best with the intake valve closing very late. If the original timing was in accordance with the maker's setting it will be right and you probably cannot improve upon it.

Fitting Bronze Bearings

Editor THE AUTOMOBILE:—I have a model 17-1909 Buick, which is fitted with full babbitt connecting rod bearings. They require close attention and pound out in very short time. Would a full bronze bearing without babbitt face be advisable? If not, what would you advise?

2—Will you kindly give me the names of a few concerns who would make these bearings?

Genoa, Neb. C. L. A.

—Your experience with these bearings is rather unusual and you will be well advised to make a careful examination of the lubrication system to see that this is operating properly. If this fails to cure the trouble any repair shop will make you bronze bearings with a babbitt face and these are of course stronger than the full babbitt although the latter are most commonly employed in modern engines.

Try Kerosene Mixture

Editor THE AUTOMOBILE:—Would you kindly advise me as to whether the Schebler model L carbureter on my Overland model 59 would handle kerosene as a fuel or not? Would any change be necessary? I have been thinking that I would reduce the tension on the auxiliary air intake valve spring. Would this be advisable or not? I am going to fit a small tank on the dash of the car to supply gasoline for starting.

Vineland, N. J. R. W. C.

—You will very likely find the carbureter will operate well on a half and half mixture of kerosene and gasoline. Some engines run well on this mixture though not all. It will probably need more air. You would be well advised to fit the small tank for starting purposes.

Applying Kerosene to Gas Motor

Editor THE AUTOMOBILE:—To burn kerosene instead of gasoline in a modern gasoline engine what would be the necessary changes to make?

2—Just what effect would the using of kerosene have on the motor and how different from when gasoline is used?

3—Make comparison regarding power, fuel consumption and motor cleanliness.

4—Would it be advisable to use a six-cylinder on a farm tractor instead of a four-cylinder of the same power? State advantages and disadvantages.

De Kalb, Ill. W. B. S.

—A certain quantity of kerosene can be mixed with good gasoline and used in an ordinary carbureter but to burn pure kerosene a special vaporizer is necessary.

2—Usually an engine running on kerosene carbons up more rapidly.

3—There should be practically no difference in power, fuel consumption a little heavier and motor cleanliness inferior.

4—Probably not, the four-cylinder being simpler and having fewer parts.

Speeding Up Buick Model 10

Editor THE AUTOMOBILE:—I am rebuilding a Buick model 10 motor for speed purposes and wish to increase the length of the piston from the wristpin up to give me a higher cylinder pressure. What was the original cylinder pressure of this motor and how much should I lengthen the piston to bring the pressure up to modern requirements?

2—At what speed did this motor develop its maximum power and what was that power?

3—Can you offer me any suggestions to increase the speed and power of my motor?

Marion, Ind. A. E. V.

—It would probably be unwise to increase the compression of your Buick motor as this was designed for the present compression.

2—Model 10 engine developed a maximum of 30 hp. at 2200 r.p.m.

3—For increasing speed, we would suggest the lightening of all reciprocating parts and careful balancing of rotating members. Valve opening can be increased by substituting exhaust cams for inlet cams, and the bottom half of the valve cages can be cut off and the valves seated directly in cylinder head. The magneto timing can also be advanced a little.

Australia Needs Cheap Cars

Stringency of Money Combined with Prosperous Conditions of Industry Creates Market for Low Priced Cars —Country Will Absorb Large Numbers This Year

By THE AUTOMOBILE'S Special Correspondent

THE outlook for the immediate future of the automobile trade in Australia is not a very promising one. The war is costing the Commonwealth $6,250,000 a week, and this has to be paid for by ourselves and not by the Imperial Government, as this party has its hands full with its own affairs. There have been two successful war loans floated in this country, which shows that the wealth of the people is more than anticipated, but this loan, unfortunately as far as trade is concerned, is attracting money that otherwise would have been put into different channels, such as purchasing automobiles. No doubt further loans will have to be floated as expenses keep going.

However, there is one consolation, that is, trade will never go flat while we get good seasons here. The wheat crop this year was enormous, and the same with the wool. The trouble is to shift it away from the country, and the enormous freights that have to be paid does not give the producer the amount of profit he would get in normal times. In fact, the government has commandeered the whole, and so far is only allowing the producer 30 cents a bushel, with the promise that if there is anything left over after the government has finished shifting it to other parts of the world, they will be paid the surplus. It is the producer on the land who is the greatest car buyer.

Mineral Exports Fall Off

On the other hand, there is an immense falling off in the export of mineral wealth, more especially coal. All the mining centers now are very dead indeed, and the purchasing power of the people interested must suffer as a result. Of course, like every war-stricken country, we are burdened with heavy taxation, and this naturally must restrict the purchasing power of the people somewhat.

For the future, though, a good market for the low-priced light American car is assured. At the time of writing freights are $40 a ton, and this, together with other charges, brings the importation cost of the average motor car up to nearly $1,000. These figures include ocean freights, inland freights ranging from $35 to $85, depreciation of English money, exchange assurance and other factors. Thus you will see that the $1,000 car has to be sold in this country at a price something like $2,000.

Practically every make of American car has now found agents in this State, but the older firms do not lose anything by this. The business of several firms has increased by more than double in the last few months, among them being Overland, Hupmobile, Studebaker and Oakland. At present the newcomer, the Dodge, is causing a sensation.

Having regard to the circumstances, the import figures suggest that American manufacturers did not take the fullest possible advantage of the conditions.

Registration of Cars in New South Wales in 1914 and 1915

Return compiled from information supplied by Traffic Department:

	Year 1914	Year 1915
New Registrations, Cars	3293	2758
New Registrations, Commercial Vehicles	229	280
New Registrations, Motor Cycles	3147	2629
Licenses, Drivers	5597	5980
Licenses, M. C. Riders	3550	3796

	On Dec. 31, 1914	On Dec. 31, 1915
Total Cars in use in N. S. W.	10,001	11,345
Total Motor Cycles in N. S. W.	6373	6401
Total Drivers Registered in N. S. W.	15,058	18,800
Total M. C. Riders in N. S. W.	8095	6502
Commercial Vehicles in N. S. W.	585	749
Taxi-cabs in N. S. W.	235	232
Taxi-cab Drivers licensed	377	366

AUTOMOBILE IMPORTS TO NEW SOUTH WALES

Return showing the Imports according to Countries whence imported and Countries of Origin of Motor Cycles, Motor Car Bodies and Chassis during the calendar years 1914 and 1915.

Country Whence Imported	1914	1915
United Kingdom	$987,050	$404,950
Canada	528,055	342,515
Ceylon	1,020	......
Fiji	10	3,720
India	3,045	455
New Zealand	35,980	15,670
Belgium	140,020	2,840
France	20,570	10,910
Germany	104,550	2,445
Italy	89,495	152,555
U. S. A.	555,730	555,525
Hawaiian Is.	......	570
Java	......	8,835
New Caledonia	......	2,145
Totals	$2,455,525	$1,514,345

Country of Origin	1914	1915
United Kingdom	$801,875	$349,400
Canada	338,480	273,515
New Zealand	50	......
Austria	1,210	......
Belgium	58,185	18,705
France	184,790	53,335
Germany	155,785	12,235
Italy	110,575	171,425
U. S. A.	797,575	732,345
Switzerland	......	3,385
Totals	$2,449,525	$1,614,345

Bodies

United Kingdom	$151,100	$65,375
Canada	127,030	84,670
Ceylon	140	.....
Fiji	4,410	1,005
New Zealand	7,530	3,370
Belgium	5,780	875
France	570	.....
Germany	8,565	500
Italy	5,595	7,195
U. S. A.	132,385	158,985
India	......	330
New Caledonia	......	330
Hawaiian Is.	......	105
Java	......	340
Totals	$444,205	$324,080

United Kingdom	$147,415	$66,750
Canada	75,650	64,595
New Zealand	225	.....
Belgium	1,135	.....
France	6,950	2,455
Germany	11,955	2,020
Italy	8,245	7,195
U. S. A.	192,520	180,185
Commonwealth	......	880
Totals	$444,205	$324,080

Motor Cycles

United Kingdom	$277,035	$188,470
Canada	2,000	1,430
New Zealand	1,400	2,075
Belgium	11,020	.....
France	1,075	.....
Germany	1,015	.....
Italy	1,090	.....
Java	155	.....
Netherlands	75	.....
U. S. A.	4,210	17,755
Totals	$299,085	$209,730

United Kingdom	$277,670	$188,255
Belgium	9,505	70
France	255	.....
Germany	2,165	235
Netherlands	75	.....
Switzerland	2,385	750
U. S. A.	6,920	20,225
Canada	......	195
Totals	$299,085	$209,730

ACCESSORIES

Bergen Carbureter

THIS carbureter, just introduced after tests during nearly five years, is of the constant vacuum and metering pin type, as shown in the illustration. The distinctive feature is the use of a ported piston *P*, which operates within a ported cylinder *C*. No springs or auxiliary air valves are employed. The suction of the engine controls the opening and closing of the air ports, the movement of the piston varying with the speed of the engine. Attached to the piston is a tapered metering pin *M*, which moves with the piston, being suspended from a ball so that the pin moves up and down within the gasoline jet *J*, increasing and decreasing the gasoline aperture. The pin is tapered in relation to the opening of the ports so that the correct proportions of air and gasoline are maintained, no matter how much the engine speed may vary.

When starting, the piston is down and the ports are closed. Air is supplied through the hot air hose *A*, passing through a series of holes *B* in the base of the cylinder, then through the venturi leading it to the top of the jet, where it meets the gasoline. From here the air and gasoline mixture passes through the spray *H* and is deflected into the mixing chamber. This arrangement, in conjunction with the constant vacuum principle upon which the carbureter is based, facilitates starting under all conditions and, after the engine is warmed up, aids carburetion.

After starting, when the suction of the engine has lifted the piston, the gasoline passing up the jet mixes with the hot air, passes through the spray, strikes the baffle plates in the base of the piston and passes into the mixing chamber, where it is thoroughly mixed with the air taken in through the lower ports and further mixed when passing the upper ports.

The only adjustment on the carbureter is made by the lever *L* attached to the gasoline jet by which the jet can be raised and lowered, thus changing the mixture by bringing a different part of the tapered pin *M* into operation. When this adjustment is properly set at any speed the mixture is correct at all speeds. The metal float is of standard construction, gasoline being delivered to the float chamber through a fine mesh strainer.

Some of these carbureters have been in successful operation for a considerable time. The manufacturers claim that workmanship and material are of the best and that the adaptability of the various parts is unusual. List prices are: 1-in., $25; 1¼-in., $30; 1½-in., $35; 1¾-in. $40; and 2-in. $45.—Bergen Carburetor Co., Inc., Long Island City, N. Y.

Pennsylvania Ebony Tread

This new black-tread tire, illustrated herewith, is claimed to offer unusual resistance to cuts, punctures and abrasion, owing to the great thickness and toughness of the tread. The manufacturer guarantees this addition to its line, which includes the Pennsylvania Vacuum Cup tires, for 5000 miles.—Pennsylvania Rubber Co., Jeannette, Pa.

A C Long-Body Titan Plug

This new plug, recently placed on the market, follows A C Titan design and is called the long body ⅞ A C Titan, having the standard S. A. E. ⅞-18 thread but differs from other models in that the body of the plug is considerably longer rendering it particularly suitable for motors in which the plugs are located in a deep recess. It sells for $1.

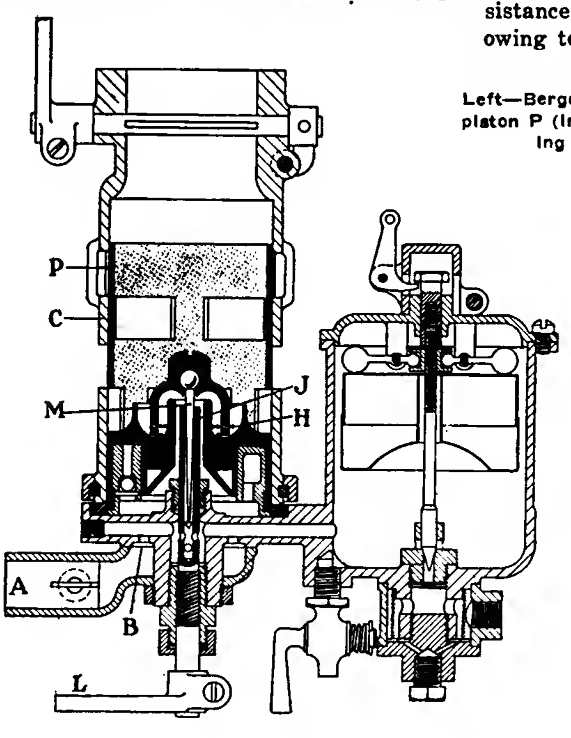
The A C Titan plug is also made in a long body metric size particularly adapted to foreign cars. Renault has adopted it as regular equipment. The plug is furnished either with regular length of thread or with extension.—Champion Ignition Co., Flint, Mich.

Top Covering for Fords

A top covering ready to attach to any Ford is made of a rubber composition. It takes the place of the old top when it is worn and leaky.—Cray Bros., Cleveland, Ohio.

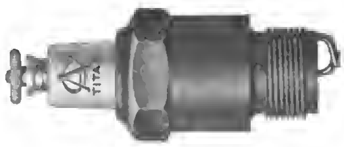
Airspring Grease Cups

The body of this grease cup is internally threaded and a hollow top screws in air tight. Within a cap is a metal disk which rests on the grease and is pressed down by a light coil spring. Screwing down the cap increases the air pressure in the cup and causes the grease to be fed gradually. Air pressure is assisted by the spring. The cups are of pressed steel and all parts are readily removable for cleaning. Copper and brass finishes may be had, and polished or nickel-plated finishes are extra. Prices, plain, ½-oz., $1; 1 oz., $1.25; 3 oz., $1.50; 6 oz., $1.75.—Hunter Pressed Steel Co., Philadelphia, Pa.

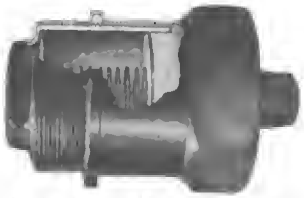


Left—Bergen carbureter in section, showing ported piston P (in black) operating in ported wall of mixing chamber C. Note hot air hose A

Right — Pennsylvania Ebony tread tire which is said to be unusually tough and durable



Long body ⅞ A C Titan spark plug



Air Spring grease cup, showing spring actuation

The AUTOMOBILE

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Air Cooling

IT is impossible to read F. W. Lanchester's analysis of the problem of cooling internal combustion engines without a feeling of surprise that so little has been done to develop the air-cooled cylinder type. After abandonment by Lanchester's own concern the Franklin car remained the only air-cooled car in the world, barring very small machines. The early Lanchesters were entirely successful engines, and the Franklin is equally so, yet there are no imitators.

The immense concentration of thought upon the aëroplane engine which is observable at present cannot fail to establish exactly what are the good and bad points of air cooling as applied to engines of all sorts of designs. Whereas data on the subject used to be scarce, it will soon be plentiful, and it is interesting to ponder upon the probable effect on automobile engineering.

It is unquestionable that the water needed by most cars is a nuisance. We are so accustomed to it that the trouble in keeping the radiator full, in preventing it from freezing, in guarding its delicate structure from injury has become second nature. If it can be abandoned so much the better, if we lose no other qualities concurrently.

In these days, when new ideas are being accepted so readily, it seems fitting that the subject of air-cooling should receive its share of attention by automobile engineers. There is now no doubt whatever that automobile engineers are going to be the aeronautical men of the future, at least so far as the power plants are concerned, and this can only mean that the design of aeroplane engines and of car motors will become more similar.

War has proved that the automobile engineers could make the best engines by far; it has completely discredited the aero specialists who claimed that theirs was a special subject, and it is thus impossible to believe that automobiles of the air will not henceforward be closely identified with those of the land.

Engine Temperature Control

AS gasoline becomes of heavier gravity, the need for some automatic means for controlling the temperature in the water system of the modern car is apparent. All sorts of makeshift devices are used for shutting off part of the air that passes through the radiator, so it is a strange thing that engineers have not hit upon a method of regulating the cooling in proportion to the demands of the engine at any temperature.

In summer a larger cooling area is wanted; in winter very much less, and it is surprising that someone has not hit upon a means for controlling this either automatically or manually, just as the heating of the carbureter is controlled.

The attempt to control the temperature of water in cylinder jackets has been very successful, but, having regard to the fact that the air passing through the radiator is the ultimate cooling medium, it would seem possible to obtain the advantages of the thermostat by controlling the air flow instead of the water flow. There is a correct temperature for each type of engine, and anything which assists to maintain that temperature accurately will be an improvement to the car.

Individuality

THE ultimate future of custom body building just now offers an interesting field for speculation. The outstanding fact is that there is a greatly growing demand for special bodies, for automobiles that are distinctive from all others.

There are two possible viewpoints. One is that the present state of affairs is a passing craze which will die away, and that the steady improvement of the stock body will reduce the demand for bodies that are built specially. The other view is that the men who can well afford to have what they want are waking up to the fact that there is a greater pride of possession in a car which is unlike any other in the world, than in a vehicle made to pattern.

If the latter idea is the true one, and it appears the more rational in many ways, then the building of custom bodies is likely to become a very important branch of the industry. In Europe the carriage building trade has flourished exceedingly under the automobile régime; it has even grown, and there seems no reason why the same thing should not happen in America.

Motor Reserve Called Out for Service in Mexico

Los Angeles Corps Ordered to the Border—Five Companies of Volunteers Ready for Service—War Department Buys Fleet of Trucks

Los Angeles, Cal., March 12—Volunteers in the Los Angeles Motor Reserve Corps and the recruits in new corps which are being organized this week are to have a chance to show what they can do as quickly as things begin to happen when Uncle Sam gets into action down Mexico way. The first call for volunteers sent out from Washington came this week to the motor reserve corps of California cities, while the well-drilled Los Angeles corps received notice to depart for the border Wednesday, March 15. These are the men who belong to the battery which has been getting in trim for military service, staging practice maneuvers and trial runs in the vicinity of Los Angeles and San Diego in the last few weeks. In addition two full companies of touring car reserves have been recruited in Los Angeles, ready for immediate service. San Francisco is sending two companies and San Diego early this week completed the organization of a fifth company.

The Los Angeles Motor Reserve Corps is under command of Lieut. Al G. Waddell, staff correspondent for The Automobile. He will keep The Automobile readers informed of the operations of the motor reserves during the Mexico expedition. The entire body of motor reserves will go into the field under command of Capt. H. D. Ryus, winner of the first Phoenix road race.

Truck Efficiency High

The corps led by Lieutenant Waddell is the volunteer motor reserve organized in the United States. In recent maneuvers it was shown that a field artillery train composed of four 2½-ton Moreland, worm-drive trucks, the type so far used, are equal to fifty cavalry horses in moving equipment, not considering that they will cover as much ground in a half-hour's time as a troop train could cover in a hard day's driving. It looks as if Gen. Francisco Villa's sharpshooters will have to contend with a considerable amount of dust when the motor artillery drives in their direction, especially since the government has purchased 54 new trucks.

Watt L. Moreland, manager of the Moreland truck factory, is a private in the motor reserve corps and has been present at the practice expeditions. He will furnish fifty-four expert drivers. The men in all of the volunteer companies have undergone a rigid physical examination. Before the truck drivers are accepted for service the officers examine them in the operation of Moreland trucks.

A 3-in. field gun and twenty men were carried on each of the four trucks which recently made the 132-mile run from Los Angeles to San Diego, and a complete field battery, consisting of the gun, shells and battery wagon, weighing more than 4 tons all told, was transported as well. The gun and caisson were trailed behind one of the trucks. The average speed was 20 miles per hour.

In co-operation with Uncle Sam's aeroplane squadron the motor reserve corps will constitute one of the army's chief adjuncts, in the event of an extended expedition into Mexico. The distances and the sparsely settled condition of the region will require exceeding efficiency in maintaining the lines of communication and in moving supplies. Americans may see American military motors in action at the moving picture theaters in future where they have become accustomed to seeing foreign pictures. Cameramen for the news films can take real instead of "faked" pictures for a while. Lieutenant Waddell will tell the story from week to week.

Determined to conduct the pursuit of General Villa in an efficient and modern manner, the War Department asked for bids on two complete motor truck companies, opening on March 14. Besides the short notice given bidders, the action is also interesting in that not only are the manufacturers requested to furnish the chassis but the drivers and officers as well.

New York City, March 15—Colonel A. L. Smith, the United States Army Depot Quartermaster, has awarded to the White Motor Co., Cleveland, and the Thomas B. Jeffery Co., Kenosha, the contract for furnishing the trucks requested by General Funston for the coming campaign in Mexico.

Colonel Smith said he believed that speed in delivery was the prime factor on which the awards were based, and he attributed the selection of two companies instead of just one to a desire on the part of the Government for an experiment in trying out distinct types of machines.

The proposals were for fifty-four 1½-ton motor truck chassis, two wrecking and supply trucks to be equipped with machines for field repairs, such as a small lathe, a drill-press, a forge and a bench vise, and a selection of repair parts. In addition to these, fifteen motorcycles for the use of corporals and messengers are to be supplied. These trucks will be divided into two companies organized along lines identical with those used for horse companies, there being twenty-seven trucks and one wrecking car in each company.

The men desired to go with the vehicles are one truckmaster at $150 per month, three assistant truckmasters at $125, one mechanic at $125, one assistant mechanic at $100 and twenty-seven drivers at $100 for each company. These men are to be civilians familiar with the operation of the vehicles, and are to be paid by the Quartermastor Corps.

No bodies are asked for; the regulation United States army body, 10 ft. 4 in. long, will be used. The trucks are to be delivered f.o.b. the factory. The regulation United States army specifications for 1½-ton trucks are asked for, but delivery will be one of the prime considerations.

More reliance is to be placed upon these two companies than would at first be apparent, for it is expected that the two truck companies will furnish the entire transportation for the present force of 5000 men, in the expedition into Mexico, between the base of supplies and the troops. Each regiment will have its own company of twenty-seven horse wagons, but the trucks will be the connecting link between all five regiments and the base of supplies.

Colonel Smith, who has seen service in Sonora, states that one truck company of twenty-seven trucks should be sufficient for the entire force for the first four marches of 20 miles per day, after which the second company will be needed. He points out that service in Mexico will be very different from that in Europe today, as the distance which the troops will travel and the amount of marching they will do will be much in excess of that encountered abroad.

It is estimated that the two truck companies will cost about $125,000.

Handle Time Payments for Dealers of Twenty Factories

New York, March 13—The Guaranty Securities Co., Toledo, through which the Willys-Overland Co. a short time ago completed arrangements for the disposal by its dealers of cars on the time payment plan, is about to be reorganized and its scope of operations greatly increased. Under the reorganization plan, the company will be known as the Guaranty Securities Corp., and will be prepared to handle time payment business for the dealers of some twenty different manufacturers. The system under which the corporation will operate is somewhat similar to the general plan outlined in Automobile for March 1, there being no expense to the dealer.

Overland Income $9,870,678

Earns Over 46% on Common After Adding in $1,000,000 Set Aside for Emergencies

TOLEDO, March 13—The annual report of Willys-Overland, Inc., for the fiscal year ending Dec. 31, 1915, which has just been made public, shows a net income of $9,870,687 for the year, after setting aside $1,000,000 as a reserve for contingencies. With this reserve added, the figure is equal to over 46 per cent earned on the $21,000,000 of outstanding common stock after figuring 7 per cent on the preferred stock of $15,000,000. The report also shows a profit and loss surplus at the end of the year amounting to $14,720,550, as against $7,651,931 for the previous year, or practically double, thus evidencing the excellent condition of the concern at the start of its largest production year. During 1915, there was redeemed $250,000 of preferred stock, this amount being included in the surplus account.

The total of assets and liabilities reached $58,908,803 as compared with $43,407,482 the previous year, and in this, the item of good will, patents, trade marks, etc., is still set down at $14,059,932. As an evidence of the plant and real estate extensions of the Overland concern, the increase of the item covering these from $9,127,188 to $16,945,453 this past year is of interest. It shows plant and equipment appreciation of over $7,500,000. The inventories account covering parts and materials on hand also took a big jump from $9,648,745 to $17,752,812.

Comparative balance sheet and report for 1914 and 1915 appear below:

Net after expenses, taxes, repairs, depreciation, etc.	$11,201,255
Reserve for contingencies	1,000,000
Interest	330,577
Net income	$9,870,678
Preferred dividends	322,165
Surplus	$9,548,513
Common dividends	2,229,895
Surplus	$7,318,618
Redemption of preferred stock	250,000
Previous surplus	7,651,931
Profit and loss surplus	$14,720,550

The consolidated balance sheet of the Willys-Overland Co., and subsidiaries, as of Dec. 31, 1915, compares as follows:

Assets

	1915	1914
Good will, patents, trade marks, etc.	$14,059,932	$14,059,932
Real estate, buildings, plant and equipment	16,945,453	9,127,188
Investment in and advances to affiliated companies	680,286	2,251,767
Inventories	17,752,812	9,648,745
Balance due from European agents and domestic selling companies	1,081,770	901,942
Accounts receivable	1,929,757	1,813,656
Notes receivable	2,048,494	1,501,283
Miscellaneous investments	70,475	49,925
Cash	4,023,342	3,928,098
Deferred charges to future operations	316,482	124,943
Total	$58,908,803	$43,407,482

Liabilities

	1915	1914
Preferred stock	$4,483,700	$4,721,000
Common stock	21,000,000	20,000,000
Real estate mortgage assumed	448,269	131,500
Notes payable—bank loans	10,200,000	4,434,476
Trade accounts	....	3,164,820
Accounts payable	4,942,179	1,669,273
Pay rolls and salaries accrued	216,560	46,590
Customers' deposits	451,944	291,760
Taxes and interest accrued	164,426	114,021
Reserve for rebates to customers	424,838	235,485
Reserve for car repairs	30,000	30,000
Reserve for royalties payable	30,000	....
Preferred dividend payable Jan. 1	78,465	82.617
Reserve funds	1,717,873	834,005
Profit and loss surplus	14,720,550	7,651,931
Total	$58,908,803	$43,407,482

3787 Saxons Shipped in 2 Months

DETROIT, March 4—During the first two months of this year the Saxon Motor Car Corp. has shipped 3787 cars or 2237 more than during those corresponding months in 1915. This is an increase in shipments of 144 per cent.

The February shipments totaled 2231 cars or 1387 more than in 1915. In January 1556 cars were shipped or close to twice as many as last year when 850 were shipped.

Chalmers Starts New Parts Building

DETROIT, March 4—The Chalmers Motor Co., has started the construction of a new four-story manufacturing building, 60 x 400 ft., to be known as building No. 2. Only parts for Chalmers models of past years are to be made in that structure. Part of the main floor will be provided with factory offices and store room. With a wing, 50 by 60 ft. and the service building recently completed, this will provide 156,000 sq. ft. of additional floor space bringing the total of the entire plant to about 777,500 sq. ft.

Van Schlegell Hupp V.-P.

DETROIT, March 6—Arthur van Schlegell has been appointed vice-president of the Hupp Motor Car Co. Mr. Schlegell is a well known Detroiter who has been general manager and vice-president of the Michigan State Telephone Co. He will remain as vice-president of the telephone company, but not as an executive.

Parrott One-Wheel Tractor Announced

JACKSON, MICH., March 4—The Parrott Tractor Co., has been formed in this city to make the one-wheel Parrott tractor. The officers of the company are B. R. Parrott, president; Louis Goodhart, vice-president and sales manager and M. N. Stewart, secretary-treasurer.

The concern has started operations in the plant of the old Fuller Buggy Co.

Perlman Rim Corp. Organized

Demountable Rim Inventor Heads $10,000,000 Concern Controlling His Patent

NEW YORK CITY, March 15—Announcement is made to-day of the formation of the Perlman Rim Corporation, under the laws of the State of New York, with a capital of $10,000,000. The company has acquired all of the patents, applications for patents and rights of L. H. Perlman, the inventor of the Perlman demountable rim, which, in various forms, is now in almost general use throughout the world.

While the company has a broad charter, it will, for the time being at least, confine its operations to the manufacture and sale of demountable rims of which upwards of 700,000 sets will be required to meet the demands for the season of 1916.

Strong Financial Backing

Mr. Perlman, the president of the company, makes the following statement:

"The threatened shut down of automobile production incident to the settlement of the demountable rim patents controversy has now been happily averted. The manufacture of automobiles, so far as demountable rims are concerned, will go on as usual and without pause. Infringing rim makers and users will be treated fairly."

The Perlman Rim Corporation is being financed by Mr. L. G. Kaufman, President of the Chatham & Phenix National Bank, who has associated with him a number of prominent and equally influential interests.

The long continued and vigorously contested legal battle culminating in a recent decision by the United States Circuit Court of Appeals, established for the Perlman patent basic rights and carried with it judgment for an accounting against the rim manufacturers of the country under which back damages of upward of $1,000,000 have accrued.

Manufacturers' Meeting at Detroit

Probably no decision rendered by the courts of this country in recent years has created a greater sensation, due to the entanglements resulting therefrom which bid fair at one time to tie up nearly the entire automobile industry.

The announcement of the formation of the Perlman Rim Corporation which carries with it the assurance of early adjustment of all differences will come as a pleasant surprise to the automobile manufacturers who are to-day (Wednesday) in session at Detroit, Mich., in the hope of averting a crisis.

Full Season For Des Moines

Speedway Plans Include Many Events—300 Mile Free-for-All Heads List

DES MOINES, IOWA, March 13—The Des Moines speedway announces the complete program of events for the season of 1916. A racing meet, limited to Iowa entries, will open the season of Memorial Day. The big event of this meet will be the Iowa Derby, for a distance of 20 miles, and with entries limited to Iowa-owned cars. There will be a 10-mile race with entries limited to Des Moines-owned cars. An Iowa Derby of 20 miles will be held also for Iowa motorcycles and a 10-mile race also for Des Moines-owned motorcycles. The entry fee for these events will be nominal only and the size of the prizes will be determined by the gate receipts.

The big event of the year for the Des Moines speedway will be the 300-mile free-for-all on June 28 with minimum speed requirements, a technical committee to determine the qualification of drivers, and a purse of $10,000. Bob Burman, Billy Chandler and Fred Duesenberg are prominent among those who already have entry blanks for the June 28 event.

A non-competitive program will be staged at the speedway on July Fourth. It will be a sort of celebration with exhibition automobile races, aeroplane flights, fireworks and kindred attractions.

An invitation meet on Sept. 4 will end the Des Moines speedway program for the year. This will be in celebration of Labor Day, which falls on that date. The starts will be limited to six in number and invitations will be issued only to drivers who have finished first or second in races on the American Association speedway circuit for the season of 1916. The winners and the management will split the gate receipts, fifty-fifty.

Coffin Heads Industrial Preparedness Committee—Speeds Organization Work

NEW YORK CITY, March 15—Howard E. Coffin, chairman of the committee on industrial preparedness of the Naval Consulting Board, yesterday opened headquarters in the Engineers' Building. Here Mr. Coffin will accelerate the work of mobilizing the industries of the country, comprising almost two-thirds of the world's output for preparedness purposes. The co-operation of the nation's business men is being sought through the Chamber of Commerce of the United States. With the support of the manufacturers the next step will be the gathering of information about 40,000 plants through 240 field directors, a board of five men in each State who are leaders in their professions. This information will be tabulated under the direction of W. S. Gifford, chief statistician of the American Telephone and Telegraph Co., who is the supervising director of field work of the committee.

The idea is that the Government will place small yearly orders for military and naval supplies with each plant to be filled at cost and in the event of war each concern will receive orders based on a 10-per cent profit.

To Handle Federal and Commerce Trucks in New York City

NEW YORK CITY, March 15—The local branch of the Federal Motor Truck Co., Detroit, has been purchased by prominent New York men, who will complete a corporation and will market both the Federal and Commerce trucks in the Metropolitan district. This branch is the last one to be sold, the Federal company having decided more than a year ago to sell all of its branches. After negotiations, Cornelius Vanderbilt, J. B. Ford, Henry Whiton, Edwin Palmer and M. W. Smith, all prominent local club men, were brought together and the deal was made.

Splitdorf Starts Plant Addition

NEWARK, N. J., March 10—Ground has been broken for the new addition to the plant of the Splitdorf Electric Co., this city. This new six-story building will practically double the present production of 1500 Splitdorf magnetos a day, and will add approximately 110,000 sq. ft. in space. The dimensions of the addition are 300 by 60 ft. and the construction will be along the most modern lines of concrete, brick and steel. It is estimated that the present number of employees, 2000, will be increased approximately 33 1/3 per cent.

Two Detroit Plants in Cleveland

CLEVELAND, OHIO, March 12—The H. J. Walker Co. has now removed its entire equipment from Detroit into a plant built for it on the grounds of the Chandler Motor Car Co. The Walker shops handle much of the Chandler company's machining.

A plant for the Briggs Mfg. Co., Detroit, is also being erected on a site adjoining the Chandler factory. In this plant the Briggs Co. will paint and upholster 20,000 bodies for this year's Chandler production.

2,430 Fords in 1 Day—A Record

DETROIT, March 3—The Ford Motor Co. broke its previous output and shipping record Feb. 29, when 2,430 Fords were made and shipped. This is 330 more than the previous high mark.

Four Events Open Sheepshead Bay

New York Speedway Will Have Varied Program of Race Events May 13

NEW YORK CITY, March 15—Four events will open the Sheepshead Bay motor speedway racing season May 13. The feature event will be the Metropolitan trophy, a 150-mile race for cars within the 300-cu. in. piston displacement limit. Entrants will be required to make 90 m.p.h. to qualify, and the race will be limited to 90 min. It is an A. A. A. 1916 championship award event under the new plan of the contest board of that organization for determining racing champions. The trophy will be contested for over three or five years. There will be $15,000 in prizes distributed over seven places, varying from $6,000 for first to $400 for seventh.

The other events are: The 50-mile Queens cup race carrying $2,500 spread over five places; the 20-mile Coney Island cup with $1,500 for five places; both being for cars within the 300-in. limit; and the 10-mile Brooklyn handicap for non-winners, the prize being the Wm. Kemble cup and $1,000 in five prizes. Anyone not taking a prize in the previous events is entitled to compete in this race. These three cups are given outright to the winners.

Big Match Race

The Sheepshead Bay corporation is setting the fashion with short races, another interesting event for the May 13 opening promising to be a match race for 10 miles for a big purse between the three fastest cars in the world.

Albany Court Holds Maker Liable for Defects

ALBANY, N. Y., March 14—A manufacturer is liable for defects in an article which causes injuries to the purchaser, even though the article is purchased through intermediaries, according to a decision of the Court of Appeals, yesterday. The decision is said to establish a new principle in law, for previous court rulings held that manufacturers were liable only for articles inherently dangerous, such as poisons, explosives and firearms.

Suit was brought to recover damages resulting from being thrown out of an automobile purchased a year before the accident. One of the wheels collapsed and it was found that it had been constructed of defective wood and that the defect could have been discovered upon examination before the car left the factory.

S. A. E. Summer Meeting Program

Full Details of Arrangements for Four-Day Trip on Noronic Now Completed

DETROIT, MICH., March 10—Complete arrangements for the mid-summer cruise of the Society of Automobile Engineers, June 12-16, as evolved by the 1916 meetings committee, contemplate the most extensive summer outing the society has yet undertaken. The steamer Noronic, with accommodations for approximately 550, has been chartered, and the four-day cruise on Lake Huron and Georgian Bay embraces Mackinac Island, Collins Inlet and parts of the thirty Thousand Islands, with a complete day given over to picnicking, fishing and sight-seeing through the island.

The four-day cruise starts from Detroit Monday, June 12, at 2 p. m., and ends here Friday, June 16, at 6 p. m. The complete itinerary is:

Monday, June 12—Leave Detroit 2 p. m., Eastern standard time.
Tuesday, June 13—Arrive Mackinac Island 11 a. m.; leave Mackinac Island 6 p. m.
Wednesday, June 14—Arrive Killarney, Ont., 7 a. m. Day given over to picnics, etc.
Thursday, June 15—Leave Killarney 5 a. m.; arrive Owen Sound, Ont., 3 p. m.; leave Owen Sound 7 p. m.
Friday, June 16—Arrive Detroit 6 p. m.

$35 Inclusive

Full details with regard to tickets, reservations, etc., on the Noronic for the four days have been concluded, and boat tickets including meals and berths in all staterooms (ten parlors excepted) are at $35 each for all members. Guests are charged $5 additional. Children between five and twelve, $17.50 each. The ten parlors, which occupy the best positions on the Noronic and afford special facilities, cost $150 each, this including two tickets and meals, etc.

Entire charge of selling tickets and making reservations is in care of the 1916 meetings committee, which has headquarters at 601 Kerr Building, Detroit, where W. H. Conant, treasurer of the committee is in charge. All applications for reservations must be addressed to the S. A. E. at this address. Checks payable to the Society of Automobile Engineers must accompany all orders for tickets and reservations.

Last year the capacity of the Noronic was well taxed on the occasion of the mid-summer S. A. E. session, but this year so great is the interest that it is expected the total accommodations of 550 will be reserved by May 1. In order that S. A. E. members may not be disappointed in securing space, their applications will receive first consideration providing they are in the hands of the committee by May 1. Previous to this date applications will be considered in the following order: First, S. A. E. members and their families; second, applications of sectional associates; third, applications for guests of S. A. E. members; and, fourth, applications for guests of sectional associates. Names must accompany all applications for tickets and reservations.

Daily Program Drafted

Already a tentative program for the four-day session has been drafted by Chairman George H. Dunham and his associates. This program will give approximately the same time to professional sessions as last year, but will afford more opportunity for recreation. Three of the four evenings on the boat will be given over to entertainment furnished by the six sections of the society, to be followed by dancing. Only one evening—namely, Monday—will be devoted to a professional session.

In order to give all in the party aboard the Noronic an opportunity of becoming acquainted, a promenade will be held on the deck Monday afternoon, soon after sailing, and on Friday afternoon, previous to the party disembarking at Detroit, there will be an *au revoir* promenade.

Picnic June 14

Wednesday, June 14, should prove the greatest picnic day in S. A. E. records, as morning, afternoon and evening will be given over to recreation. W. A. Brush, secretary of the 1916 meetings committee and in charge of steamboat arrangements, has arranged with the Northern Navigation Company to afford facilities for fishing, picnicking and excursions through the islands. Provision will be made so those desiring to charter motorboats and launches for the day can do so through the 1916 meetings committee.

President Wilson May Open World's Salesmanship Congress

DETROIT, MICH., March 11—President Wilson has signified his willingness to open the World's Salesmanship Congress, which will be held in Detroit, July 9 to 13. He stated to H. W. Ford, president of the Saxon Motor Co. and vice-chairman of the program committee of the Congress, who made a special trip to Washington to invite him to attend, that he wanted to be at the Congress at least one day and that, providing something unforeseen did not prevent him at the last minute, he would be there either to attend the opening or on some other day.

Many Additions to Detroit Plants

Numerous Parts and Accessory Makers Find Need for Enlarging Their Factories

DETROIT, MICH., March 13—Automobile parts and accessory makers here figure prominently in the list of local concerns which are having additions or new plants erected. Contractors and architects say that they are doing more work for the parts and accessory makers now than in several years. It is quite natural, because with the big increase in car output many of the parts and accessory makers, in order to take care of the increased needs for their products by the car makers, must greatly enlarge their plants and increase their manufacturing facilities.

The American Auto Trimming Co. is adding a five-story building 254 x 95 ft. to its Meldrum Avenue plant. This will provide 120,650 sq. ft. of additional floor space. The working force is to be increased from 500 to at least 700 men, and the top-making part of the company's business will be concentrated upon at the plant on East Grand Boulevard.

The Detroit Auto Specialty Co. has in course of erection a new enameling plant one story high, 300 x 40 ft. When the plant is completed the company will employ 300 or more men.

A three-story addition 92 x 70 ft., providing nearly 20,000 sq. ft. of additional floor space, is being added to the plant of the National Can Co. With the exception of new offices, the entire addition will be an extension of the automobile radiator department, in which it is said that an average of 150 radiators are made now. The working force will be increased from 600 to 800 or more.

At the General Aluminum Brass Mfg. Co. a third floor 160 x 60 ft. is being added.

Nearly 40,000 sq. ft. of floor space is being added to the former Metal Products Co.'s plant, which since last year is a part of the Timken-Detroit Axle Co. A four-story addition 163 x 60 ft. is in course of construction. At least 400 more men will be given employment, bringing the total up to at least 1650.

The Roberts Brass Mfg. Co. is more than doubling its plant. The additions consist of a new foundry, enlarged machine shops and new offices. When completed the plant will front 300 ft. on Fort Street west, 200 ft. on Junction Avenue and 200 ft. on Merrill Street. Most of the new buildings will be two stories high. The foundry will be located on the second floor, alongside of the alley. The company makes, among many other products, special parts for automobiles.

A.A.A. Grants Hudson Records

Revised Record Sheet Covers Conditions of Non-Competitive Records

New York City, March 9—The recent performances of the Hudson Super Six stock car on Sheepshead Bay Speedway, Nov. 25, were incorporated into the official records of the Contest Board of the American Automobile Assn. at its meeting here to-day. The records granted are non-competitive ones, namely, those in which only one car was on the track and occupy a separate division from competition records. It was necessary for the Contest Board to revise its entire schedule of official records and create a non-competitive division. This division covers practically the same field as the present competitive records and includes all classes of speedway distances according to piston classification; 1 mile circular dirt track distances; speedway records regardless of class; straightaway free-for-all records; and stock chassis straightaway records; and 24-hr. records.

Under this new classification the new Hudson non-competitive records granted are:

Stock car non-competitive records—piston displacement 231 to 300 cu. in.

10 miles	7:54.4
20 miles	15:45.8
50 miles	39:30.8

Under the revision of the official record table it will be possible for manufacturers and others to secure non-competitive stock car and stock chassis records as well as non-stock car and non-stock chassis records. The revised record sheet is sufficiently comprehensive to practically embrace all forms of tests that may be expected for several years to come. In the reclassification all existing records of various classes are continued as heretofore. Up to this time there has been some confusion between records made in competition with other cars and those without competition, namely a single car on the track. The board was convinced it was not right to put competitive and non-competitive records in the same division and hence the new arrangement in which all competitive records are classified under Division 1 and all non-competitive records under Division 2. There are arrangements for official fuel economy records, etc.

The further important work of the board was the drafting of specific rules for stock 24-hr. races. There has been a demand for such and already a sanction has been granted for a stock car race June 16 and 17. The new stock chassis rules permit of certain options on the chassis. A stock chassis is defined as:

"A motor car chassis which for the options and requirements listed below can by adding the necessary parts be assembled into a complete stock car."

The options or changes in construction of the chassis permitted are merely those made necessary by safety in driving and others due to removing the body. Thus it is possible to remove leaves from the springs; to change the angle of the steering column for safety purposes and also to make whatever changes are necessary in gearshift and brake levers as well as pedals. Wire wheels are optional and the rear axle gear ratio is such as the standard axle construction will permit of.

Stock Car Restrictions

Certain requirements are added under the new rules: Thus bonnet straps must be carried, fenders and running boards must be removed, and only stock arrangements of ignition, lighting, starting, carburetion, lubrication, cooling, etc., are permitted. Not the slightest change is allowed in any of these systems. The taping of electric connections at terminals, and the taping or wrapping of piping used in the fuel, water, gas or other lines prohibited. The chassis must have complete set of floor boards and standard dash. Wrapping of springs not permitted. In the race the complete lamp equipment is necessary.

Under the stock chassis definition it is naturally permissible to remove the body, running boards, brackets supporting same and other parts which do not serve any direct part in the function of the vital parts, but which are necessary because of the body.

Many Reinstatements

Considerable routine work was carried out at the meeting: Percy Keene, driver, Danbury, Conn. was reinstated; Roy F. Metz, driver, Detroit, was declared eligible for registration; Jos. L. Mazuco, driver, Chicago was reinstated. Terms of disqualification were reduced on the following drivers so as to terminate at dates mentioned: C. D. Klein, July 1; Wm. E. Brown, Sept. 1.

E. H. Shannon, California, was suspended until July 1 for failure to report to officials and failure to start at a California meet Dec. 28.

The Maxwell racing cars recently purchased by Ray Harroun from an outlaw promoter were reinstated on the ground that when these cars were leased to the promoter under the terms of the contract with the Maxwell company the promoter was in good standing. The mile track at Kalamazoo, Mich., was reinstated on recommendation of Clifford Ireland, board representative, Illinois.

Gas Price Hurts Independents

Standard Oil Gets More Gasoline From Crude Oil by Patent Process

New York City, March 10—The rise of gasoline prices has brought a crisis in the affairs of several of the companies among the Independents. There is an old feud between them and the Standard Oil interests, and every cent that is added to the price of gasoline aggravates the difficulty. It is those who are being pinched the hardest who come with an appeal to the motorists of the country. They urge the necessity of a public policy which will act to conserve the supply of crude oil, and to protect motor car users from excessive gasoline prices in the future. Plans are afoot to renew the effort to pass legislation which would allow federal regulation of oil production by the method proposed in 1913 by Secretary of the Interior Franklin K. Lane.

Ask Public Support

Motorists and manufacturers of motor cars are scarcely aware of the power that might be exerted by their combined influence. Men in the oil business, however, who are looking about just now for a life-belt of some sort, have recognized the vital interest which the motoring public has in the problem of gasoline supply. They see too that more crude oil is required for the manufacture of gasoline than scientific methods make necessary. The patented process of refining, controlled by the Standard Oil interests, extracts from two to three times as much gasoline from the oil as other refineries obtain. This is one source of waste. Too many wells in the same vicinity, a condition which arises when there is no regulation exercised in the drilling and production, constitutes another great source of loss by draining the fields too rapidly and reducing the flow of the wells, at least so the experts declare.

Want Congress to Help

In demanding that Congress adopt a plan of conservation to end the exploitation of the country's oil fields, the companies desiring this step are acting not wholly in spirit of generosity toward gasoline users as they have a selfish motive, too. If it were possible to obtain government regulation of oil lands under Secretary Lane's plan, just as the government now exercises control over the pipeline companies as common carriers, the Independent producers would be placed on an equal footing with the Standard Oil organizations, so far as production is concerned. If at the same time the patents controlled by the Standard Oil Co. were to be released to the public, the greatest handicap of the Independent refineries would be removed.

Litigation to force such a step is possible, but in years gone by none of the independent companies has shown an inclination to take the initial steps in the fight. Competitors of the Standard Oil Co. assert that the patent on the Burton process is invalid because it is based on improvements to other patents which have expired.

Whatever the merits of the claim, conditions compel the Independent refineries to use two hundred barrels of crude oil oil to produce 40 gal. of gasoline, while the Standard Oil refineries would obtain the same amount of gasoline from 100 gal. of the same quality of crude oil. The burning oil and fuel oil, which are the other products of the still, must be disposed of also, though both are produced in quantities exceeding the normal demand. Thus while gasoline sells at high prices and is scarce, the burning oil and fuel oil are over-plentiful and sell at low prices. Any profit realized on the crude oil must be derived from the gasoline, which is one of the important factors in raising prices. Little or no profit can be obtained from the sale of fuel oils that are produced from high grade crude. This is due to the fact that fuel oil must be sold at a price which is equivalent to, or less than, the cost of coal that would yield the same energy in calories.

The Burton process is commonly known as the pressure-still process and the method is known as "cracking." The government appropriated a sum for experimenting in the methods of refining crude oil three years ago. The Rittman process has been worked out and placed at the disposal of all refineries. An Independent jobber makes this comment:

"One-third of the amount of crude oil that is now used would supply the market for all requirements if all the heavy ends were run through pressure stills. This would have the effect of reducing the price of crude and lowering the cost of all products. The government has made a step in the right direction in the Rittman process, but it is a failure, all reports to the contrary notwithstanding. Even if the method were practical it has not been developed to the point where it can be used. No refineries are using it, and none will under the conditions laid down by the government, which require parties using the process to bear all the expense of developing with no means of reimbursing themselves and they must also give the result of their discoveries to others. This is all right in one way, but it has the effect of making every one hold off waiting for some one else to stand the expense of trying out the method."

Record for Unfilled Steel Orders

Number of Tons on Order Exceeds Previous Highest—About Double Normal

New York City, March 10—In its last monthly statement the United States Steel Corporation reports unfilled orders on its books as of Feb. 29 last of 8,568,966 tons. This compares with 7,922,767 tons on Jan. 31, an increase of 646,199 tons, and with 4,345,371 tons on Feb. 28, 1915.

The total of 8,568,966 tons on the books establishes a new high record, and exceeds by 79,248 tons the previous topmark of 8,489,718 tons on Dec. 31, 1906. At that time, however, there was considerable duplication in compiling the orders because of the fact that business taken by one subsidiary which had to depend upon another for part of its supplies, was included for both amounts. This feature has been eliminated, however, and the orders on the books of the corporation at present will exceed those of the previous high mark by a much larger total if it were possible to eliminate the duplications in 1906.

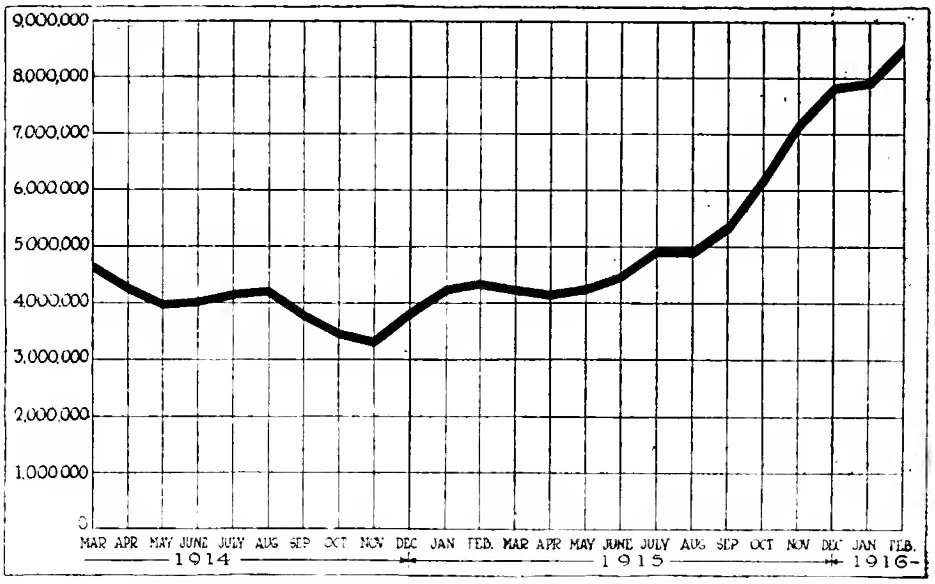
The increase of more than 646,000 tons was larger than had been generally expected. Before the statement was issued the estimates varied from gains of 250,000 to one or two as high as 600,000 tons, but a belief prevailed that the higher figures were too optimistic. It had been generally known that the orders received by the Steel Corporation during February were considerably above those of the previous month, and also that the officials of the company were more discriminatory in accepting business than ever before in the history of the concern.

That, in view of these conditions, such a large increase was recorded was, therefore, considered remarkable. The fact that the present bookings are all firm orders and not contracts against which specifications have been made, therefore allowing cancellations, also is significant.

During February the Corporation established more than one record. It is believed that never before since its organization has the company been booked so far ahead. A considerable tonnage apparently was taken to be filled during 1917. It has been known that some subsidiaries had sufficient orders on hand to keep them operating at capacity during the remainder of 1916, and in view of this fact it can be expected that further business for next year's delivery will be taken during March.

So far this month the orders received compare favorably with those of February, it is unofficially stated. The buying by railroads, while not taking the first position so far as steel consumption is concerned, is receiving the bulk of the attention of the steel makers. When it is recalled that the carriers have placed orders for delivery in the first quarter of 1917 for more than 125,000 tons of rails, it can be seen that a large amount of business can still be expected from this source.

Excellent net earnings of the Steel Corporation for the remainder of 1916 are now practically assured. Estimates ranging to as high as $280,000,000 for the entire year are being made, but these, it must be admitted, are merely guesses. No one can forecast as early as this what the Corporation will show at the end of the fourth quarter, but it seems fairly safe to say that with the large amount of business on hand and the probability of further advances in the prices of various products, the Steel Corporation will establish new records in the succeeding quarters of 1916.



Variation in Unfilled Steel Orders (Tons) During Last Two Years

Mexico Will Be Good Market

Good Roads Planned Throughout Mexico—Trade Expansion Will Demand Trucks

LAREDO, TEX., March 10—The automobile, tire and accessory business in Mexico shows indications of a marked revival, according to information received here from reliable sources. When business fully opens up it is expected that an unprecedented demand for automobiles, motor trucks and delivery cars of American manufacture will be mainifested. The trade in tires and accessories has already reached considerable volume, and it is increasing gradually. Dealers in Laredo expect to get their full share of this Mexican business, along with the automobile and accessory concerns of Eagle Pass, Brownsville, El Paso and San Antonio.

Five Years Closed

It is practically five years since Mexico was eliminated as a market for automobiles and other motor vehicles. At the time the revolutionary period in that country was inaugurated practically all of the leading automobile manufacturers of the United States were represented by agencies in the City of Mexico, Monterey, Aguas Calientes, Vera Cruz and other of the larger cities of the republic. Garages and dealers were located in all of the principal cities, and large stocks of tires and accessories were carried. In those days the trend of the demand was for the higher priced French cars, and in the City of Mexico more automobiles of French make were to be seen upon the streets than of American manufacture. A very large part of the tires and accessories came from France, Germany and England.

While there has been some replenishing of automobiles in Mexico during the last few years, and particularly during the past few months, it is still a virgin field for this class of trade. Most of the cars that have been shipped to Mexico from Laredo and other border towns recently were for military uses and to replace the old, worn-out motor vehicles that saw hard service during the revolutionary period. The demand now extends to private customers to a large degree. In this connection it may be well to mention that the prevailing idea in the United States seems to be that the people of Mexico have exhausted or lost all their wealth by reason of the trials and tribulations through which their country has passed. This is an erroneous impression. While it is true that many men there have had their fortunes badly depleted, there is still much actual cash in the country and it is being placed in circulation as political conditions continue to show improvement.

In the matter of being in a position to quickly supply the needs of the Mexican trade for cars, tires and accessories, the dealers of the towns of Laredo, Eagle Pass and El Paso through these open gateways have a distinct advantage over possible competitors in towns farther removed from the border, it is claimed. As a usual thing the buyer in Mexico wants quick delivery. Not long ago the Laredo Auto Sales Company filled one order for two carloads of tires and tubes for delivery to Yberra & Co., a commission brokerage concern in the City of Mexico, which amounted in value to $25,000 gold.

It is stated by dealers here and at Laredo that there is a good demand for second-hand automobiles for shipment to Mexico. The fact that that country is now short of good horses, and that many people have no means of getting about in carriages, as formerly, is one of the elements that enter into the growing demand for automobiles.

All automobiles and other motor vehicles, as well as tires and accessories, which are sold by dealers here and at other border points are paid for in cash or New York exchange before the shipments are sent across the Rio Grande.

During the last few weeks agencies for the sale of American automobiles have been established in Monterey, Torreon, San Luis Potosi, Tampico, City of Mexico and a number of other larger cities of Mexico. Quite a number of garages have also opened.

Large Trucks Ordered

Some of the larger mining companies and industrial concerns operating in Mexico have placed orders recently for a number of large trucks, and some of these shipments have already gone forward. It is believed that the sale of motor trucks in that country will reach big proportions, inasmuch as they are known to be specially adapted to the heavy hauling which is required in the mining camps and manufacturing centers.

The Mexican duty on automobiles is 66 cents gold each for the first 250 kilos of 2 1/5 lb. each. 55 cents for each of the next 500 kilos, and 45 cents for each of the remaining kilos.

It is said here that it is the plan of "First Chief" Venustiano Carranza and his de facto government to inaugurate an energetic and extensive campaign for the construction of good highways in various parts of Mexico as a part of the general plan of his administration for public improvements. Besides giving employment to many men of the poorer class, the building of roads will be the direct means of bringing about the development of the country.

Colorado Shales Rich in Oil

May Soon Be Worth the Cost to Extract Oil by Distillation

WASHINGTON, D. C., March 13—In view of the ever-increasing demand for gasoline and the increase in price of crude oil, it is important to know, according to a report made public to-day by the United States Geological Survey, that an almost inexhaustible supply of oil may be obtained from the shale of northwestern Colorado, northeastern Utah and southwestern Wyoming. This shale contains materials which, when heated, may be converted into crude oil, gas and ammonia. The high cost of distilling oil from shale as compared to the cost of producing oil from wells has thus far prevented the development in this country of such an industry and may continue to prevent it for some time, but sooner or later this great source of supply will be utilized to supplement the decreasing production from the regular oil fields.

According to the Geological Survey report, the oil derived from the shale is similar to that which is being produced from wells in the United States at the rate of more than 250,000,000 barrels a year. When refined by ordinary methods the shale oil yields an average of about 10 per cent gasoline, 35 per cent kerosene and a large amount of paraffin. The yield of gasoline from the shale may probably be largely increased by the use of refining methods especially designed for that purpose. The gas, which is a very good illuminating gas, will perhaps be sufficient to furnish all the heat required to distill the crude oil from the shale.

The ammonia is a most valuable byproduct of the distillation and may be utilized in the manufacture of commercial fertilizer or other nitrogen compounds, as the market demands. The United States Geological Survey has examined large areas of the shale in Colorado, Utah and Wyoming, and has made many distillation tests. Some beds of shale that are several feet thick will yield more than a barrel of oil to the ton of shale, and one bed 6 in. thick will yield more than two barrels of crude oil to the ton of shale. One ton of this shale should therefore yield nearly 10 gal. of gasoline by the present commercial methods of gasoline extraction, and larger yields may be made possible by new methods.

Little attention has been paid to this shale, because the quantity of petroleum produced from wells in the United States has been sufficient to satisfy all demands; but for more than fifty years the oil shale industry of Scotland has been a very important one. In a recent year more than 8000 men were employed in the industry in that country, yet the average yield of oil per ton of shale was much less than that which appears possible from the shale of Colorado and Utah. It is estimated that in Colorado alone there is sufficient shale, in beds 3 ft. or more thick and richer than the shale being mined in Scotland, to yield 20,000,000,000 barrels of crude oil, from which at least 2,000,000,000 barrels of gasoline may be extracted by ordinary refining processes.

As was stated in the recent reply of Secretary Lane to a Senate resolution on the subject of gasoline: "The development of this enormous reserve simply awaits the time when the price of gasoline or the demand for other distillation products warrants the utilization of this substitute source. This may happen in the future. At all events these shales are likely to be drawn upon long before the exhaustion of the petroleum fields."

Gold Paint for Automobiles

Los Angeles, Cal., March 11—When Mr. F. E. Runner, who recently arrived in Los Angeles from Billings, Mont., ordered a Franklin car last summer, he gave instructions that it be painted a gold color, his idea being that that was the best color to disguise the tint of Montana dust. Experience during the past few months has demonstrated the soundness of his idea, and many of his friends have since had their cars painted the same unique color.

Canadian Dealers May Join American Assn.

Chicago, Ill., March 9—At a meeting of the board of directors of the National Automobile Trade Assn., Feb. 26, held at the headquarters, 208 South La Salle Street, Chicago, it was voted to allow the garagemen and dealers of the Dominion of Canada to become members. This action was taken as a result of many requests from Montreal, Toronto, St. Johns and Hamilton.

Kankakee Co. to Make Six-Cylinder Car

Kankakee, Ill., March 12—Chiniquoy Brothers and Parker, is the name of a new firm just organized in Kankakee, which will market a six-cylinder, five-passenger automobile with standard parts, the latter to be assembled in Kankakee and put together with certain parts to be manufactured in that city. The company has been corresponding with manufacturers of engines and other supplies and contracts are now being written sufficient to cover a good-sized output.

Texas Farmers Plant Peanuts

Poor Wheat Crop Offset by Other Activities—Agriculture in Good Financial Condition

Austin, Tex., March 12—Notwithstanding the fact that the crop-growing season, which is now fairly opened in a large area of the State, is not as promising as the farmers would desire, due to a lack of rainfall in central and south Texas, the demand for automobiles in the agricultural districts keeps up remarkably well. In some of the towns dealers are far behind in filling orders.

Preparations are going forward for planting a big increase of acreage of cotton over that of last year. It is estimated that this increase will amount to fully 15 per cent. The winter oats and wheat came through the cold weather months in such bad shape that thousands of acres of these crops have been plowed up and the land prepared for planting in cotton. Farmers are not paying much attention to the advice of bankers and others that they reduce their cotton acreage this year. The high prices that were obtained from last season's crop are an alluring inducement to engage in the industry to the full limit.

Peanut Industry Booming

The peanut industry has suddenly sprang into much prominence in Texas. It will take rank this year as one of the standard crops of the State. This is due to the fact that many of the cottonseed-oil mills have installed cold presses for the utilization of the peanuts in the manufacture of oil and cake. In every locality where there is an oil mill the farmers are being encouraged to grow a large acreage of peanuts this year.

The livestock industry continues to be in an exceedingly prosperous condition. In some parts of the ranch territory the range is very dry and an unusually large amount of feeding has had to be done to carry the animals through the winter. Many herds are being fattened on silage. Nearly all of the stockmen now grow enough forage upon their ranches to supply an abundance of foodstuff for their cattle.

Building activities in the different cities and towns of the State are now being carried on upon a larger scale than for several years. This is shown by the building permits that have been issued.

Public improvement bonds, both county and municipal, have a higher market value than ever before known, and this fact is causing a veritable boom in civic improvements of various kinds and the construction of good roads. The installation and improvement of public utility plants is receiving much attention. The development of the electric power field in this State has made wonderful progress during the last several months, and important extensions of the power transmission lines are to be made during the present year.

It is the belief of the banks that the farmers will require less assistance in the way of money advances to grow their crops this year than ever before. For the most part the agricultural element of the State is in splendid financial condition. The good prices that were obtained for cotton, livestock and other products placed the average farmer well to the good. The condition is reflected by the unusually large deposits in the country banks.

Bill Regulating Jitneys Passed

Trenton, N. J., March 9—The bill regulating jitneys in this State and introduced as a committee substitute for the Kates bill, also regulating jitneys, has been passed. Opponents of the bill argued that its passage would clear the State of jitneys because the terms of regulation are so onerous. Particular exception was taken to the requirement for indemnifying bonds, though it was subsequently explained that the State jitney organization has already made plans to organize an insurance company to provide bonds for its members.

Governor Fielder signed the amendment to the traffic act of 1915, which gives pedestrians the right of way over vehicles in thickly populated communities and repeals the section of the law providing that any person crossing a street where there is no crosswalk does so at his own risk.

Gray & Davis Laboratory in Detroit

Detroit, Mich., March 12—In order to afford maximum co-operation to automobile manufacturers in Detroit and vicinity, Gray & Davis have established an engineering laboratory at 1602 Woodward Avenue, Detroit. In the past, all engineering problems connected with electric starting and lighting have been worked out at the Boston plant, but under the new plan, automobile designers who now use, or are about to adopt Gray & Davis equipment, will have the services of the Detroit laboratory at their disposal.

The laboratory will be under the management of C. M. Tichenor, long associated with Gray & Davis, both as engineer and factory superintendent. Mr. Tichenor will be assisted by capable engineers. A complete line of Gray & Davis systems are part of the laboratory equipment and these units will be available for instant installation on various engines, thus expediting all experimental work on new jobs.

Three New Delage for Speedways

Harry Harkness Now Has Lyons Grand Prix Racing Cars

NEW YORK CITY, March 13—Harry S. Harkness will compete this coming season on the speedways with the three Delage cars which were driven by Duray, Bablot and Guyot in the French Grand Prix at Lyons in 1914. The three cars arrived in New York last week and are now being overhauled and fitted with new bodies. Carl Limberg, who will manage the team, will drive one of the cars. This team ought to be one of the most important competing this year, as the cars have been run in the one race only. The motors are peculiar in that the valves are operated positively in both directions, being closed by the cam as well as opened. In the Grand Prix the Delage cars did not do very well owing to some unfortunate adjustment having been made the night before the race. Bablot held the record for a lap over the Lyons circuit in practice spins previous to the race and it was the general opinion among French sportsmen that the Delage cars were faster than the Peugeot. There is no doubt whatever that if the three cars had shown the same form in the race that they had already exhibited in the previous practice trials that it would have been possible to push the victorious Mercedes very hard indeed.

Jacksonville Show Pleases Bankers

JACKSONVILLE, FLA., March 10—Florida's first automobile show with thirty-four different makes of cars and trucks, closed to-night in this city. Success marked it from every viewpoint and was in many ways a stimulant for business in the Southeast. The show opened on March 5 and was held in a specially constructed building in Confederate Park, making it the first outdoor automobile show of 1916.

The biggest season in this State for automobile men is predicted by Florida bankers, who are very optimistic. At the present time there are a million tourists in this State and in the local banks alone $25,000,000 is on deposit. Business conditions have improved lately. Though some of the industrial mainstays have been hurt by the war, a general improvement has set in lately. Florida industries consist of turpentine, rosin, phosphates, agriculture and lumber. The first three have been slackened up by the war. Turpentine, however, has picked up lately with its domestic business. The citrus fruit market has been productive and the lumber industry is improving. There is a $1,500,000 potato crop in the State and the tomato crop is in a thriving productive state.

With only 14,000 cars in this State, the show has naturally increased interest in the automobile. Banks are not looking with as much disfavor as they did some time ago on the automobile dealers' paper.

As to the demand in Jacksonville and the surrounding territory, the medium-priced car selling from $800 to $1,500 is most in demand. The local purchasing public is looking for power in its cars due to the heavy sands that must be negotiated. The city is lax on improved streets and in the by-ways leading off the main streets there is sand so difficult to go through that the majority of cars have to shift into low gear.

Locomobile Wins Carbureter Suit

BRIDGEPORT, CONN., March 11—The United States Circuit Court of Appeals has just handed down a decision which reverses that of the Lower Court, which sustained Joseph N. Parken's suit against the Locomobile Co. of America for infringement of his patents for a carbureter.

The patents declared to be infringed by The Locomobile Co. of America cover the use of auxiliary air valves regulated by two springs successively coming into use to automatically meet the requirements of low speed and high speed and at the same time independently adjustable to meet the needs of special conditions.

The main defense on the part of The Locomobile Co. was that the invention was not one, in fact, that the construction was known and had been used before and that it was a natural development of the carbureter art.

It was shown at the trial that a number of persons were working independently on the problem which the plaintiff claims he first solved and that the ideas, possibly the idea of springs, independently adjusted, which occurred to the makers of automobiles were put into form and tried out not only by the inventors themselves, but were given trials by the general public.

In conclusion, the Court of Appeals maintained that, "The improvement based and dependent on the first patent and which simply consisted in controlling the adjustment from the operator's seat, is lacking in invention. The decree is therefore reversed and the case will be remanded with instructions to dismiss the bill."

Denby Pres. Detroit Board of Commerce

DETROIT, MICH., March 14—Edwin Denby, treasurer of the Hupp Motor Car Co., and of the Denby Motor Truck Co., was to-day elected president of the Detroit Board of Commerce.

Harroun Building Twelve

Will Try Out Aviation Engine in Racing Car Chassis—250 H.P. Expected

CHICAGO, March 4—Ray Harroun, one time International Speedway champion, has become the owner of the three big Maxwells which have been campaigned for two seasons. These are the predecessors of the smaller Maxwell racing cars now in Indianapolis. Along with the cars themselves, Harroun has acquire the tools, jigs, patterns and so on which will be used in manufacturing his aviation motor.

First of the aviation motors according to Harroun's plans is a 250 hp. engine of twelve cylinders and will make its first appearance in the racing car Harroun is building. In a letter to *Motor Age* Harroun says:

"I have purchased all of the Maxwell race car equipment, including drawings, tools, jigs patterns, and all spare parts on hand, also the three 450 cu. in. racing cars.

"It is my intention to apply this tool equipment, patterns, etc., to the manufacturing of my aviation motor which will be largely along the lines of the racing car motors, with the exception that they will be of the twelve-cylinder variety. The first one will be 250 hp., which is the one I will try out on the free-for-all racing car which I am building.

"I will sell the 450 cars just as soon as I can find customers for the same—these have been recently overhauled and are now in first class shape.

"I am negotiating with parties in California for the purchase of two of these cars and it is quite possible they will be seen at the Corona race."

Big Lamp Merger Planned

DETROIT, MICH., March 13—While negotiations are pending between the Edmunds & Jones Mfg. Co., automobile lamp makers here; the Canadian Lamp & Stamping Co., Walkerville, Ont., and the Chicago Electrical Mfg. Co., Chicago, with the object of a merger which is to be eventually named the Edmunds & Jones Corp., George E. Edmunds, secretary-treasurer of the Edmunds & Jones Mfg. Co., states that the deal has not yet been completed, and that statements published locally regarding the combine are as yet premature.

Local financial circles have it that a syndicate of New York brokerage houses, consisting of Hornblower & Weeks; White, Weld & Co., and Merrill, Lynch & Co., are offering participation in the marketing of $1,000,000 in 7 per cent cumulative preferred stock and 40,000 shares of common stock which may go on sale at $40 a share, and which is to constitute the capital stock of the new corporation.

This merger, if consummated, would be one of the largest automobile lamp manufacturing enterprises in the world. The Edmunds & Jones Mfg. Co. has been in business in Detroit since 1904, and is capitalized at $500,000 and has always been one of the best known automobile lamp makers in the industry.

Stubbs Premier Sales Mgr.

INDIANAPOLIS, IND., March 9—P. S. Stubbs has been appointed sales manager of the Premier Motor Corp., this city. Mr. Stubbs became assistant sales manager of the Knox Automobile Co., Springfield, Mass., in 1906; a year later he joined John N. Willys, serving as sales manager and director of the many enterprises undertaken by Mr. Willys—among them the Overland, Marion and American.

When the Hudson Motors reorganized its personnel in 1910 he joined its sales organization and has been associated in an executive capacity with that company as Eastern manager, assistant sales manager and later as Pacific Coast distributor.

Goodrich Increases Number of Directors to Eighteen

AKRON, OHIO, March 12—The B. F. Goodrich Co. has declared a regular quarterly dividend of 1 per cent on the common stock, payable May 15 to stock of record May 4.

The following have been elected directors of the company to fill the increased places on the board, and one to fill the vacancy of A. H. Wiggin, resigned: W. O. Rutherford, A. B. Jones, Dr. W. C. Geer, H. E. Joy and H. K. Raymond. This makes the present number of directors eighteen.

At a meeting of the directors, officers of the Goodrich company were re-elected. They are as follows: President, B. F. Work; secretary, C. B. Raymond; treasurer, W. A. Means; and sales manager, H. E. Raymond.

At a special meeting of the stockholders of the company, the authorized preferred issue was reduced from $28,000,000 to $27,300,000.

3025 Ignition Systems Shipped by Atwater-Kent March 1

PHILADELPHIA, PA., March 11—A shipment of ignition systems, equaling one-half of its entire year's output 5 years ago, and amounting to 3025 systems, was made by the Atwater Kent Mfg. Works, on March 1.

F. T. C. Active for Gasoline Supply

Commission Speeds Up Inquiry Into Subject—Congress Urged to Action from All Sides

WASHINGTON, D. C., March 14—Federal activities to determine causes for the high price of gasoline and to effect a reduction may be briefly summed up as follows:

Federal Trade Commission making thorough investigation of facts, considering this the most important work before them. The commission will make a report before Congress adjourns.

The Director of Mines states that the Rittman process was offered free to all producers and refused on account of a clause which prevented monopoly.

The Bureau of Mines has issued a bulletin describing the Rittman process to minimize the cost of refining.

Representative Steenerson is drafting a new bill to present to Congress which he says will "prevent the high cost of gasoline."

Sentiment in Congress shows that any measure for relief will be heartily indorsed by members.

Members of Congress are being besieged to take action by letters from all parts of the country.

While it will be impossible for the Federal Trade Commission to take any drastic steps or make any specific report for some weeks, Commissioner Harris said to-day that they were urging all their agents to make as quick and thorough an investigation of all conditions as soon as possible, and that all the men who could possibly be called upon for this work have been sent into the field. He expects that it will be at least six weeks before these agents can return and make their reports.

Congress is ready to take prompt action for relief of the automobile users, for every member of Congress is being besieged by constituents to take action. The manufacturers of motor cars are deeply concerned and say that already their trade is suffering seriously because of the heavy increase in cost of running a car. Some of them have written to members of Congress stating that if the present prices for gasoline are maintained it will ruin their business. In response to these urgings Congress as a whole is prepared to give a friendly ear to any adequate measure for relief.

The collection of statistics concerning the production and use of gasoline is asked for in a bill introduced in the House by Representative Carter of Oklahoma. The bill would authorize the director of the Bureau of Mines to collect and publish the statistics, which should include facts concerning the production of crude petroleum, as well as facts concerning its manufacture into gasoline, and the best obtainable facts concerning the marketing of gasoline.

Ford May Make Gasoline

Henry Ford will get into the fight on the high cost of gasoline. This announcement was made to-day by Congressman Randall of California, who appealed to the manufacturer to aid in promoting processes for the cheaper production of gasoline.

Ford, Randall said, believes the Rittman process, discovered in the United States Bureau of Mines, will result in greatly reduced cost to the consumer. Rittman is now experimenting with another process to produce more gasoline from kerosene, Randall said. Ford in a letter to Randall said: "The solution of the gasoline problem is an urgent matter; if one attempt fails, the quickest way to get a solution will be to commence with another. Although I may not be able to take up the Rittman process at once, in response to the appeal of Congressman Randall, after the present test is completed I may go into it thoroughly."

Chevrolet Bros. To Race Three Frontenac Cars This Season

DETROIT, MICH., March 12—Louis Chevrolet, having completed experiments with the aluminum engine he made last fall, is now completing three brand new racing cars for competition on the speedways during the present year. The cars will be known as "Frontenacs" and will be driven by Louis, Arthur and Gaston Chevrolet.

It is expected that the first of the three will be ready early in May and will appear first on the Sheepshead Bay speedway. The other two should also put in an appearance at Indianapolis.

Chevrolet is building every part of the cars to his own design from engine to rear axle, and expects to get a minimum of 125 hp. from each motor. Light weight has been an aim, and the completed car is scheduled to turn the scale at not more than 1750 lb.

Embargo on Hides in South Africa

CAPETOWN, March 14—The exportation of wet or dry salted hides has been prohibited except to the United Kingdom. The shipment of sun-dried hides of light weight is permitted conditionally.

Royer Wheel Co. Formed

AURORA, IND., March 10—The Royer Wheel Co., Aurora, Ind., has been incorporated with $150,000 capital stock, for the purpose of manufacturing automobile wheels, both for pleasure cars and trucks.

I. A. L. Representatives Indicted

Uniontown Grand Jury Charges Conspiracy and False Pretences—Other Arrests

UNIONTOWN, PA., March 13—The grand jury has indicted A. C. Bidwell, president of the International Automobile League, Buffalo, N. Y., and two of its representatives, Harry Ames Van Auken and F. A. Chapman on charges of conspiracy and obtaining money under false pretences. Chapman is under arrest here and entered a plea of guilty today. He was placed on parole for two years and released. Van Auken was arrested in Valdosta, Ga., and will be brought here for trial.

The Standard Automobile Garage, this city, charges that Van Auken, exhibiting power of attorney signed by A. C. Bidwell and an Illinois Surety Bond, agreed to furnish an Illinois Surety Bond in the amount the garage would pay for a jobbers' contract issued by the I. A. L. However, upon accepting the contract, which purported to enable the garage to purchase accessories and supplies at from 10 to 33 1/3 per cent of the manufacturers' wholesale price, the bond which was returned was not an Illinois Surety Bond, but a bond of the I. A. L. which was almost an exact imitation of an Illinois Surety Bond in appearance and phraseology.

An investigation by the garage proved, it states, that the League has no contracts with manufacturers of standard supplies and accessories. The League denied Van Auken's authority to promise that it would furnish tires, accessories, etc., at the discounts he promised, in spite of the power of attorney he carried. It is stated that several other dealers in accessories and supplies in this vicinity were also induced to sign contracts.

Blames the League

Richard H. Lee, chairman of the A. A. A. legislative board and president of the Cleveland, Ohio, Automobile Club states in the *Ohio Motorist*, the club organ:

"Owing to the great number of individuals throughout the United States who have at one time or another contributed to the International Automobile League, Inc., of Buffalo, N. Y., considerable interest will be displayed in developments at St. John, New Brunswick, Canada, where two agents of the International named Harold Cottrell and Roy Grey, are under arrest charged with receiving money under false pretences.

"The attorney general, upon the opening of court, moved to have the prisoners, who were represented by counsel, immediately enter a plea of guilty. They were not prosecuted on the other ten counts charged against them. The judge suspended the passing of any sentence and let the prisoners go on a recognizance of $1,000 each and warned them that they must refrain from acting as agents of the International Automobile League.

"The attorney general stated that he felt justified in taking this course in suspending the sentence, in view of the fact that the public welfare would be sufficiently served by preventing the operation of the International Automobile League of Buffalo in this territory; that although the prisoners had made improper and untrue representations, they were to a certain extent victims of the system pursued by the parent company at Buffalo for the purpose of getting money from the public without intention to give an honest return for it."

Brookfield, Rock Falls President

STERLING, ILL., March 12—Galt Brookfield was elected president of the Rock Falls Manufacturing Co., this city at a meeting of the board of directors this week, succeeding C. R. Hardy, resigned. The new president has been connected with the sales department for many years, and is the son of the founder of the company. This concern has been engaged for a number of years in the manufacture of motor hearses, motor ambulances and other motor vehicles.

S. A. E. Sections Have Busy Week

NEW YORK CITY, March 14—Detroit and Cleveland sections of the S. A. E. both expect to hold big meetings this week. J. G. Perrin will discourse to the Detroiters on the past, present and future of rear axles, tracing the problems appertaining to them and paving the way for an active discussion. In Cleveland, C. F. Kettering will read a paper on the Chemistry of Combustion. Mr. Perrin is particularly adapted to handle his subject, having had so great an experience in the industry, culminating in the chief engineership of the Timken Detroit Axle Co. Mr. Kettering is equally a master of his subject, which has a distinct bearing upon the problems of an ignition expert. The Detroit meeting takes place to-night, and that in Cleveland is on Friday, March 17.

Chalmers February Shipments Total $3,000,000

DETROIT, March 12—During February the Chalmers Motor Co., shipped $3,000,000 worth of Chalmers. The biggest day was Feb. 29, when 193 cars were shipped. The number of orders carried over from February is 1747 and besides these there are now 4148 cars ordered for delivery in March. Indications are that April and May will be two record-breaking months for the company.

S. A. E. Discusses Gasoline

Metropolitan Section Expects Big Meeting—Dr. Rittman to Speak

NEW YORK CITY, March 14—At the meeting of the Metropolitan Section of the Society of Automobile Engineers to be held Thursday, March 16, at 8 p. m., at the Automobile Club of America, this city, the topic for discussion will be fuel. E. S. Foljambe, who has studied the subject for a number of years, is presenting a comprehensive paper on this topic.

Dr. Rittman of the U. S. Bureau of Mines, and W. A. Williams, chief petroleum technologist for the government have already signified their intention of being present, and a large attendance is expected in view of the pertinence of the subject.

Before the meeting there will be an informal dinner at which President Russell Huff of the S. A. E. and the council of the society will be the guests of the Metropolitan Section. The students from the neighboring universities have been invited, as have also members of the Motor Truck Club, Electric Vehicle Assn. and Automobile Dealers' Assn. The dinner will start at 6.30 p. m.

White for Detroit Section Chair

DETROIT, MICH., March 9—The annual election of officers of the Detroit Section of the Society of Automobile Engineers is scheduled for April 17. The nominating committee has prepared the following slate of officers for the coming administrative year: For section chairman, D. McCall White; vice-chairman, W. A. Brush; treasurer, J. G. Heaslet; secretary, B. G. Koether; for member of the national nominating committee, K. W. Zimmerschied; members of the nominating committee: S. B. Dusinberre, J. W. Stark and C. M. Hall, the latter as its chairman.

14,537 Licenses in Alabama

MONTGOMERY, ALA., March 10—The State board of equalization has issued 14,537 licenses to owners of automobile and motorcycles since the beginning of 1916. Of these, 11,615 were for pleasure cars and 2183 for motor trucks. There are many owners, however, who have failed to obtain new licenses and it is believed the total number of automobiles in the State is well up to 14,500. Jefferson County, of which Birmingham is the capitol, leads in number of machines with 2100 pleasure cars and 635 motor trucks. Montgomery County, in which is Montgomery, has 930 passenger machines and 160 commercial cars, while Mobile County has 912 pleasure cars and 192 of the other variety. One county is without a truck entirely, according to reports sent in, while the smallest number of machines in a single county is 20.

It is expected that the State will purchase very close to 5000 new cars during 1916. Financial improvement in both industrial and agricultural lines will bring this about. The war has brought prosperity to the Birmingham district, with its big steel mills, and enlargements and improvements have been coming rapidly. Other sections, with coal and iron interests, are feeling the improvement. The rural sections are benefitted by the clarification of the cotton situation and the improved condition of the market in the staple. Better methods of farming, likewise, are resulting in more profits for the farmers; road improvement and the establishment of national highways crossing the State are also factors in the growth of the automobile industry, and dealers in cars and accessories throughout the State are expecting a good year.

Half Total Rubber Used for Tires

Washington, D. C., March 13—The census bureau has issued a preliminary statement of the general results of the 1914 census of manufacturers with reference to the rubber industry. It shows, among other things, that the production of rubber tires for 1914 was valued at $146,411,692 and formed almost half, 48.8 per cent, of the total value of all kinds of rubber goods manufactured during the year. Statistics for the manufacture of tires were not obtained for 1909, but it may be safely assumed that the increase of 52.1 per cent in the total annual output of rubber goods during the 5-year period is accounted for in very large part by the enormous growth of this branch of the industry.

There was reported the manufacture of 8,020,815 automobile tires or casings, valued at $105,671,223; of 7,906,993 inner tubes, valued at $20,098,936; of solid tires for motor and other vehicles to the value of $13,735,681, and 3,728,138 motorcycle, bicycle and aeroplane tires, valued at $6,905,852.

Record Shipments in Feb.

21,502 Carloads of Automobiles Sent—Almost 100% Better than Feb. 1915

New York City, March 11—Record-breaking shipments of automobiles continued during February, when 21,502 carloads of automobiles were shipped. This is the biggest month in the history of the industry and almost 100 per cent better than February, 1915, when 11,973 carloads were shipped.

On account of the freight shortage, more than 1500 carloads were shipped on open cars covered with tarpaulins or in ordinary box cars by partly disassembling the automobiles, including the removal of mudguards.

It was expected that the larger part of 10,000 new railroad cars would be in service by this time to care for the increased production, but because of the inability of car builders to secure materials only 1200 of them have been put into service, making the total equipment of the railroads about 60,000 automobile cars.

Gramm Gets Big British Order

Lima, Ohio, March 9—The Gramm-Bernstein Co. has closed a $1,225,000 order for trucks said to be for commercial purposes in Great Britain.

Steel Prices Higher

New York City, March 14—Material prices continue to soar. With few exceptions prices are being maintained at the high level established during the past few weeks. Rubber seems to be the only product which is at the present time quoting around normal prices. The metals, however, are continuing on their skyward ascent. Both Bessemer and open-hearth steel prices are now double what they were before the start of the war. Aluminum and lead have taken another jump, and tin has established a new high mark by rising to $6 per 100 lb.

Though the price of gasoline remained constant last week a rise of significance occurred in crude oil from Kansas, which jumped to $1.45 a barrel with a net gain of 15 cents.

Last week aluminum rose 5 cents a lb., to 65, establishing a new high mark. Lead, which has been on the ascendency during the past month, again rose, reaching $6.85 per 100 lb. Bessemer steel, after a rise of $2 per ton the previous week, went up $3 more in price, establishing a record mark of $40. Open-hearth steel also rose to $40, the previous price being $38. Copper prices remained unchanged, the market being dull, with little business being done. The scarcity of tin has caused a further rise in quotations. This metal is now quoting at $55 per 100 lb. Though there is an active demand for spot tin, the scarcity of the product has been the cause for very little business being done.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.60	.64	.64	.64	.58	.65	+ .05
Antimony	.44	.44	.44	.44	.44	.44	...
Beams and Channels, 100 lb	2.42	2.42	2.42	2.42	2.42	2.42	...
Bessemer Steel, ton	37.00	37.00	40.00	40.00	40.00	40.00	+3.00
Copper, Elec., lb	.27½	.27½	.27½	.27½	.27½	.27½	...
Copper, Lake, lb	.27½	.27½	.27½	.27½	.27½	.27½	...
Cottonseed Oil, bbl	10.25	10.28	10.46	10.49	10.42	10.45	+ .20
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb	6.70	6.90	6.90	6.90	7.10	6.85	+ .15
Linseed Oil	.78	.78	.78	.78	.78	.78	...
Open-Hearth Steel, ton	38.00	38.00	40.00	40.00	40.00	40.00	+2.00
Petroleum, bbl., Kansas, crude	1.30	1.30	1.40	1.40	1.45	1.45	+ .15
Petroleum, bbl., Pennsylvania, crude	2.50	2.50	2.50	2.50	2.50	2.50	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.77	.78	.77	.77	.76	.76½	— .00½
Rubber, Ceylon First Latex	.94	.93	.94	.94	.93	.93	— .01
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	49.00	49.50	51.00	55.00	55.00	55.00	+6.00
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Large Increase in N. J. Licenses

Newark, N. J., March 9—Registrations in New Jersey during the first two months have shown a large increase over the same period in 1915. To February 29, the collections of the Department of Motor Vehicles amounted to $726,633.26, as compared with $526,613.83 in the same period in 1915, an increase of over $200,000.

During this period the department has registered 56,012 cars, and 114 trailers. Drivers' licenses numbered 66,983; and transfers recorded were 862.

Australian Shipping Costs High

New York City, March 11—The American automobile manufacturer is now not only confronting a shipping problem by rail in this country, but one on his exports also. In line with his desire to open up trade in China, Australia and other countries, he must now pay the shipping companies high rates on account of few ships and lack of space. Just before the war rates to Australia were running from 25 to 30 cents a cubic foot. Now the shipping companies demand $1 per cubic foot. This means at this rate every one of the automobiles going to that country would cost for ocean freight alone approximately $400.

California Co. May Use Rittmann Process

Los Angeles, Cal., March 10—The first California company to apply to the government for permission to use the Rittmann process of refining gasoline is the Independent Oil Producers' Agency, of which L. P. St. Clair is the president. At present the agency members are producing large quantities of low gravity crude oil, which under the refining methods now employed yields very little gasoline. With the Rittmann process it is believed that a yield of motor spirits equivalent to gasoline, running as high as 60 per cent, may be obtained from the crude oil. The actual cost of producing the gasoline is estimated at 1 cent a gallon, exclusive of the cost of the oil from which it is extracted; and the officials of the Independent Agency confidently expect that they will be able to retail gasoline in California for less than 10 cents a gallon.

It is understood that the Rittmann process is to be held by the government solely for the benefit of the public, and that any improvements that may be made by companies which install the process eventually will become the property of the government. At the present time, however, refiners who make improvements will not be asked to share their secrets with their competitors, although all companies which adopt the process will be given the benefit of the knowledge now possessed by the federal officials.

The Independent Oil Producers' Agency will begin work at once upon their plant, and will soon be a competitor for the gasoline trade of California.

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EAST PALESTINE, OHIO, March 9—The McGraw Tire and Rubber Co. has decreased its capital from $1,500,000 to $1,475,000.

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CANTON, OHIO, March 9—The Timken-Detroit Axle Co. has increased its capital from $3,000,000 to $6,000,000.

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ARVADA, COL., March 9—The Dry Climate Tire Mfg. Co., Arvada, has increased its capital stock from $200,000 to $500,000, and is arranging to install additional machinery in its new plant and increase its working force.

Better Tone in Securities

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Mexican Affair Seems to Have No Effect on Quotations—Overland Rises to 228

NEW YORK CITY, March 12—Automobile and accessory security prices last week reversed the usual order of declines manifested during the year, and showed gratifying gains on top of a better market. The annual reports made by several of the companies listing their stocks on the Exchange probably were responsible for the upward tendency. The market is acting better than it has for months and there seems to be a persistent confidence in higher prices eventually. The new phase in the Mexican affairs serves to divert attention from our European negotiations. It is thought that the Mexican trouble will not be regarded as a particular menace to any market betterment.

Overland featured the market with a jump of 12 points, reaching 228, and 10-point rises were recorded by Chalmers, Miller Rubber and Paige. General Motors responded to the turn in prices with a 5-point rise, reaching 465. And Maxwell, Studebaker, Chevrolet, Goodrich, Firestone and U. S. Rubber came to the fore, after a period of declines, with very substantial gains. Chevrolet, especially, showed a gratifying gain of 7 points, after reports of its earnings during the past four and a half months had been reported.

Just what effect the present gasoline investigations will have on the stocks of the oil companies is not as yet known; however, oil stocks for the past two weeks have not been as strong as usual, both Texas and Vacuum issues showing drops during each of the two weeks.

Last week the New York Stock Exchange admitted to the regular list $3,758,200 6-per cent cumulative preferred stock and $3,582,500 common stock of the Kelly-Springfield Tire Co. This company may also add $1,324,700 in common stock on official notice of issuance, making the total amount of common to be listed $4,907,200.

General Motors featured the Detroit Exchange with a rise of 37 points, reaching 462½. Prices in that city showed a higher tendency. Chalmers common rose to 152 at a gain of 13 points.

During February 80,580 shares of stocks were sold on the Detroit Exchange, not including 296 shares of stocks of banks. The biggest sales were those of Reo Motor Car Co. shares, the total which changed hands being 22,400, at from 33⅞ to 39¼ per share. Of the now Continental Motor Co.'s shares at $10, a total of 12,379 were sold, at from 25 to 35¼, while of the old stock at $100, 1085 changed hands at from 292 to 515 a share.

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Dividends Declared

Electric Storage Battery Co.; 1 per cent from net earnings of company on common and preferred, payable April 1 to stock of record on March 21.

Willys-Overland Co.; quarterly of 1¾ per cent on preferred, payable April 1 to stock of record March 21.

Chandler Motor Co.: quarterly of 1½ per cent, payable April 1 to stock of record March 7.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	67	70	—1½
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	75	80	84	87½	—1
Chalmers Motor Co. com	..	83½	140	160	+10
Chalmers Motor Co. pfd	92	94	98½	100	— ½
Chevrolet Motor Co	..	..	147	149	+7
Electric Storage Battery Co	48½	49½	63	64	+1
Firestone Tire & Rubber Co. com	398	403	745	755	+5
Firestone Tire & Rubber Co. pfd	109	111	113	115	..
General Motors Co. com	95	96½	465	469¾	+5
General Motors Co. pfd	96	96¾	112¾	113¾	— ¼
B. F. Goodrich Co. com	34	35	72½	72¾	+2¼
B. F. Goodrich Co. pfd	97½	99½	116	116½	+2¼
Goodyear Tire & Rubber Co. com	192	194	338	343	—7
Goodyear Tire & Rubher Co. pfd	104½	105½	115	115½	—1
Grsy & Davis, Inc., pfd	..	..	98	102	..
International Motor Co. com	..	..	19	23	..
International Motor Co. pfd	..	..	32	38	+2
Kelly-Springfield Tire Co. com	111	112	..	..	..
Kelly-Springfield Tire Co. com. (new)	..	..	69	71	+2
Kelly-Springfield Tire Co. 1st pfd	83	85	95	97	..
Kelly-Springfield Tire Co. 2d pfd	118	125	..	..	..
Maxwell Motor Co. com	30¾	31¼	60	60½	+1
Maxwell Motor Co. 1st pfd	73⅛	73½	83	84	+ ¾
Maxwell Motor Co. 2d pfd	30¼	30½	45½	46	+1½
Miller Rubber Co. com	163	170	235	240	+10
Miller Rubber Co. pfd	101	103	112	115	+1½
New Departure Mfg. Co. com	125	126	172	175	+1
New Departure Mfg. Co. pfd	105½	108	111	..	+1
Packard Motor Car Co. com	..	97½	170	185	..
Packard Motor Car Co. pfd	93½	97½	102	‡104	..
Paige-Detroit Motor Car	..	..	675	700	+10
Peerless Motor & Truck Corp	..	..	27¾	28½	+ ¾
Portage Rubber Co. com	34	36	70	72	+2
Portage Rubber Co. pfd	85	95	106	107	..
Regal Motor Co. pfd	..	..	..	16	..
*Reo Motor Truck Co	11½	12½	24	26	—1
*Reo Motor Car Co	28½	29¼	33	34	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	54½	56	86½	88	+2½
Stewart-Warner Speed. Corp. pfd	101½	..	108½	..	..
Studebaker Corp. com	47	47¾	140	140½	+3½
Studebaker Corp. pfd	93	95	113	113½	+3
Swinebart Tire & Rubber Co	73	75	88	89	..
Texas Co.	131½	132½	191½	192	—8
U. S. Rubber Co. com	55½	56½	51½	52	+2
U. S. Ruhber Co. pfd	102½	103	107½	108½	+ ½
Vacuum Oil Co	180	183	220	224	—3
White Motor Co. (new)	..	..	47½	48	+ ½
Willys-Overland Co. com	107½	110	228	233	+12
Willys-Overland Co. pfd	99¾	101½	104	105	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Chalmers Motor Co. com	..	82	152	162	+13
Cbalmers Motor Co. pfd	91½	93½	98	101	+ ½
Continental Motor Co. com	170	187½	33½	35	+4
Continental Motor Co. pfd	80	85	9	10	— ½
Ford Motor Co. of Canada	525	..	..	370	—15
General Motors Co. com	95	97	462½	..	+37½
General Motors Co. pfd	96	97	111	114	..
Maxwell Motor Co. com	29	31	59	62	+1½
Maxwell Motor Co. 1st pfd	72	74	82	86	+1½
Maxwell Motor Co. 2d pfd	28½	30½	44	48	+1½
Packard Motor Car Co. com	..	97½	170	178	+3
Packard Motor Car Co. pfd	93¾	97	..	104	..
Paige-Detroit Motor Car Co	..	..	675	..	..
*Reo Motor Car Co	28½	29½	33	34	..
*Reo Motor Truck Co	11½	12⅛	24¾	25½	— ⅛
Studebaker Corp. com	46	47	140	143	+5⅛
Studebaker Corp. pfd	93	95	107	..	..

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	25	32¼	40	..
Kelsey Wheel Co	195	..	435	..	..
*W. K. Prudden Co	19	20½	..	33	..
Regal Motor Car Co. pfd	..	25	..	16	..

*Par value $10. ‡Accrued.

Factory Miscellany

Armstrong Spring Co. to Enlarge—An addition, 60 by 260 ft., is to be put up at the plant of the J. R. Armstrong Mfg. Co., Flint, Mich., automobile spring manufacturer.

Continental Motor to Add—The Continental Motor Co., Muskegon, Mich., has been granted permission by the city for the erection of new steel and concrete machine shops, which will be additions to the present sawtooth buildings on Western Avenue and Water Street. Plans have also been made for the erection of a new sand blast.

Jones Motor Co. Buys Plant—The Jones Motor Car Co., Wichita, Kan., has purchased the plant formerly occupied by the Burton Car Works in the North End, Kansas City, Mo., and will move the Jones car factory there as soon as the necessary improvements can be made.

Hayes Truck Adds—The Hayes Motor Truck Wheel Co., St. Johns, Mich., recently installed a new band saw and is now sawing its own logs. Heretofore the company had been using rough planks bought from lumber companies, which now is no longer necessary.

Atlas Drop Forge Completes Addition—The Atlas Drop Forge Co., Lansing, Mich., has completed an addition 40 by 150 ft, for the heat-treating department; also a 70-ft. addition to the steel shed. Foundations are being laid for six new mammoth hammers.

To Make Hubs for Four-Wheel-Drive Cars—E. C. Heimke of the Northern Machine Works, Wausau, Wis., is preparing to undertake a production of a new type of hub for automobiles and trucks with four-wheel drive. Mr. Heimke has been granted patents on the device. He also is the inventor of a portable stone picker, in the form of a light trailer to be attached to vehicles. The picker rakes up and gathers all stones, sticks and other obstructions on highways. The rubbish is conveyed from the road surface into a container.

Hall Secures New Building—The Hall Motor Co. has secured a building at Markham, Ont., and will install equipment for the manufacture of trucks, engines, etc.

New Haven Carriage Adds—The New Haven Carriage Co., New Haven, Conn., builder of automobile bodies, has begun the construction of an addition, 50 by 90 ft., two stories.

Belknap Remodeling Plant—The Belknap Wagon Co., Grand Rapids, Mich., is remodeling its plant and will add to its equipment machinery suitable for the manufacture of automobile bodies.

Buick Adds—The Buick Motor Co., Flint, Mich., is taking bids on the erection of a new heat-treating plant to cost about $9,000.

Truck Plant in Milford—The F. W. Mann Co., Milford, Mass., has bought a one-story building on Central Street and will increase its capacity. This company manufactures trucks.

Hartford Parts Not to Move—The Hartford Automobile Parts Co., Hartford, Conn., has decided not to move to New Britain, as planned, but will retain the old Cheney mill property and operate the New Britain works as a branch. The company plans to increase its capital from $300,000 to $600,000.

Marshall Co. Makes Parts—The Marshall Castings Co., Marshall, Mich., which was organized only a few weeks ago, will specialize in automobile parts. The two first orders which the company has received are from the Buick Motor Co., Flint, and from Dodge Bros., Detroit, and are of a total value estimated at $20,000.

The Automobile Calendar

March 14-17	Springfield, Ill., Show.
March 15-18	Trenton, N. J., Show, Armory, under auspices of Chamber of Commerce.
March 15-18	Newburgh, N. Y., Show, Armory.
March 18-25	Pittsburgh, Pa., Twelfth Annual Show, Automobile Dealers' Assn., Motor Square Garden.
March 16-19	Manitowoc, Wis., Show, Orpheum Theatre, F. C. Borcherdt, Jr., Mgr.
March 19	Los Angeles, Cal., Speedway Race, Ascot Speedway Assn.
March 25	San Diego, Cal., 50-Mile Automobile Track Race at Fair Grounds.
March 21-25	Deadwood, S. D., Show, Auditorium. Deadwood Business Club.
March 22-25	Lexington, Ky., Show, Woodland Auditorium.
March 25-April 1	Wheeling, W. Va., Show, Market Auditorium.
March 27-April 1	Danville, Ill., Show, Eastern Illinois Dealers.
March 27-April 1	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
Mar. 29-Apr. 1	Wheeling, W. Va., Show.
April 1-8	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 3-8	Twin Falls, Idaho, Show, Oliver Tabernacle, B. H. Fuller, Mgr.
April 8	Corona, Cal., Race, Citrus Belt Racing Assn.
April 10-15	Seattle, Wash., Show, Arena.
April 14-16	Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
Apr. 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show, Automobile Industries Assn.
May	Chicago, Ill., Speedway Race for Amateurs, Speedway Park Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 13	New York City, Sheepshead Bay Speedway Race.
May 20	Chicago Non-Professional Speedway Race, Western Interclub, Speedway Park.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway Race.
May 31	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race, International 300 - Mile Race, Speedway Park, Speedway Park Assn.
June 28	Des Moines, Iowa, Speedway Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Coeur D'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 11-12	Pikes Peak, Colo., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Race.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair, H. P. Murphy, Racing Sec.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.

The Week in the Industry

McFadden Buffalo Firestone Mgr.—H. W. McFadden has succeeded A. L. Manley as manager of the Buffalo branch of the Firestone Tire & Rubber Co. Mr. McFadden was transferred from Dallas, Tex.

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Dealer

Southwest News Items—The Hannon Motor Sales Co., Tulsa, Okla., agent for the Oakland in four of the State's largest counties, has opened a branch salesroom at 616 Okmulgee Avenue, Muskogee.

M. S. Pogue, formerly of San Antonio, Tex., has been named general manager of the Muskogee Overland Co., agent at Muskogee, Okla., for the Overland.

D. D. Davis, Kansas City, Mo., has opened a salesroom at 1922 Grand Avenue, and handles the Scripps-Booth cars in the Kansas City territory.

The Western Auto Supply Co., Tulsa, Okla., has absorbed the Segar Auto Supply Co.

The Joplin Motor Co., Joplin, Mo., has moved into new quarters at 517-520 Joplin Street. The company is distributor for the Studebaker line in six southwestern Missouri counties and two adjoining in Kansas and Oklahoma. A trainload of eighty cars will be received by the company about March 15.

The Chase Motor Truck Co. of Missouri, Kansas City, Mo., has been organized to look after the distribution of the Chase line of trucks in Kansas City. William Wallace is head of the new company and service quarters have been opened at 413-415 Wyandotte Street.

Packard to Build in Pittsburgh—The Packard Motor Car Co., Detroit, has awarded the contract for the construction of a two-story, 100 by 233 ft. service building at Pittsburgh, Pa. The estimated cost is $200,000.

Salt Lake Co. Branches Out—C. L. Evans and A. M. Daly have bought the India Rubber Mfg. Co., 336 South State Street, Salt Lake City, Utah. In the past the company has very largely confined itself to the operation of a vulcanizing plant. The new owners intend to add automobile tires and supplies.

Rex Ignition's New Branch Offices—The Rex Ignition Mfg. Co. has established branch sales offices in Philadelphia and Chicago. F. E. Bruckner is manager of the Chicago branch and William Payne, formerly with the Ferguson Publishing Co., takes charge of the Philadelphia office.

Motor Men in New Roles

Bradner Auto Body V.-P.—H. E. Bradner, since the organization of the Auto Body Co., Lansing, Mich., secretary and general manager of the concern, was, upon his request, relieved of the office of secretary and elected vice-president. He will continue as general manager. As secretary of the company the directors have chosen F. C. Ruch, a stockholder and a well-known insurance man.

Tobin Promoted by Willard—F. D. Tobin, who has been connected with the branch of the Willard Storage Battery Co. in Detroit, has been promoted to assistant district manager of the Detroit territory.

Rippingille Hudson Assistant Mgr.—E. V. Rippingille has been appointed assistant sales manager in charge of service by the Hudson Motor Car Co., Detroit. He has been with the company since its inception.

Greiner Jeffery Secretary—G. W. Greiner, formerly in charge of the credit department of C. T. Jeffery Co., Kenosha, Wis., has been made secretary of that concern.

De Vault Promoted—A. L. De Vault, who was manager of the Detroit branch of the Federal Rubber Co., has been promoted and now has charge of the central district, which comprises the territory of the Detroit, Cleveland, St. Louis and Chicago branches, which have been combined and are now placed under the direct jurisdiction of the Chicago headquarters.

Bloom Rex Sales Mgr.—L. S. Bloom, for years British sales manager of the Rex Ignition Co., has been appointed sales manager of this company in the United States and Canada. Mr. Bloom assumed his new responsibility on March 1, making his headquarters the New York office of this concern.

Whisler Peru Parts Super.—I. S. Whisler has been promoted to the position of superintendent of the Peru Auto Parts Mfg. Co., Peru, Ind.

Williams Chicago Goodyear Mgr.—C. H. Williams has been made manager of the Chicago branch of the Goodyear Tire & Rubber Co., with headquarters at 1601 Michigan Avenue. He was formerly manager of the branch in Portland, Ore.

Duffield with U. S. Rubber—J. E. Duffield has joined the U. S. Rubber Co. interests by becoming sales manager for the Mechanical Rubber Co., Chicago.

De Land with Milwaukee Chalmers—L. S. De Land has been appointed sales representative of Harry Newman, Inc., Milwaukee, distributor of the Chalmers car.

Hoover Leaves Splitdorf—C. A. Hoover has resigned his position with the Splitdorf Electrical Co. to take a Western agency for the Rex Ignition Mfg. Co. He will be located at Kansas City, Mo.

—

Dealer

Philadelphia News Item—The branch of the Goodyear Tire & Rubber Co., 207 North Broad Street, Philadelphia, Pa., has increased its business to such an extent that additional quarters have been added at Twenty-fourth and Locust Streets. The new warehouse contains 23,180 ft. of floor space and will accommodate 25,000 tires.

Philadelphia contractors are estimating on the erection of a factory addition to the plant of the Hess-Bright Mfg. Co., maker of ball bearings, at Front Street and Erie Avenue.

The Baker-Price Co., which has handled the KisselKar in this city for some time, has been made sole distributor in this territory for the Westcott.

The interests of F. Winsor Eveland in the Yerkes-Eveland Co., distributor of the Stearns-Knight, have been purchased by President William Yerkes. The latter has plans under consideration for improving the business at 1411-1419 Spring Garden Street.

The Reading-Philadelphia Auto Messenger Co. of Reading has been formed with S. H. Hochfeld as manager. The company, practically the first of its kind in the field, will operate several auto trucks between Reading and Philadelphia.

Opens N. Y. Office—The United Smelting & Aluminum Co., New Haven, Conn., has opened a branch sales office in New York City at 26 Stone Street.

New Supply House in Newark—The Elin Auto Supply Co., 273-275 Halsey Street, Newark, N. J., has just started business. Edward Elin is manager.

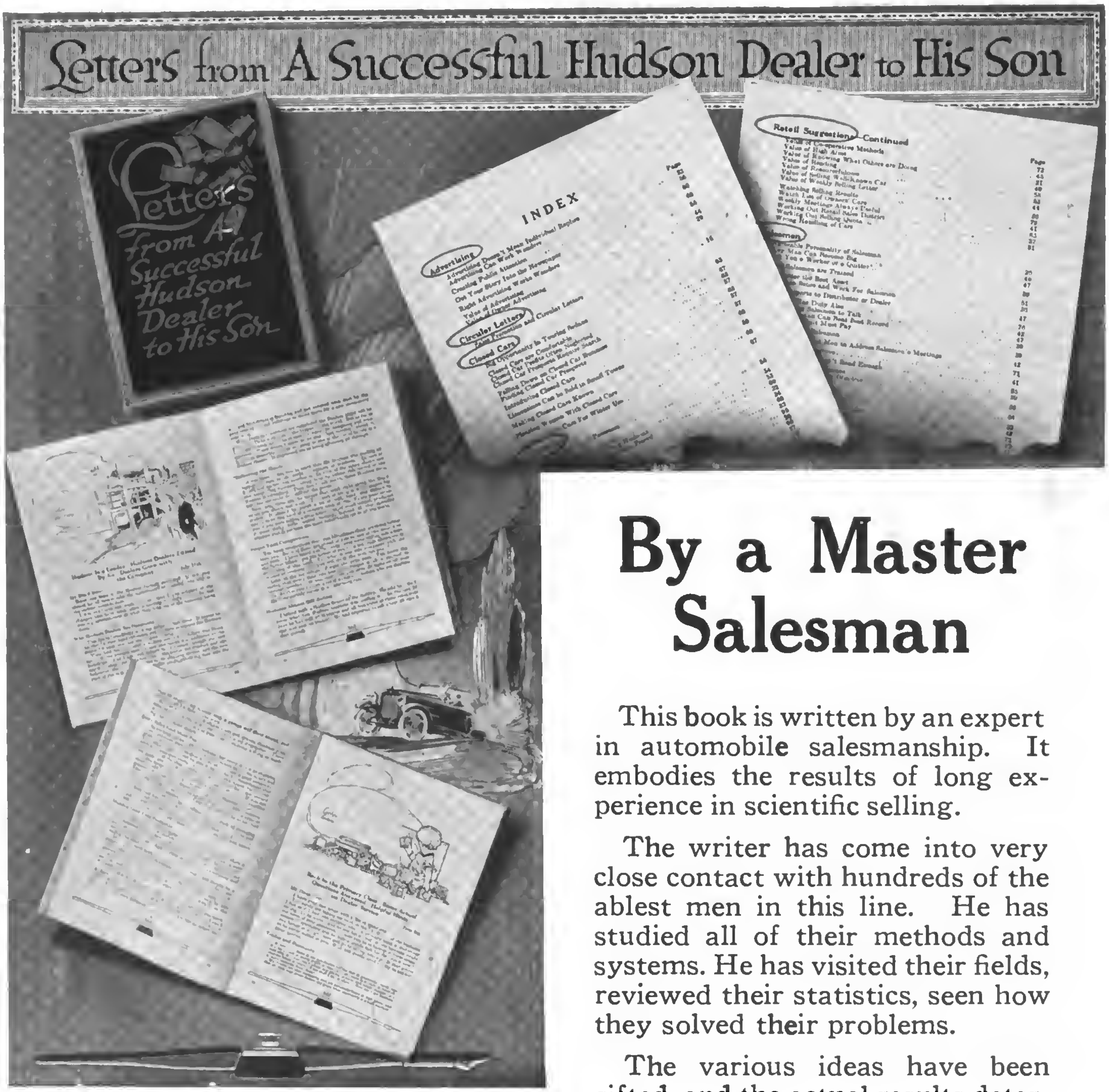
U. S. L. Offices Moved—The New England office and service station of the U. S. Light & Heat Corp. have been moved to the Exposition Bldg., Cambridge, Mass., from 25 Irvington Street, Boston. The Detroit office has recently moved from 203 Monroe Avenue to 43-45 Brady Street.

The AUTOMOBILE

Vol. XXXIV,
No. 12

NEW YORK, MARCH 23, 1916

Ten cents a copy
Three dollars a year



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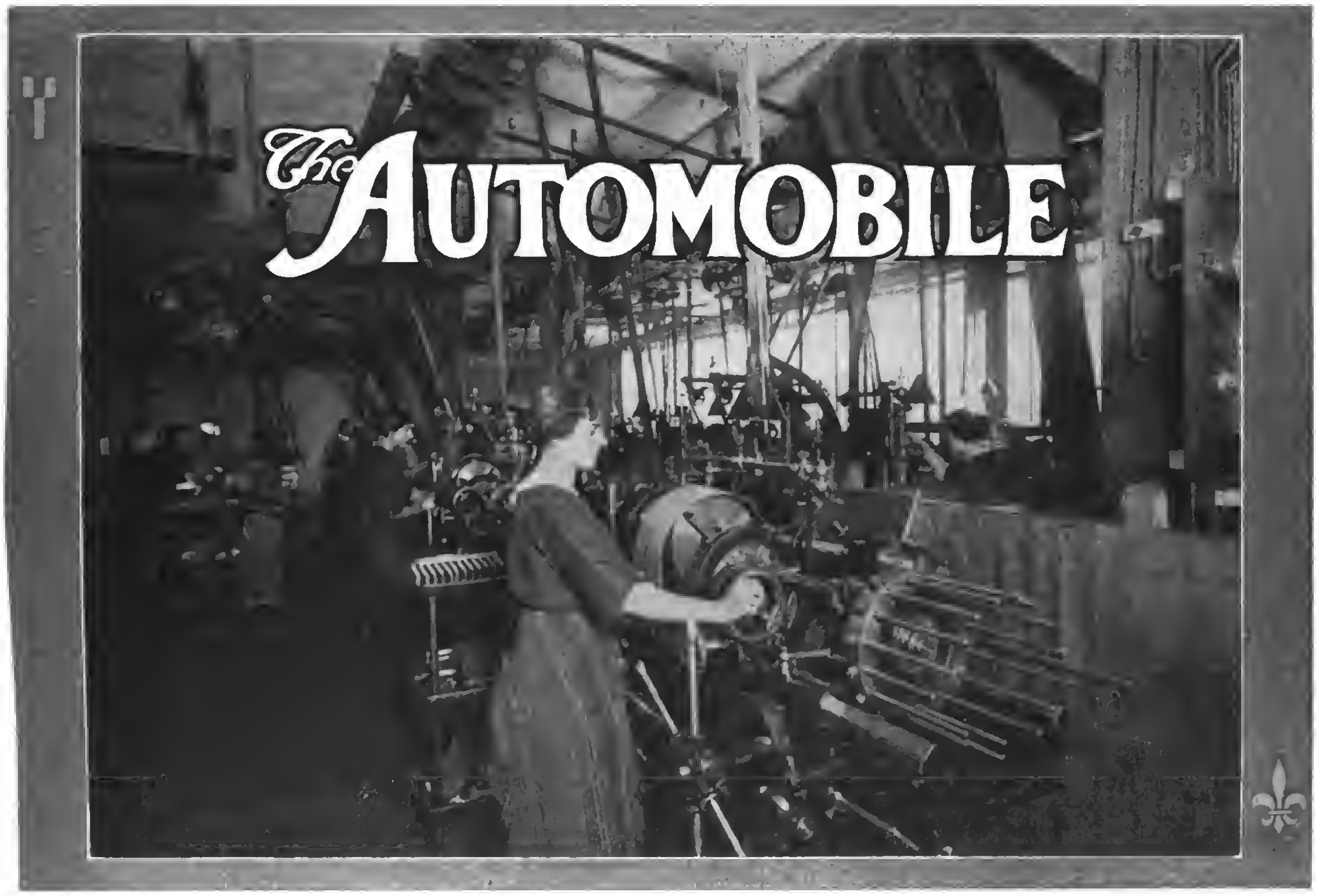
VOL. XXXIV NEW YORK—THURSDAY, MARCH 23, 1916—CHICAGO NO. 12

The AUTOMOBILE



Women in Europe are finding machine shop work both patriotic and profitable

British Industry Better Equipped

Effect of War Different in Different Plants—Reorganization for Munition Making Will Aid Better Manufacturing in Peace Time—Cheaper British Cars Anticipated

ASKED how the British automobile industry stood at the present time, one of the leading manufacturers replied "There isn't any British motor industry now—that's all there is to say." It was the same maker who, asked by King George, during an official visit, how the war had affected them, replied "It has given us Hell."

In the same town, not more than a mile away, another automobile manufacturer said "come and see." And he took me through shops with not a square inch of waste space in them; he showed me women and girls making hand grenades and encouraged to maximum output by means of intelligently distributed premiums; he took a pride in pointing out a score of contrivances to simplify operations and adapt existing machinery to special munition work; he showed how, by an intelligent system, he was able to secure material and was able to keep his car section running on a reduced scale while making bigger deliveries of war material than the army had estimated his factory could produce.

Another manufacturer's leading hope was that the government would prohibit the importation of automobiles for two years after the war. A fourth was of the opinion that if England could not compete with foreign nations without protection there was something wrong with her system. He also pointed out that the American car, by coming in when the British manufacturers were unable to supply, had saved hundreds of automobile dealers from financial disaster.

These examples have been given to show the varied viewpoints of the British automobile manufacturers. Go into one factory and there is dark pessimism; go into another and it is to find buoyant optimism; in a third the outstanding feature is jealousy that a rival should have found means to keep on with a certain measure of car production; another has grasped the truth that it is necessary, first and foremost, to get through with the war, and let the future take care of itself. There is no uniformity of view; there are no indications of any national program for the future conduct of the automobile industry; there appears to be very little hope that the government will assist the industry in the critical reconstruction period which will immediately follow the war; it does not seem that any plan has been worked out by which the government could help the industry. The general impression gained after mixing with members of the English automobile industry is that the British car manufacturer does not realize his own strength. He has accepted war conditions according to his particular temperament; he is going through to the end, whatever the end may be; but he has not yet had time or sufficient imagination to lay out possible plans.

All Factories State Controlled

Practically the whole of the English automobile factories are state controlled establishments. The exceptions are some of the smaller factories which, while undertaking a ceramount of military work, are also continuing the production of cars or other components in which they are normally interested. The amount of such work being done for private owners bears a very small porportion to the whole, and is not worth the indignation, or jealousy, as the case may be, of those manufacturers who have been absorbed entirely by the war machine. In this connection, there is no ground for a suspicion that some English makers appear to have, which is that the French factories are doing more private business than they. The English are doing little for the civilian client; the French are doing less.

Conditions Vary Widely

Factories under government control are not necessarily prevented from making automobiles; but they are prevented from doing other than government work, except under special circumstances and with special permission. There are shops in which hardly a shell is to be seen, the entire plant and all hands being employed on trucks, touring cars and aviation motors for the army. In others not a single machine is running on automobile parts. The former have a certain advantage over the latter, for they are keeping their staffs on the usual work, they are gaining experience with war models, and that experience can be put to good use when peace conditions are re-established. It appears to be one of the chances of war whether a factory shall be kept on trucks and cars or on shells.

The fact is obvious, merely from an examination of the English automobile factories, that there has not been the single national control of the industry which is such a distinctive feature of the continental industry. A few of the big factories were switched from civilian car work to the production of military automobiles within a week of the outbreak of war and have from that time to the present date been employed exclusively and ever-increasingly on war material. Other and smaller manufacturers state that for months they tried to get war contracts for either automobiles or munitions and failed to obtain any satisfaction from the authorities. Finally they were able to get sub-contracts from the big contractors.

Half-Finished Cars

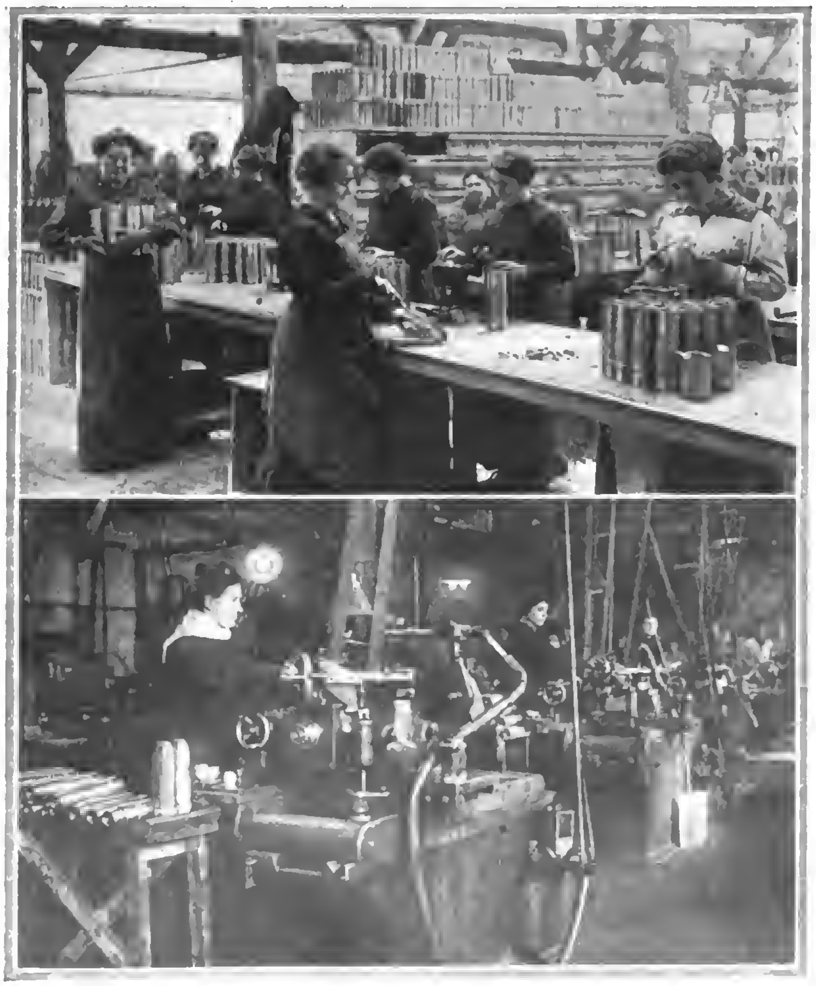
Many of these factories now running two shifts on war munitions were doing practically nothing when Asquith made his famous "no shell shortage" speech. Other cases are to be found where factories tried to carry on their ordinary production, building for stock under the impression that the war would be short and that there would be a big demand for cars at its close. Several of such factories were suddenly ordered to accept contracts for shells and other military material, and work on cars had to be stopped at practically a moment's notice. This is shown by the large stocks of partly finished material—frames, cylinders, gearboxes, axles, motor units, etc.,—sometimes piled up nearly as high as the roof. Control is so close that even the little labor necessary to transform some of these units into complete cars cannot be obtained.

In these shops it will be an easy matter to resume work on automobiles without loss of time as soon as military restrictions are withdrawn. Obviously however, the pre-war models will have to be continued for a certain length of time.

Engineering Activity at Maximum

Although there is still room for extension in some of the automobile factories, the engineering industry as a whole appears to be getting very near its maximum output. One authority states that the limiting factor now is the world's production of steel. He claims that the amount of steel used for shell making at the present time is equal to the total world's output before the war. As an instance of the world-wide influence of the war on the metal industry, Japan is now supplying some English factories with brass bars.

The work done during the past twelve months is nothing less than stupendous. In this connection it is necessary to avoid anything like precise statements, for obvious reasons. As instances of activity, I was shown one factory employing 2500 Belgians—men and women—running two shifts and working six and one-half days a week, producing 3500 shells a day, having six hydraulic presses which would go into service within a week and increase the output 100 per cent, and possessing a laboratory and test department equal to those of the best engineering establishments to be found in any part of the world. Where this modern, highly efficient, and well organized factory now stands, there was but one year before an uncultivated field without a brick on it. It was not only necessary to plan, build, and equip that factory,



Making and loading shell in a factory where high grade passenger cars are the stock product

Frenchwoman operating a lathe in the Panhard factory in Paris

Girls gauging shell parts in the Panhard plant

but to bring together and find accommodation for the workpeople and their families, numbering about 4000 people, most of whom did not speak a word of English.

In another town a French automobile company had opened an English factory and had trained 300 mechanics to the highest class of work in which no tolerance whatsoever is allowed. All finished parts have to be dead accurate. While this work is going on in the temporary factory, a bigger factory for 1000 workpeople is being erected, the builders being under a penalty of $500 per day for late delivery. In addition to this factory, the same company has completed a new factory in the south of France and has doubled the size of its original factory. Practically all the automobile factories of the Midlands are extending, building operations going on both day and night by the aid of special electric lights.

Women Do Good Work

Increased output has only been made possible by a considerable dilution of skilled labor and the introduction of women on work to which they were originally entire strangers. This change is less evident in the automobile than in the national ammunition factories. Nevertheless women are now an important factor even in the automobile shops and they have been responsible for a considerable amount of speeding-up. It is found an easy matter to train a woman to get the maximum out of a machine, and this has had its influence on men who have systematically kept machines below their maximum output.

The change in the internal organization of the factories has not been possible without some friction. There have been strikes in certain districts, and there are a few labor disturbances at the present moment. But so far as the British automobile industry is concerned, it has not been found possible to discover a single case of a strike, and where there have been dissensions they have always been settled amicably by a straight talk between employers and workpeople.

As an indication of the spirit of the workpeople in the automobile industry, one man in a factory of 2000 workers refused to join up under the Derby recruiting scheme. He was roped into a wheelbarrow and taken by force through the streets of Coventry to the recruiting station. In another factory in the same town 500 men threatened to down tools if a Colonial, who had refused to recognize the recruiting scheme, was not dismissed. The man was obliged to leave without waiting for a dismissal from the firm, and could not gain employement elsewhere in the town.

Joining the army under the group scheme does not make any material change to the majority of the men in the automobile factories, for they are in reserved occupations and are considerably more use to the army as mechanics than as soldiers. The fact remains, however, that by joining the groups they put themselves under military law and could be drawn from their present occupations and put into the army if it became necessary to do so for any reason. The manner in which Briand stopped the railroad strike in France a few years ago by putting the strikers under military law is an example of the force of this weapon.

Wages Are Raised

There has been a general increase in wages, but this has not attained the proportions stated in many quarters. From close inquiries it is found that wages in the automobile industry have risen 25 per cent on an average. At the same time food prices have increased 30 per cent. As this increase does not apply to more than one-half of the worker's necessary expenditure, the net result is to his advantage. Stories of youths earning $25 to $30 a week are nearly always found to be based on some special week when accumulated bonuses were paid. In some of the automobile body-building factories expert workers on piece rates are drawing $25 a week for aeroplane propeller construction, but this is above the average even in this particular branch. The general condition of working families in the automobile trade is better than at any previous time, for whereas before the war only one member worked, now three to four members can find employment with a minimum wage of $5 a week for girls.

Experimental Work Progresses

Although very little publicity is given to the fact, experimental work is still being carired on to a limited extent, in the best English factories. In addition, the best arrangements possible are being made to return to the usual class of work as soon as release is obtained from army contracts. On the whole the English factories are better placed in this respect than are the French. In England production was stopped suddenly and no attempt made to use up the series in course of construction. In France manufacturers gradually exhausted their stocks and only ceased building cars when they had nothing more to build them with.

Not much information is allowed to get out regarding the contemplated after-the-war models. It is certain, however, that there will be a decided increase in the number of medium priced cars and in small light two-seaters with four-cylinder motors 60 by 110 to 70 by 140 mm. bore and stroke. It is believed that whatever the outcome of the war strict economy will be exercised for a number of years and that there will be no demand for big cars which will be costly to maintain on account of high taxation, high cost of fuel and tires. At the present time there are important factories with a reputation for the best work and an experience in big cars only, now decided on the production of big series of 10 hp. two-seaters. These are four-cylinder models with a cylinder bore of 70 mm. maximum. Other firms, hitherto connected with a couple of models, one of them of 10 and the other of 14-16 hp., have decided to drop the bigger type and devote themselves after the war to the 10-hp. type.

No Expensive Cars Wanted

The position of firms producing costly models only is not looked upon as particularly bright for the period immediately after the war. It is known, indeed, that one of these firms is contemplating the construction of automobile trucks, a class of work to which it has never previously paid any attention. At the end of the war several thousand big cars, varying from 16 to 30 hp. will be turned on the second-hand market, and these are bound to have a disturbing influence on the higher class of car trade. A few twin sixes are under consideration, but it is rather significant that the only firm which is at present certain to produce a twelve-cylinder car is making arrangements for the bulk of its output to be 10 hp. 2 and 4-seated light cars. Considerable experience in twin sixes is being gained on aviation work, with the possibility of some really good automobile motors with this number of cylinders.

Whether prices will be cut after the war depends largely on the cost of raw material. Assuming that material can be obtained at the same price as previous to the war, prices will certainly drop, better organization, more modern plants and a general speeding up all tending to make this possible. Several instances could be given of new factories built exclusively for war orders, which will show a profit and have the initial cost of the plant completely wiped out if the war comes to a close a year from this date.

Magneto Business Problematical

The British motor industry never has had to face important competition from Germany and is likely to have less after the war. Public opinion is alone quite sufficient to prevent the sale in England or her colonies of the leading German cars. The situation is not the same with regard to magnetos. In 1913 Great Britain imported magnetos to the value of $100,000, and of this amount Germany was responsible for $95,000. Austria sent practically none, the small remaining surplus coming from France. Since then conditions have changed, all the imported magnetos coming from America. A few of the English electrical firms have taken up magneto construction, the most important development being the Thompson-Bennett Co., Birmingham, which is an auxiliary of the powerful Lucas company. There is a hesitancy about putting money into the magneto business until definite guarantees are given of a protective tariff for a minimum number of years. The Government Commission appointed to inquire into this question has proposed a 33 1/3 per cent duty on all foreign-made magnetos. If this is adopted, and there is little reason why it should not be put into effect, there are no indications in England or anywhere in Europe, that the use of the magneto will be lessened by reason of the present situation. Electric lighting and starting will be found on all European after-the-war models, but this is not likely to supplant the separate magneto for ignition purposes.

Eight Firms Make Aero Engines

The bulk of the aeroplane motor construction is in the hands of eight automobile firms, of which five are building V-motors and the three others various types including V's. Although every type of motor is in use, including Gnomes, eight-cylinder air-cooled, eight-cylinder water-cooled, six-cylinder vertical water-cooled, and twelve-cylinder water-cooled, the tendency is towards the V water-cooled motor with eight or twelve cylinders. Power is increasing, the opinion holding that comparatively few motors will be produced of less than 200 hp.

For hydro-aeroplane work numbers of twelve-cylinder motors developing 300 hp. and more are being produced. The most important of these is a twelve-cylinder of 100 by 160 mm. bore and stroke. This change from 75 to 80 hp. motors running at 1200 r.p.m. to motors of 100, 150, 200, and even more than 300 hp., running at 2000 r.p.m., and having a geared-down propeller, is one of the most important developments in connection with the automobile industry.

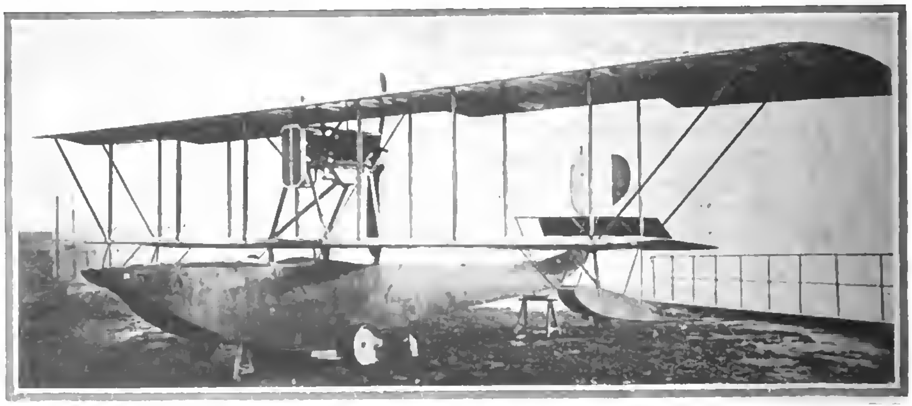
This movement is not confined to the British, but is general throughout the Allied countries. In France, Peugeot and other factories working in conjunction with them are producing thousands of eight-cylinder V-motors, the direct outcome of racing practice. In England the twelve-cylinder Sunbeams for aviation work have only been made possible by reason of racing experience.

While there is very little use of aluminum alloy pistons to be found on the Continent, the leading English firm uses aluminum-alloy exclusively. It is understood that this firm has spent $10,000 on experiments and has produced an aluminum nickel alloy piston which is perfect and can be used with the same clearances as an all-steel piston.

Hispano-Suiza Aluminum Engine

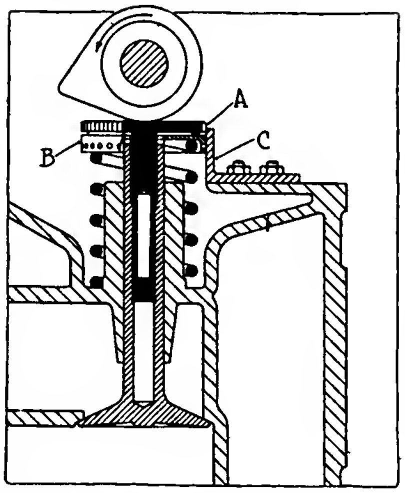
The aviation motor which is attracting the greatest amount of attention is the eight-cylinder Hispano-Suiza now being built in England. This motor is probably the first aluminum cylinder engine to be built in any quantities. It was first produced more than a year ago at the Barcelona factory of the Hispano-Siuza company and brought before the French authorities, who have decided to adopt it and had it built in the main factory of this company at Paris. It has since been taken up under license by other firms in France and more recently has been secured by the British government.

This motor has its cylinders cast in groups of four with steel liners inserted. A detachable cast-iron head carries the valves—two per cylinder—and the overhead camshaft is driven by bevel gearing and a vertical shaft at the front end of the motor. One of the patented features of this motor



An Hispano-Suiza hydro-aeroplane which has an eight cylinder aluminum engine with a special valve mechanism is the direct operation of the cams on the valve stems, without any intermediate mechanism. The general principle is shown in the illustration. There is a separate carbureter for each group of cylinders and lubrication is under high pressure to all parts, with the oil passing through a radiator.

The valve stem is hollow and has an adjustable tappet screwed into its open end. The upper end of the tappet rod carries a disc which is slotted on its edge and formed with teeth on its under side. Beneath this disc there is a second disc which is threaded on to the tappet rod, so that the rod can turn in it, but this second disc is keyed on to the valve spindle by two lugs formed on the end of the spindle. The second disc also has teeth formed on its upper face to engage the teeth on the first disc, and the two are held in engagement by a spring.



Details of the valve tappet adjustment used on the Hispano-Suizer aluminum aeroplane engine. It gives quick adjustment and is light in weight

Adjustment is effected by screwing the tappet rod up or down in the valve spindle, and it is locked once it has been adjusted by the inter-engaging teeth on the two discs, for the lower disc cannot rotate relatively to the valve spindle. The adjustment is effected by a double toothed wrench, one tooth being engaged with circumferential holes in the lower disc and the other tooth being engaged with the slots in the edge of the upper disc so that turning one of the wrenches causes a slight relative movement of the discs.

This motor drives the propeller through spur reducing gears. With a bore and stroke of 4¾ by 5⅛ in. the motor weighs 363 lb. when equipped with two magnetos and a duplex carbureter. Cooling water is not included in this weight. Fuel consumption is 11 gal. of gasoline and 1 gal. of oil per hour. Horsepower is 200.

Official aeroplane motor tests are now very severe. The French authorities demand 50 hours' constant running, half of this at three-quarter power and half at full power. The British put all motors through a 100 hours' test before accepting and in the case of big units make them run at the end of 100 hours with the propeller out of balance for a short time.

Rushing Trucks to Mexico

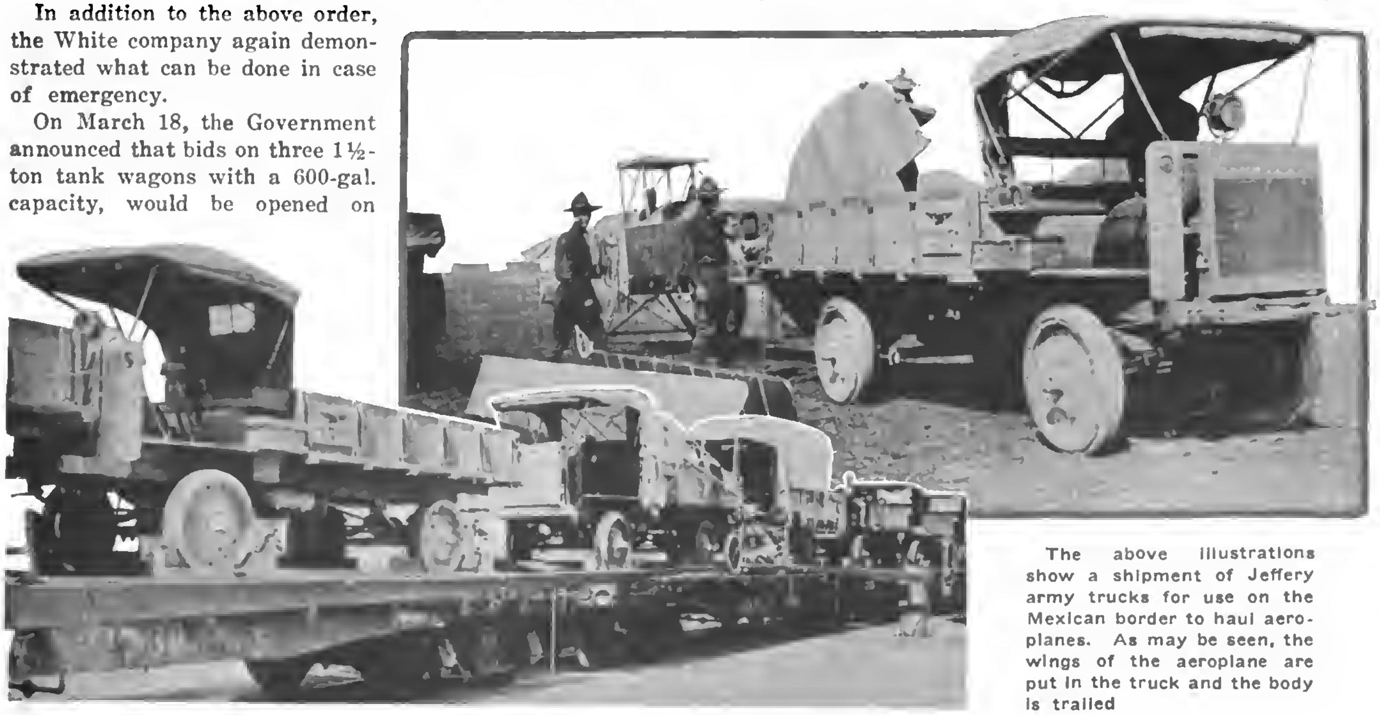
THE speed with which American truck companies can be mobilized to supply the sudden needs of the United States army was demonstrated this week when a long distance call from the War Department to the White Co. resulted in the dispatching of a special trainload of White army escort trucks to the Mexican border within 24 hr. after the order was placed.

Bids were opened at 10 o'clock on Tuesday morning and by 5.30 that afternoon the order was sent to the factory for twenty-seven chassis and one truck, which left 6 o'clock Wednesday morning. On Thursday morning the bodies and parts for these trucks were shipped, and that evening the entire personnel of White Truck Co. No. 1, consisting of one truck master, three assistant truck masters, twenty-eight chauffeurs, one mechanic and a helper, left for the Mexican border.

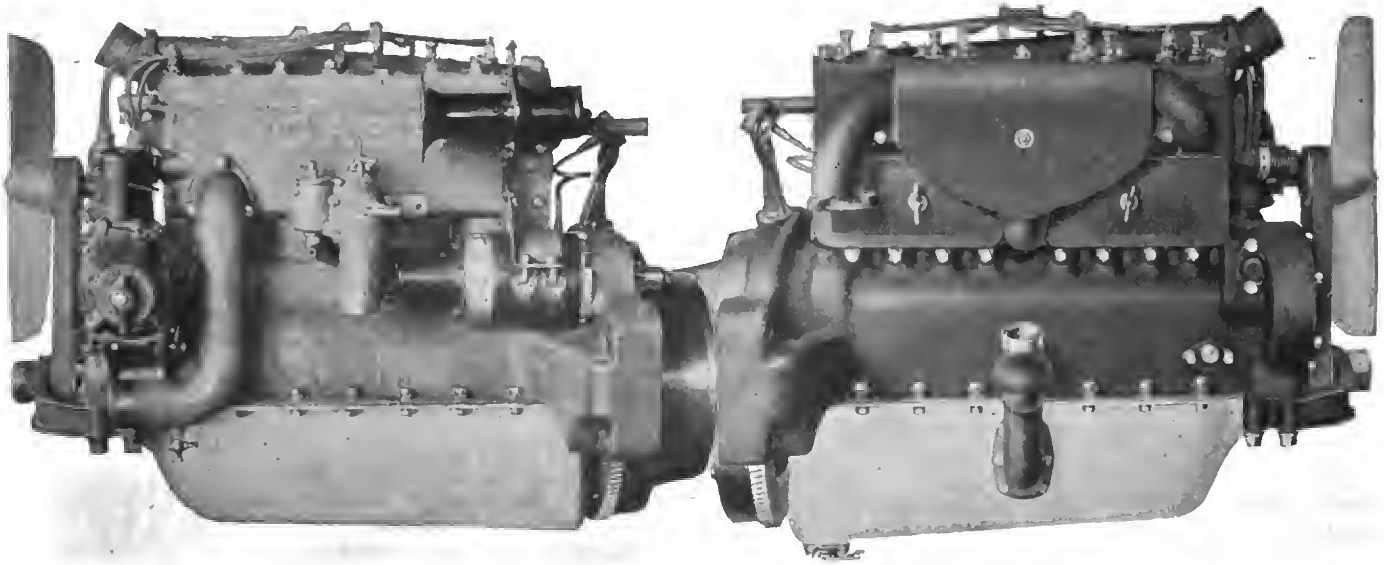
In addition to the above order, the White company again demonstrated what can be done in case of emergency.

On March 18, the Government announced that bids on three 1½-ton tank wagons with a 600-gal. capacity, would be opened on March 20. In between those two days, the White company found out that the Standard Oil Co. of New York had recently installed three of these tanks on White trucks, and immediately got into communication with them. As the Standard Oil Co. was willing to help out, the War Department was told that immediate delivery could be made on the order, which was accepted.

The Thomas B. Jeffery Co., which also figured prominently in the War Department order for twenty-seven trucks, received its order at 5 o'clock Tuesday night, March 16. At that time the workmen in the factory were leaving for home, but the Jeffery officials called them back, the order being rushed through that night. The trucks were in the freight cars at 7 o'clock Wednesday evening. The full equipment of thirty-three men was on the train at 2 a. m. Thursday.



The above illustrations show a shipment of Jeffery army trucks for use on the Mexican border to haul aeroplanes. As may be seen, the wings of the aeroplane are put in the truck and the body is trailed



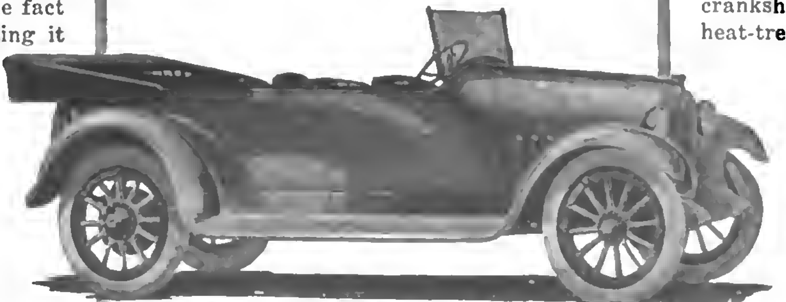
Accessibility Features Case Forty

Compact Power Plant Gives 40 Hp. at 2100 r.p.m.—Uses Detachable Cylinder Head, Integral Crankcase and Unit Construction—Test Shows Easy Suspension and Flexibility

DESIGNED especially to appeal to those who believe in a four-cylinder car, the Case Forty has been put out with the idea of incorporating the essentials of careful workmanship necessary to make this vehicle compete with the lower priced sixes. Selling at $1,090 the Case Forty, as will be noted, is in a price field which is almost as thickly populated by six and more cylinder cars as it is by fours, and consequently in a study of the design it will be seen that the flexibility and power demanded at this price have been attained in the four-cylinder motor. Throughout the design is of a rugged character.

The car itself is large and roomy, having capacity for seven passengers and a wheelbase of 120 in. A test of its riding qualities shows it to be exceptionally well sprung and also to be capable of the speed demands of practically any tourist. On intermediate gear the motor propelled the car at 32 m.p.h. without any troublesome vibration and on high gear a speed of over 60 m.p.h. should readily be attained, although on the test run this was not done by THE AUTOMOBILE representative owing to traffic laws and the fact that the car was new making it undesirable to operate at the highest speed.

Brake horsepower between 40 and 45
Detachable L-head block cast motor
Silent chain camshaft is adjustable
Magnetic pinion starter engagement
Pedal compensates for clutch wear



The new Case Forty

The manufacturers rate the engine as having from 40 to 45 brake horsepower at a speed of 2100 r.p.m. The four cylinders are cast in a single block and have 3⅝ bore by 6-in. stroke. The casting work is thoroughly up to date, the power plant being a unit with the gearset and the cylinders integral with the crankcase. In working out the suspension of the motor the front support is made up of a yoke with a ball and socket bearing in the front frame crossmember. This is the flexible point, the rigid attachments being by means of arms at the rear of the engine, bolted to the frame by a bracket which carries the transmission case.

In working out the design of the cylinders the trend toward detachable cylinder head has been followed, thus making removal of the valves an easy matter and also facilitating the removal of carbon from the combustion space and from the tops of the pistons. Close-grained gray iron is the material employed for the latter, which are fairly light.

The bearings throughout the motor are of S. A. E. specification babbitt, with bronze backing. The main crankshaft, connecting-rod and gearset bearings are provided with brass laminated shims, and the three main bearings all have the same diameter of 1¾ in. The lengths of the three main bearings are respectively, from front to rear, 3⅝, 2½ and 3¾ in. These carry the high-carbon steel crankshaft which is forged and heat-treated in the Case shops. The finished grind brings the crankshaft to 1¾ in. in diameter. The piston pins are carried on bronze bushings which are inserted directly in the piston boss, and each piston is provided with three Wasson piston rings.

Drop-forged I-beam connecting-rods made, with the rest of the engine, directly in the Case shops are employed. These are of chrome-nickel steel heat-treated to secure the greatest possible strength. The bottom bearing is held in place by four bolts, which are also of chrome-nickel steel.

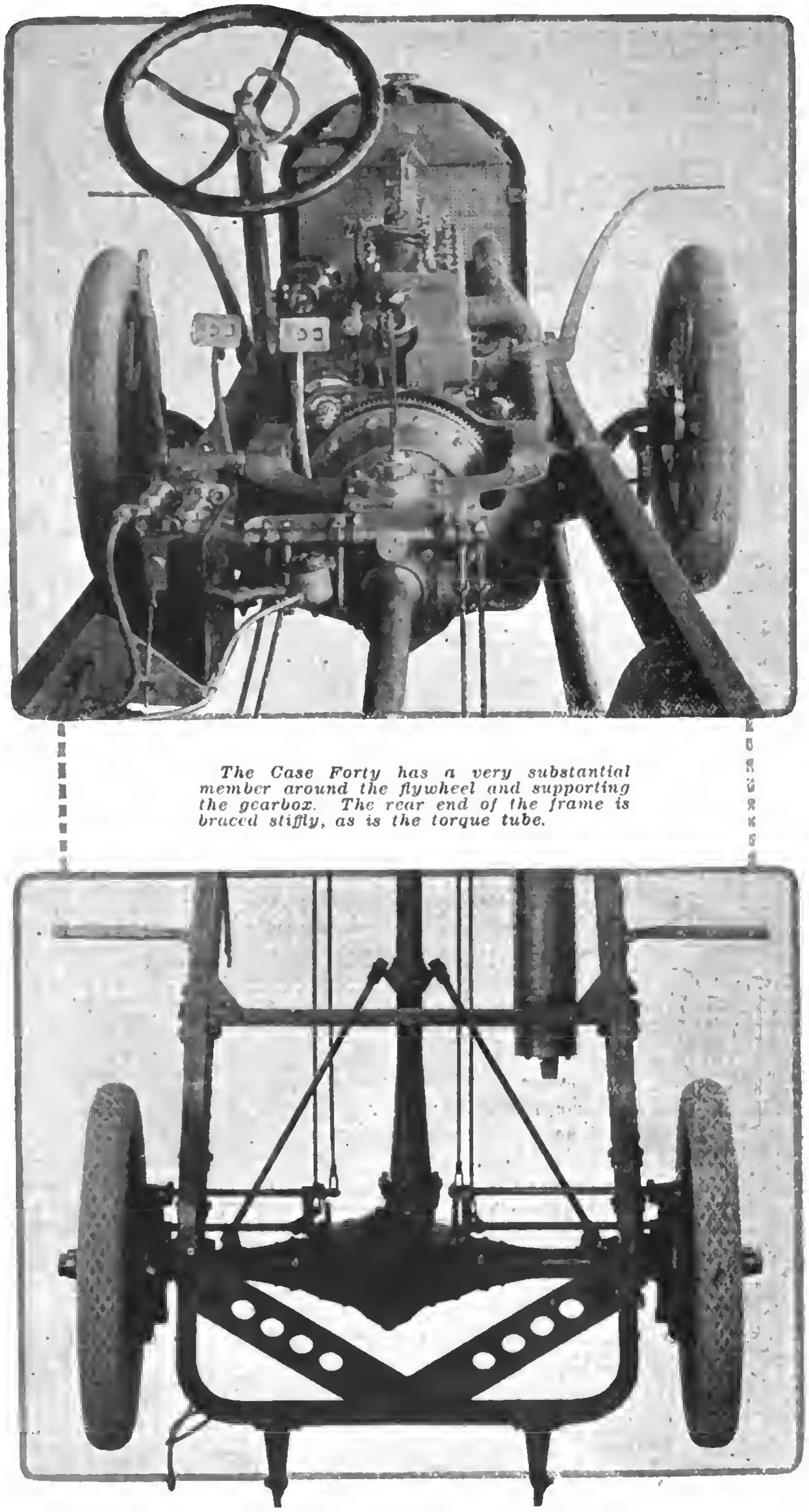
Uses Chain Camshaft Drive

A feature of interest is the care in which the valve drive mechanism has been worked out. The camshaft is driven from the crankshaft by a Morse silent chain and the sprocket on the camshaft is provided with an adjustable hub for changing the timing. The camshaft itself is drop-forged, having the cams and pump eccentric integral parts of the forging. It is supported by three plain, removable bearings and is ground to a final finish. The valves are operated from this shaft through roller type cam followers operated in removable die-cast bushings. The lifters have the standard adjusing feature and the valves are of the regular mushroom type made of 3½ per cent solid nickel steel. The valve diameter is 1⅝ in. with a lift of ⅜ in.

Lubrication is a combined force feed and splash system. The oil is forced to the crankshaft and camshaft bearings and splashed to the piston pins and cylinder walls. The oil pan is of pressed steel and has a 3-gal. capacity, and as already stated, the pump for circulating the oil is a plunger operated from the camshaft by an eccentric. Flow through the leads can be varied by means of an adjustable pressure release, and a pressure gage is provided on the dash which shows, at all times, the pressure under which the system is operating, while there is also a dial depth gage which shows the amount of oil in the crankcase. The leads run directly to the crankshaft and camshaft bearings and the overflow maintains a constant level in the splash troughs, insuring a supply of oil regardless of whether the car is operating on an upward or downward slope.

The cooling system is of standard thermo-syphon design. The radiator is a cellular type of bronze and a notable feature of its construction is that the ordinary soldered joints are not employed, the various members being sealed together instead; giving a core which is more in the form of a casting than of a made joint. The fan is two bladed and of the type commonly known as aeroplane design. It is made of cast aluminum and is equipped with a spring tightener which maintains a constant tension on the belt.

The carbureting and gasoline system is made up of a gravity feed from a cowl tank having a capacity of 14 gal. The carbureter itself is of special Case design and is equipped with a dash adjustment so that variations may be made for temperature and road conditions.



The Case Forty has a very substantial member around the flywheel and supporting the gearbox. The rear end of the frame is braced stiffly, as is the torque tube.

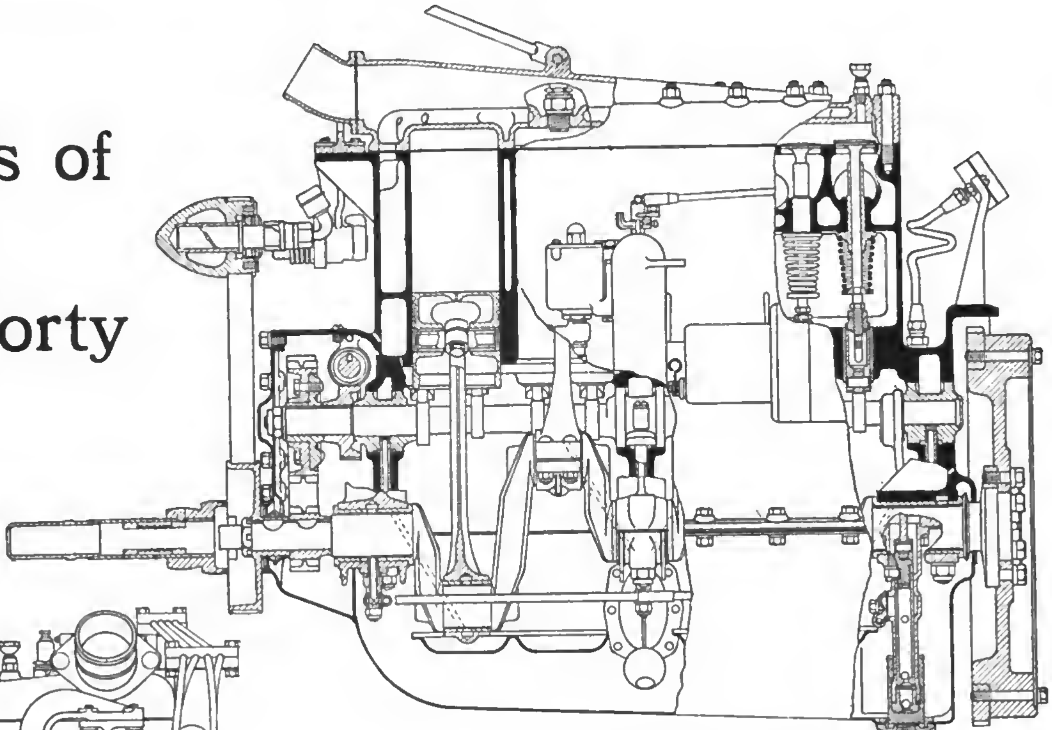
Has Magnetic Pinion Shift

Electrically, the entire car is Westinghouse, ignition, starting and lighting all being provided by this concern. The Westinghouse high-tension distributer is mounted directly on the generator by means of a vertical shaft. It includes the reversing switch feature, by means of which the polarity of the contact points in the breaker mechanism is changed frequently, thereby avoiding the possibility of building up the contact points and the subsequent seizing or irregularity in firing action.

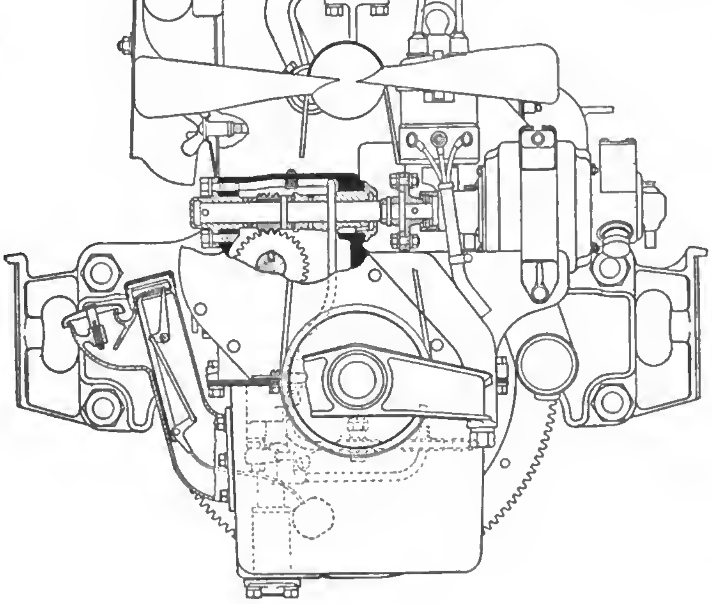
In the starting system contact is made by a magnetically-engaged pinion which meshes with the steel ring gear bolted to the flywheel. This system, as well as the ignition and lighting outfit, operates at 6 volts. The Westinghouse generator is operated at engine speed and has automatic voltage regulation. It is driven by spiral gears from the crankshaft.

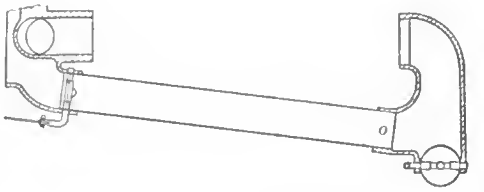
The possibilities of adjustment in the clutch have not been overlooked in the Case Forty design. The pedal has an adjustment to allow for wear, and the clutch spring is provided with means of adjustment to increase or decrease the tension as desired. The cone slides on a splined shaft and the front end of this shaft is carried by an annular ball bearing in the flywheel, which also takes up the spring thrust and

Details of the Case Forty

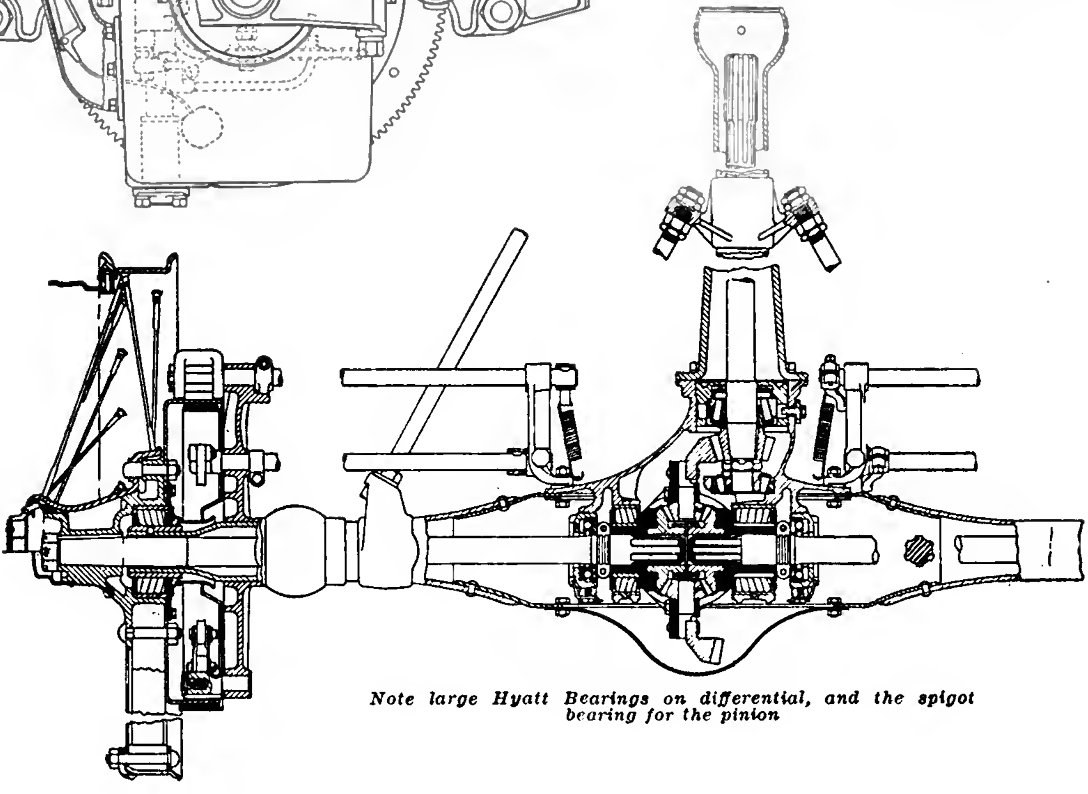


Engine of Case Forty showing chain camshaft drive and cross-shaft for magneto





Special hot air pipe used to cross cylinder block



Note large Hyatt Bearings on differential, and the spigot bearing for the pinion prevents it from being exerted endwise on the crankshaft of the engine. Another point of adjustment is on the clutch brake, which can be so arranged as to stop the travel of the disengaged clutch at any point and with any rapidity desired.

Transmission of Standard Type

From the clutch the drive is delivered to the three-speed selective gearbox, which is arranged to carry the shifter lever in position for center control. This gearbox is a fairly well standardized design, employing Timken bearings and using 3½ per cent nickel steel gears and shafts. Back of the gearbox is a Splicer universal joint connecting the gearset shaft with the main driveshaft. This in turn transmits the drive to a Weston-Mott three-quarter floating spiral bevel rear axle.

Substantial Torque Tube

On the drive layout both the torque and drive thrust are transmitted to the rear end of the gearset housing through a torque tube which is connected with the housing by a ball and socket joint. The drive pinion shaft runs upon two Bock roller bearings, the reduction in the rear axle being 4.23 to 1.

An inverted Elliot type front axle is used, this being of I-beam section, designed and built by the Case company. I-beam section is also used for the steering arms and the steering knuckles and king pins are of special chrome-nickel steel forgings, heat-treated and machined in the Case shops.

Timken bearings are used in the front axle and the steering gear is manufactured by the Jackson, Church, Wilcox Co., under the trade name of Jacox. It is a worm and split nut design and is operated by an 18-in. corrugated wood steering wheel which has the spark and throttle levers on top with the horn button in the center.

Frame Is Extra Deep

The frame is of rather deep section, the greatest depth being at the center, where it is 6-in. At this point the spring hanger for the cantilever rear suspension is attached. This spring is 50-in. long and 2¼ in. wide, and a feature is made of the special analysis steel of which this is composed, the makers claiming that the design of the spring is such that the master leaf is the last to break. The spring is carried on phosphor bronze bushings and follows the line of the frame, the main support for the spring being directly underneath the frame, doing away with any overhanging support.

The attachment to the rear axle is by universal joint, which takes up the side play and allows the spring to attain the maximum flexibility without being hampered by a fixed joint at the rear. The front spring is semi-elliptic, 37 in. long, and also said to be of a design which renders the master leaf or main plate the last to break.

Two sets of brakes, internal and external, operating on 14-in. drums are used. These bolt to the wood wheels, which are equipped with Goodyear detachable demountable rims. The tires are 34 by 4, the makers providing non-skid treads on the rear, and if desired the 35 by 4½ oversize tire can be put upon this same rim.

An all-steel body with divided front seats, adjustable back and forth, is provided and the upholstery is removable, made of grained patent leather. The standard finish of the car is Brewster green with ivory stripe and all the wiring between the body and chassis is brought to one seven-point connector-plug, which enables the body to be detached from the chassis without disturbing the wiring. There are two auxiliary seats which fold back against the sides of the body and are always accessible for service.

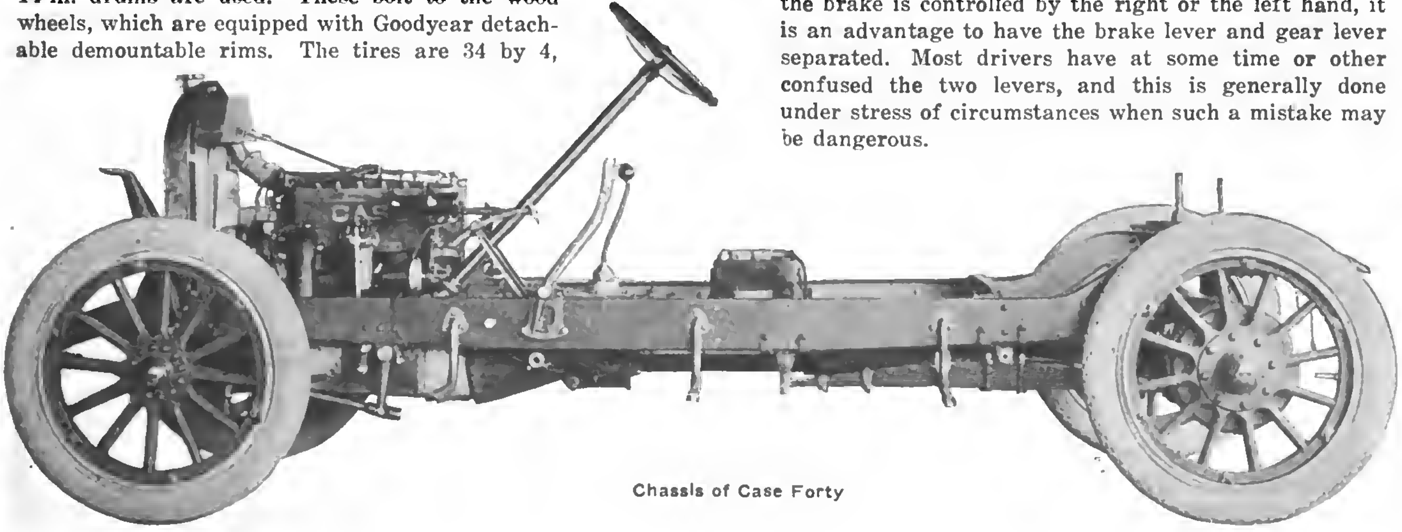
Equipment includes a 6-volt 80 amp. hr. storage battery which is located under the front seat. Thence all the wiring is carried in rust-proof flexible metal conduits. The fuse box is mounted on the back of the combination ignition and lighting switch placed upon the driver's right, being just below the right seat. The headlights are carried on the front fender apron and have a ball and socket attaching device which provides easy adjustment and focus. Double bulb headlights are used with dashlight, inspection lamp and tail light. The dash instruments include ammeter, gasoline gage, and Stewart-Warner speedometer. The windshield is rain-vision, ventilating, tires Goodyear and the top is a one-man design with dust hood and side curtains folding inside. A motor-driven warning signal, a complete set of tools and a tire repair kit are also furnished.

Upholding the Four

The Case Forty is especially interesting, perhaps, because it is one of a now very small class. With the majority of cars at approximately the same price fitted with engines having six or even eight cylinders, the manufacturers of the Case adhere to their belief in the virtues of the four.

To get the best out of the engine no pains have been spared, and it is noteworthy that the design is not laid out so much for cheapness of construction as for efficiency in all ways. An example of this is the use of a cross shaft for driving the magneto. From the viewpoint of accessibility this construction has much to recommend it, but it is unquestionably more expensive than the more usual arrangement. Again, the silent chain for driving the camshaft is not cheap by any means, though it is the accepted practice for all high grade European cars, and for a growing number in America. The body, with its divided front seats is a substantial build with nothing skimped about it either, as to proportions of finish, and the accessory equipment is thoroughly good.

Another point of peculiarity is the mounting of the hand brake lever. In this instance again it would have been cheaper to utilize a central location, but the Case engineers believe that it is an advantage to have the emergency brake operated by the left hand. There is no doubt that whether the brake is controlled by the right or the left hand, it is an advantage to have the brake lever and gear lever separated. Most drivers have at some time or other confused the two levers, and this is generally done under stress of circumstances when such a mistake may be dangerous.



Chassis of Case Forty

Analyzing Engine Cooling

An Accurate Determination of the Factors Affecting Cylinder Cooling and a Quantitative Examination of Air and Water Cooling Comparatively

Results of F. W. Lanchester's Researches Reviewed by A. Ludlow Clayden

ON the question of conductivity it is to be noted that the *pitch of the gills* in terms of the *thickness of the individual gills* at the root, gives the relation of the cross section of metal acting as the conductor in the wall of the cylinder, to the cross section of metal conducting the same heat when the latter has passed into the gill substance, and thus, if the cylinder walls and gills are of the same conductivity, the temperature gradient at the root portion of the gill will be to the temperature gradient within the thickness of the cylinder wall in the same relation as the *pitch of the gills* is to their *root thickness.* Referring to Fig. 5, it will be seen that this is only approximately true, in view of the fact that a small portion of the heat will be disposed of by the outer surface of the cylinder wall itself; however, this is commonly no more than perhaps 10 per cent of the total. If the gill be of uniform thickness from root to tip it is clear that the temperature gradient will be far steeper at the root of the gill than near the tip, because as the tip is approached the quantity of heat to be transmitted becomes less and less, the portion already disposed of at the gill surface being greater. It is evident that a more rational form of gill section will be one tapering off from a maximum thickness at the root where the heat flux is maximum to a knife edge at the periphery where the heat flux falls to zero. In Fig. 6, the heat flow and dispersion is shown diagrammatically.

In connection with the surface disposal of the heat we are not only concerned with the provision of the necessary surface and the maintenance of the necessary air velocity, but it is also obligatory to so design that the quantity of air required to carry away the heat can pass through the jacket air passages; thus if the air passage between any two gills be made of undue length the air will be so greatly heated before it has left the jacket that its temperature difference will be insufficient to make use of the gill surface, although, according to the equation, the latter may be sufficient. The upshot of this is that in the design of the *jacket as a whole*, apart from the design of the *individual gills*, the air channels must be so subdivided and connected in parallel as to pass a quantity of air several times greater than would be theoretically necessary were the air to be raised to the temperature of the gill surface. The factor of importance in calculating the quantity of air necessary is the specific heat of air at constant pressure, which is approximately a quarter that of water, or more accurately 0.24.

The position may be exemplified by the three alternative arrangements of air circulation given in Figs. 7, 8 and 9. In all three arrangements depicted the jacket gills are precisely the same, but in the first arrangement, Fig. 7, it is supposed that the air circulation be taken the complete circumference of the jacket. In the second arrangement, Fig. 8, the air stream is divided, half going one side of the cylinder and half the other, so that for a given velocity over the gilled surface there is twice the total flux. In the third arrangement, Fig. 9, the air stream is divided again, so that now there are four quadrants of the jacket all "in parallel." In this arrangement for a given velocity of air over the gills the flux is four times that in Fig. 7. It will be seen that since the expenditure of energy required to maintain the air blast is due to the skin-frictional resistance of the gills, the arrangements given involve intrinsically the same expenditure power. In other words, it is just as cheap to circulate fresh air over the gilled surface as it is to circulate air which has already been heated, provided the difficulties of design are not insuperable. Where such difficulties exist the "coarseness" of the gills will have to be proportioned to the degree of sub-division found possible, the basis of design being that of the *unit cell.*

The Unit Cell

We have already seen that the heat received by the cylinder walls internally may be approximately expressed, as an average of the whole exposed surface, by a definite number of horsepower per unit area, and that this figure under ordinary conditions may be taken to be 18 hp. per square foot. We have from the equation hp. $= \frac{\theta V}{15{,}000}$ the means of calculating for any given temperature difference and air velocity the rate of heat loss per square foot from the surface of the gills. Thus we have, for any given quantity of heat passing from the working fluid into the atmosphere, a definite relation established between a unit area of the cylinder wall and the corresponding area of the gill surface by which it is served. This at once gives us the relation between the height of the gill, that is to say its radial dimension corresponding to the direction of flow of heat and the spacing or pitch at which the gills are placed, for, referring to Fig. 5, it is manifest that if h be the height of the gill and s be the pitch or spacing, the relation of external to internal surface is approximately $\frac{2h+s}{s}$

The temperature gradient within the cylinder wall is 28 deg. C. per centimeter thickness. This may be taken as a mean value under conditions of ordinary experience; the temperature gradient at the point of maximum heat flux may be, and probably is, at least twice as great. Since the heat conductivity of copper is eight times that of cast iron, this same temperature gradient can be maintained in the gills with a thickness of copper $s/8$. The copper gills in the author's early models were based roughly on this proportion,

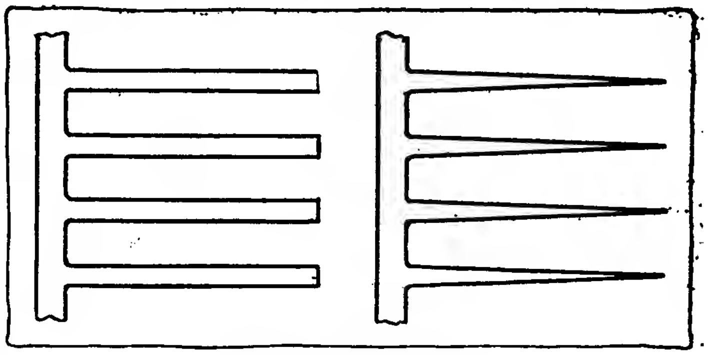


Fig. 5—Types of cooling gill

thus in the gills depicted in Fig. 2 the thickness of copper was 24 s.w.g. or 0.022 in., which is a close approximation to one-eighth of the gill space. In the gills as in Fig. 1 the gill was considerably thicker than here given owing to the difficulty of casting it thin enough; the result being that the thickness as shown is more than appropriate to the conductivity of aluminum. It is by no means necessary, however, that the temperature gradient should be maintained as low as within the cylinder wall; much depends upon the absolute value of h, the radial dimension or height. The thickness of the gill is thus dependent upon the temperature gradient, and upon the conductivity of the metal employed.

Everything points in the future to the adoption of gills of copper or aluminum, as used in the author's early experiments in air cooling. Now the space bounded by two adjacent gills may be regarded as a *unit cell* of the jacket, and the length of this unit cell in the direction of the air flow is determined by the considerations already discussed; if the length is too great the temperature reached by the air before it leaves the jacket becomes too nearly that of the gilled surface, so that the latter will be inefficient. On the other hand, to unduly shorten the unit cell gives no advantage from the point of view of design, and, involves unnecessary weight, or alternatively, too steep a temperature gradient. Making the gills of copper, and designing the cell to give efficient cooling, the height of the gill h should under ordinary conditions be about ten times the pitch, that is $l = 50s$. The unit cell so proportioned is represented to scale in isometric projection in Fig. 10.

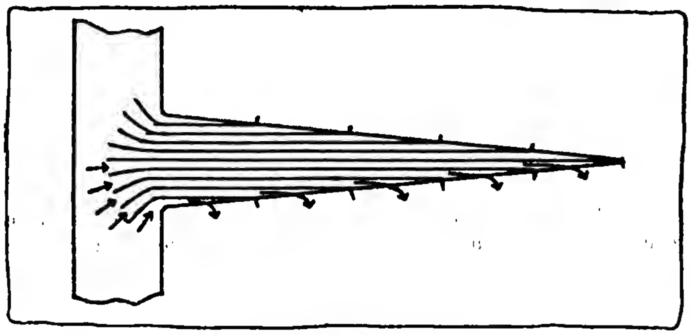


Fig. 6—Flow of heat in gill

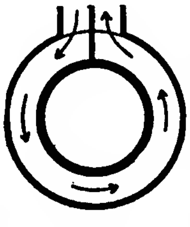


Fig 7

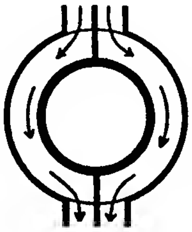


Fig. 8

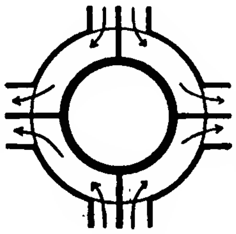


Fig. 9

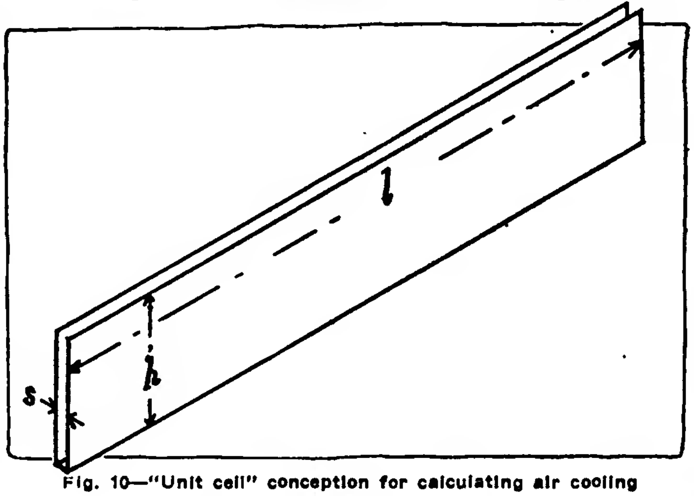


Fig. 10—"Unit cell" conception for calculating air cooling requirements

Practical considerations have very great weight when we consider how best to arrange an assemblage of unit cells to form the cylinder jacket.

It clearly is desirable to sub-divide the jacket as far as possible, and from this point of view the arrangement given in Fig. 8, is better than Fig. 7, and that in Fig. 9, is better than Fig. 8. However, whereas Fig. 8 lends itself readily to design, the air being admitted to one side of the cylinder jacket and escaping from the other side, the arrangement in Fig. 9 is not one which can usually be entertained. If we depart from the circumferential form of cell or gill assemblage, and arrange the gills longitudinally, it then becomes in most cases impossible to sub-divide it at all; the only practical arrangement is to pass the air in at the one end of the jacket and allow it to escape at the other.

Thus we have two alternative arrangements, which are given diagrammatically in Figs. 6 and 12. In the former the assemblage is circumferential, the basis of circulation being that of Fig. 8 and in the latter the gills are longitudinal; the lower figures representing diagrammatically the arrangement contemplated. In the upper portion of the figures we have a diagrammatical development of the cylinder wall, and thus in Fig. 11 we have two blocks of cells in parallel, the length of the cell being the half-circumference of the jacket; in Fig. 12 we have a single block of cells whose width is the circumference of the jacket, and whose length is that of the jacket in its axial size.

It is a significant fact that in the gasoline engine of ordinary proportions, these two arrangements result in approximately the same length of cell, so that, whatever proportion of cell is appropriate to the one arrangement, the same proportion will, roughly speaking, be appropriate to the other. From this it follows that the cell proportions may rationally be expressed in terms of the cylinder diameter, so expressed we have it that

$$l=1.6D$$
$$h=0.32D$$
$$s=0.03D$$

The thickness of the gill cannot be given in terms of D owing to the fact that it is the temperature difference between the root of the gill and the periphery which is the important factor, and thus the conductivity of the gill must be increased in proportion to its linear height. Since the conductivity of the material used is constant, its effective conductivity must be increased by an increase of thickness. From this it follows that the thickness of the gill will have to be proportioned to D^2.

Means of Supplying Air

In the generation of the air current we are faced with two alternatives; either as in the motor bicycle or the aeroplane the natural draught as due to the velocity of the machine may be relied upon, or when the conditions do not permit of this, a fan of some kind must be employed.

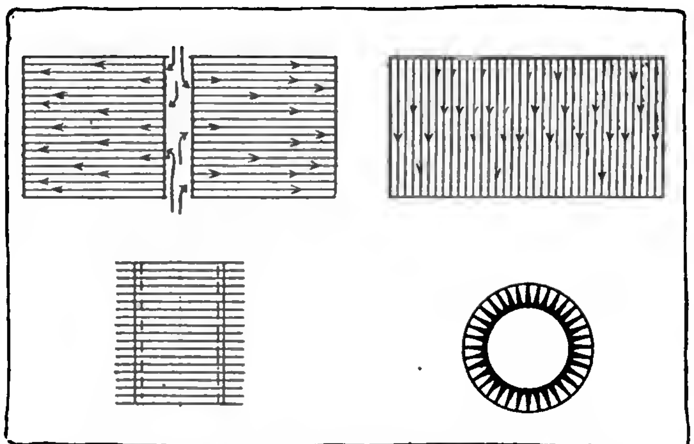
In the author's experimental air-cooled cars centrifugal fans of various kinds were employed.

In the case of the Renault aeronautical air cooled engine, a centrifugal fan, delivering at pressure, is provided for use when it is required to run the engine under stationary conditions, as, for example, when running a bench test, or employing the engine for work other than that for which it was primarily designed.

The centrifugal fan is rarely if ever met with in association with water cooling, the arrangement being adopted being almost invariably that of a screw fan placed immediately behind the radiator. In this position it commonely absorbs at speed from one to two and a half horse power, and at that is scarcely to be regarded as an efficient device.

At this point the preliminary considerations of air cooling were concluded, and the author then passes on to consider the problem of water cooling. The next section of the paper deals with the two systems, forced by pump and convection or thermo-syphon cooling. Later on the two systems are considered quantitatively and it is toward the end of the paper that the deductions are made which enable it to be said that air cooling is the lightest system for engines up to a certain size but not beyond that size.

The paper continues:



Left—Fig. 11—Diagram of air currents in circumferential gill design
Right—Fig. 12—Similar diagram for radial gills

Circulation of Water

The calculation of the quantity of water to be circulated is a matter of perfect simplicity; we must, however, first settle the *temperature difference* which is permissible between the flow and return temperatures of the water as it enters and leaves the radiator. Now the outside limits of this temperature difference are, on the one hand, the boiling point of water, and, on the other, the temperature for the time being of the atmosphere. It is necessary to considerably narrow these limits, however, for the boiling point must under no circumstances be reached, even by any part or portion of the water; and, as to the lower limit, it is clear that the water cannot be cooled down to the temperature of the surrounding air. Thus for a given velocity the cooling surface has to be proportioned to the temperature difference.

Now the boiling point of water cannot be taken at the usual 212° F. in view of the fact that cars are required to go over high mountain passes where the boiling point is considerably lowered. If we take the limit of altitude for ordinary purposes of 6,000 feet the boiling point is roughly 200° F. We may therefore take 200° F. as the upper temperature limit.

Now as to the lower limit; if we regard the highest ordinary temperature of the air to be 80° F. we have the total difference of 200—80=120° F. This difference may be regarded as well on the safe side in view of the fact that although a temperature of 80° F. is not uncommon at sea level it is exceedingly uncommon at 6000 ft. altitude; thus the difference stated may be otherwise expressed as equivalent to a permissible air temperature of 92° F. at sea level.

The above is the temperature difference between *air* and *water*. The temperature difference between the flow and return pipes, on which the water flux must be calculated, is far less than this; 20° F. may be taken as a desirable limit, 40° F. or possibly 50 ° F. should in no case be exceeded.

Where convection or "thermo-syphon" circulation is relied upon, the conditions are too indefinite to permit of ready calculation; the proportions are then usually settied by experience, founded on a rough computation. The main difficulty of accurately calculating the convection circulation is due to the fact that the outlet of the cylinder jackets is commonly at a higher level than the lower terminal of the radiator. If the arrangement were a simple one—an engine at the bottom of a circulation system, and a radiator at the top—the necessary calculations would present no difficulty.

There is one point of sufficient importance to be worthy of mention as touching the relative merits of the pump and convection circulating system. It is often found, after a stiff ascent on a car having pump circulation, that if the engine be stopped, the cooling water immediately begins to boil violently; this never happens in an engine in which the convection or thermo-syphon circulation is employed. The reason for this peculiar behavior is that the rate of heat passing through the cylinder walls into the water jacket is, under any given running condition, constant, and on the engine being stopped the rate of transfer of heat from the cylinder walls to the jacket is not immediately affected because of the heat contained in the cylinder wall itself and so, if the circulation is stopped abruptly, when the engine has been working at full load and the water is near the boiling point, there is an instant ebullition of steam within the cylinder jackets, and a quantity of water may be thereby ejected from the overflow. With convection the circulation current does not stop when the engine stops, and so the generation of steam under similar conditions does not take place.

When convection cooling is adopted the author believes that it is preferable to make no attempt to provide each cylinder jacket with separate circulation. The best results are obtained by connecting the jackets one to the other by apertures as large as found possible, so as to virtually convert the whole of the water jackets into a single tank, and by arranging this tank itself to constitute the return pipe.

Type of Radiator

The history of the radiator shows that a great many types and modifications of detail have at one time and another been tried, and in some cases widely developed.

The questions concerned in developing the best type are numerous and varied. Thus at one time flat tubes had a considerable vogue, and many of our leading firms were fitting radiators in which parallel flat vertical tubes were arranged to connect the foot tank to the "header." Now from many points of view these radiators were excellent, but they possessed one serious disadvantage; in the event of steam being raised and pressure generated in the radiator (an event which may accidentally occur from many causes) the flat tubes, bellows-like, immediately expanded, the air space between them became restricted and the steam generation became more pronounced; finally, the walls of the tubes became pressed one against the other until the whole radiator was practically a solid block and the air passages had ceased to exist.

There is a curious difficulty of an entirely different kind which is sometimes experienced with radiators having round tubes. When in such a radiator the pump delivery is brisk the turbulence produced in the header may be so great as to cause numberless eddies and to result in intereference in the flow of water down through the tubes; the eddies give rise (after the manner of the waste pipe of a bath tub) to vortices forming over the tops of the tubes which draw down columns of air. The effect of this is nearly as bad as if the water were to boil, for not only does the air so sucked down displace a quantity of water which is lost through the overflow, but the said air within the cylinder jacket and surrounded by water at near the boiling point is swollen to many times its natural volume by the high temperature and by the water vapor taken up, and when in due course it comes through into the header the result is hardly to be distinguished from actual boiling. It has come to the author's knowledge that such cases have been cured by providing for a *reduction* of the pump discharge.

(To be continued)

The Sizes of Motors for Trucks and Outline of British Practice in this Field

By W. D. Williamson

Part 2—Outline of British Truck Motor Design

(*Continued from page* 504, *issue of March* 16)

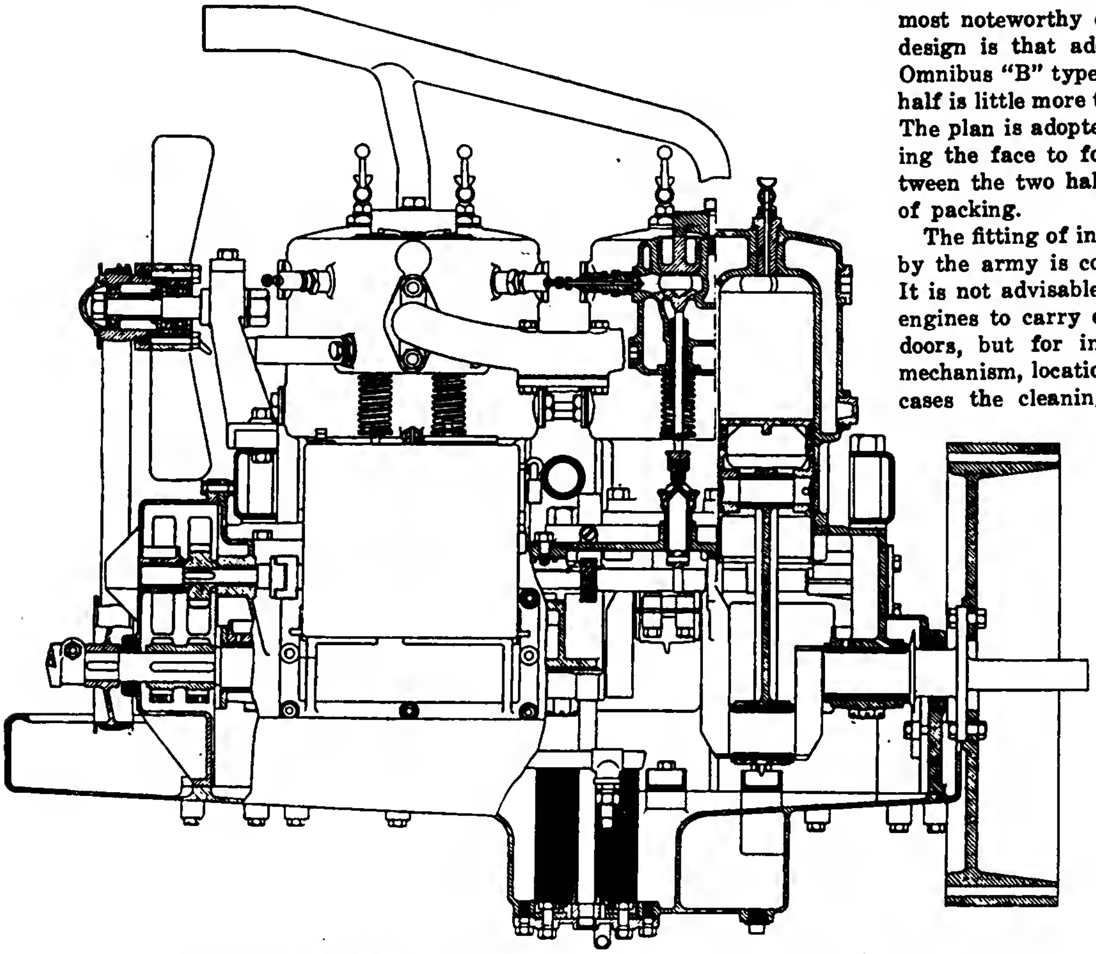


Fig. 13—London General Omnibus "B" type, with very shallow crankcase

CYLINDER DESIGN—Cylinders cast in pairs are the rule.

Austin cylinders are separate castings, however, and the Albion (Fig. 8) is a monoblock.

Ample water jackets with carefully considered arrangement round the valve pockets and stems are found in most modern engines. The plan adopted in the Napier and Pagefield engines of having the cylinders cast with large openings in the jacket at top and sides simplifies molding and insures the jacket cores being thoroughly cleared. With the ordinary small core plugs it is often almost impossible to clear the jackets about the valve pockets.

Crank Cases

Crankcases differ very little in design from those in pleasure cars, although more robust. The usual practice is to split the case horizontally on the center of the crankshaft, carrying the bearings in the upper half, and to use the lower half principally as an oil retainer and dust excluder. External ribs on the lower half, although they may be of distinct advantage for oil cooling, are not general. Perhaps the most noteworthy departure from the usual design is that adopted in London General Omnibus "B" type engines, where the lower half is little more than an oil tray (Fig. 13). The plan is adopted in this engine of scraping the face to form an oil-tight joint between the two halves without the necessity of packing.

The fitting of inspection doors as required by the army is coming into general favor. It is not advisable or even possible in most engines to carry out repairs through these doors, but for inspection of the internal mechanism, location of trouble, and in some cases the cleaning or removal of the oil filter, they are very useful. Any tendency they may have to weaken the case is usually overcome without special provision by the extra metal required for the facing and to carry the studs.

Oil Indicators

There appears to be room for a reliable oil indicator for the dashboard, of somewhat stronger construction than the usual patterns, for use on commercial vehicles.

Engine Suspension

Experiments the author has made show that for any distortion that might occur under normal conditions the ordinary underframe method of construction is quite sound. It appears to be more satisfactory than extending the crankcase arms to the main frame.

In one experiment made with a 4-ton chassis having the engine on a sub-frame, the engine was started and throttled down so that it just continued to run. The near side front wheel was then gradually raised. When the wheel was 12 in. clear of the ground, no difference was discernible in the running of the engine. From 12 in. to 15 in. the twisting of the frame did have an effect, and at the latter height the engine showed signs of stopping. The engine was switched off, and when tested at the starting handle was found to be stiff with the clutch either in or out. The chassis was gradually allowed to fall back again, and at 12 in. the whole of the stiffness had disappeared.

Standing at the back of the chassis, the shape and twist taken by the near side long member of the frame made it appear that three point suspension is more important for the gear box than for the engine. The front of the chassis was

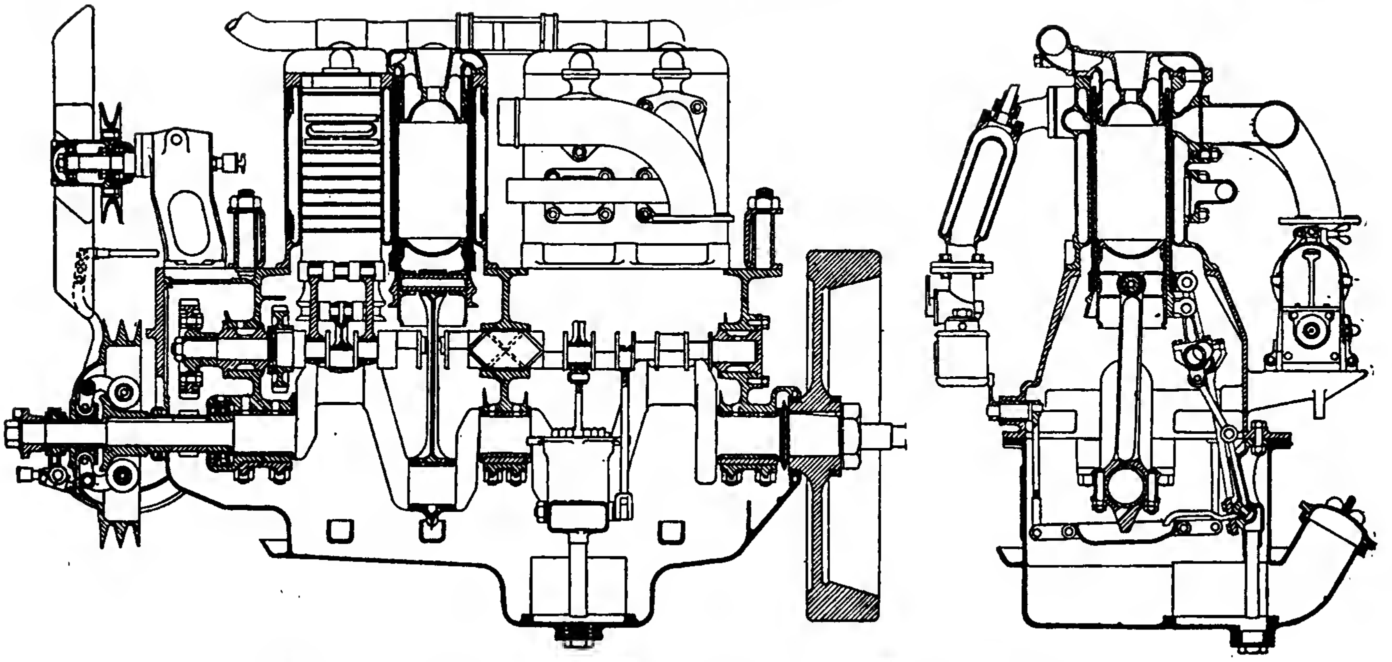


Fig. 14—The 110 x 150 Daimler sleeve-valve motor for commercial vehicle service

tilted on to the off side front wheel, and no doubt helped by the fact that the front spring acted in some measure to restrain the bending of the side member in front, very little distortion was apparent in front of the dashboard. The greatest change of shape was encountered between the dashboard and the front bracket of the rear spring, where the frame was both bent and twisted.

Cooling; Radiator Design

The problem of cooling a commercial vehicle engine, which appeared to present considerable difficulty only a few years ago, has now been satisfactorily solved. Ample water jackets and pipes of larger bore have helped to overcome the original troubles. Lorries now work under the most severe conditions without showing signs of boiling. Practically all cooling systems embody a circulating pump, and this pump is invariably of the centrifugal type. Cooling fans are of robust design, and in most cases mounted on standard type ball bearings. A fan with arms and boss cast in aluminum in one piece, secured to a malleable iron center to serve as the fan pulley, appears to be the most satisfactory type.

The fan driving belts are often much too light for the work they have to perform. They have to transmit quite an appreciable power, and in addition are subject to shocks when the engine speed is altered quickly. The positive drive for the fan in the Hallford is specially worthy of attention.

Turning to the radiator, the type in most general use is the tubular, formed of vertical water tubes soldered to tube plates, and having top and bottom boxes of cast aluminum. Opinion seems to be divided as to whether the tubes should

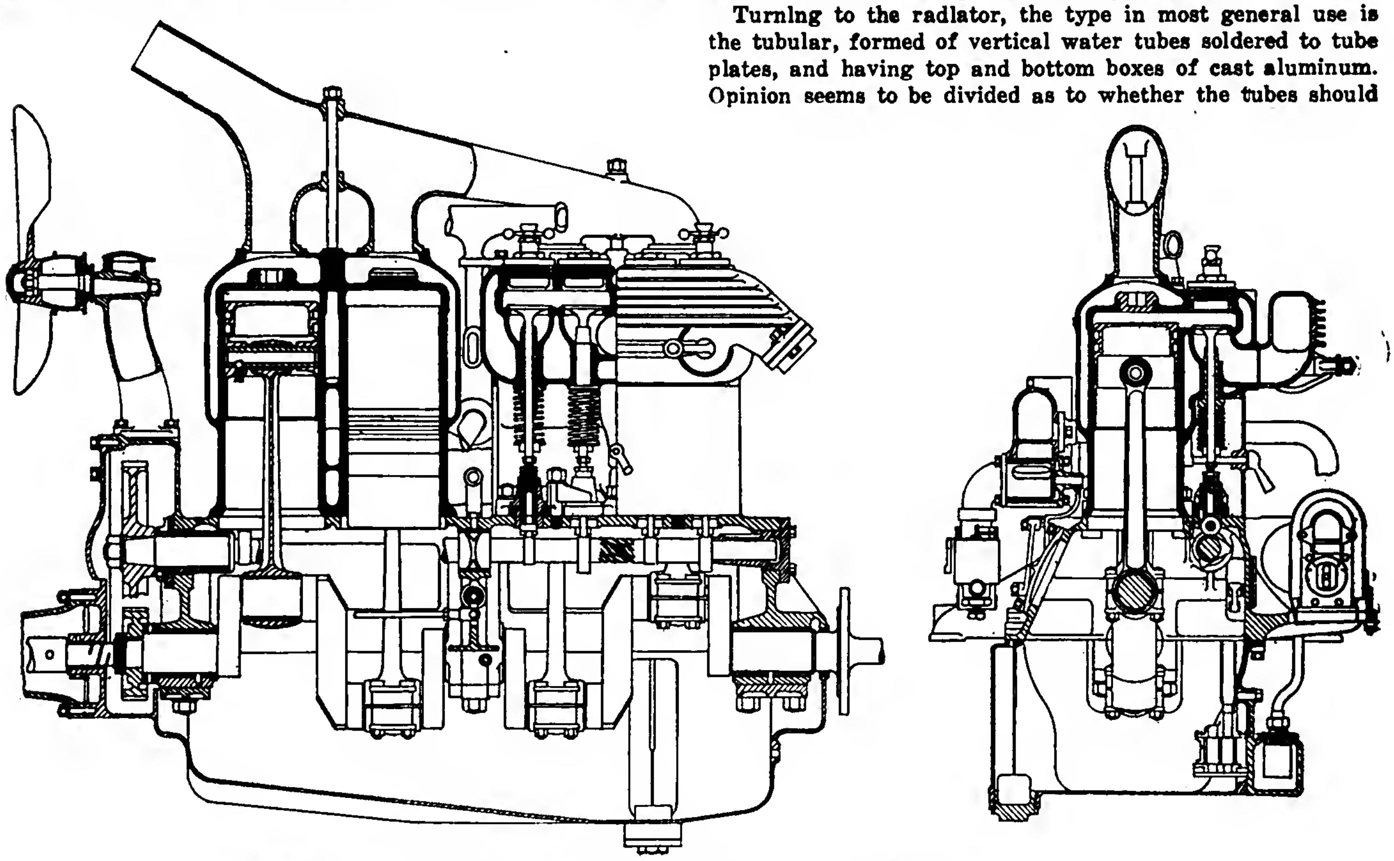


Fig. 18—Sections of Dorman engine, army truck type. Hollow fan bracket used as oil-filler duct

or should not have gills, although the general practice favors gills. The usual tube is of 26 gage brass or copper, 5/16 in. external diameter with gills 15/16 in. diameter or 15/16 in. square, soldered in position at about ⅛ in. pitch. Experiments carried out by a large maker of radiators showed the most useful ratio of gill diameter to tube diameter to be three to one. In these experiments where ½-in. tube was used with 15/16-in. gills for appearance instead of 1½ in., the efficiency fell approximately 10 per cent.

Where plain copper tubes are used they are usually ⅜ in. external diameter by 28 or 30 gage.

Further experiments went to show that the relative efficiency of gilled to plain tubes is about three to one. In other words, three times as many tubes are required in a tube stack having plain tubes as in a stack having gilled tubes. [The many details needed to make the results of these experiments fully convincing—dimensions of air channels, for example, being an important factor—are not given by Mr. Williamson.] Trouble with tubular radiators usually occurs where the tubes join the tube plates, and the reduction of the number of joints, and consequently of the possibility of leaks, is a strong recommendation for the gilled tube type. The gills, in addition, help to stiffen the tubes and afford some measure of protection against damage by impact.

When makers of vehicles commenced to deal with the trouble of insufficient cooling, the tendency at first was to err on the other side. In some cases very large radiators were fitted, having more cooling surface than is now found necessary. Current practice is very well represented by the following formula for a four-cylinder:

Bore in in. × stroke in in. × 8 = feet of 5/16 in. tube with 15/16 in. gills.

This formula does not take into account variations in cylinder design, disposition of valves, and other factors, but it has the advantage that it is easy to handle and gives a result which can be relied upon for satisfactory cooling.

There are engines in commercial vehicles with cooling surface considerably less than that given by the formula. In one case the cooling surface was carefully cut down, starting from bore × stroke × 7, and at bore × stroke × 6.2 the limit appeared to be reached beyond which it was unsafe to go.

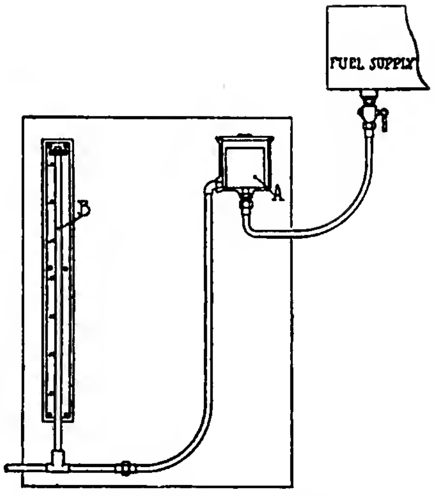


Fig. 17—Dorman Fuel Consumption Gage

A Fuel Gage

The apparatus used in making the consumption tests of Dorman engines while not entirely new is of sufficient interest to merit a description.

The apparatus, Fig. 17, consists of a float chamber "A" arranged so that at rest there is a constant level of gasoline in an open-ended glass tube "B." When gasoline is drawn away to the carbureter, the velocity of the flow past the lower end of the pipe "B" causes the level in this pipe to fall. This fall is constant for any given velocity in the horizontal pipe, but varies with this velocity. Consequently, on a suitably calibrated scale, it is possible to read off the flow of gasoline in any units.

The scale is graduated to show pints per hour, so that the consumption can be obtained instantly.

The advantage of thus being able to ascertain the effect of even the most minute alteration to the carbureter setting will be readily understood.

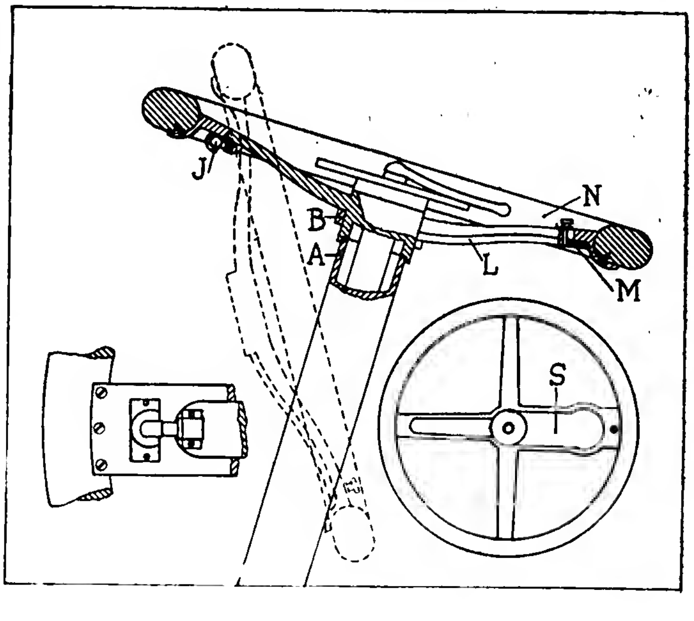
A New Steering Wheel

In view of the widespread interest in room in the driver's seat an invention recently brought out by a California man, is noteworthy. This is a pivoted steering wheel which has for its object the provision of more room for entrance into the driver's compartment, thus allowing him to use the left door, which on many cars is of little value. Another object of the invention is to provide a steering wheel having a universal joint connection with the steering shaft, whereby the wheel may be turned on the universal pivot and moved out of the way of the driver irrespective of the position of the front wheels of the car. The patent was issued to William A. Fraser of Los Angeles, under date of Feb. 22, 1916. Its serial number is 1,172,696.

Referring to the illustration, a vertical section through the steering wheel is given which clearly illustrates the method of operation. The wheel shown is of conventional design mounted on a hollow shaft through which the throttle and spark adjustments are made. On the top of the steering tube proper *A* there is a collar *B* to which the wheel is attached when it is in the running position. The wheel is provided with a slot *S*, so that when it is swung down about the ball and socket joint *J* the column does not interfere with the movement of the wheel, as it is cleared by means of this slot.

There is a spring member *M*, which is mounted in the recess which holds the wheel in its position when the driver is operating the steering mechanism. The dotted position of the wheel in the drawing shows the space occupied when the driver desires to enter or leave the seat. When it is desired to leave the seat the steering wheel is simply pushed out of the way against the tension of the spring member, thereby operating the latch part *L*.

When it is desired to tilt the wheel laterally, in the event of the front wheels being turned in one direction or the other, the steering wheel may be tilted one-quarter turn.



Timken Adds New Forge Shop

New Building to Contain All Drop Hammers Includes Large Tool Room

THE latest addition to the ever-growing plant of the Timken Detroit Axle Co. is a new forge shop. Profiting by its experience in the forging of weighty pieces on a large quantity basis, the Timken Company laid out its new buildings, which are located across the street from its main works, so as to take advantage of all the light and to bring about utmost efficiency in the making of this highly specialized class of parts. In fact, the new forge differs in many respects from most of the plants of this type.

The feature that is first to attract attention is the unusual height of the hammer room. This is not only with the idea of giving much light and air, but also to make possible the installation of a craneway above the tall hammers. The forge building and the die shop are really one long structure, although the die part is somewhat lower than the forge proper. The buildings have a total length of 650 ft., with the forge part 380 ft. long by 70 ft. wide and the die making room 40 ft. wide. The total interior height of the forge shop is 54 ft., this giving an idea of the room that was provided for the crane.

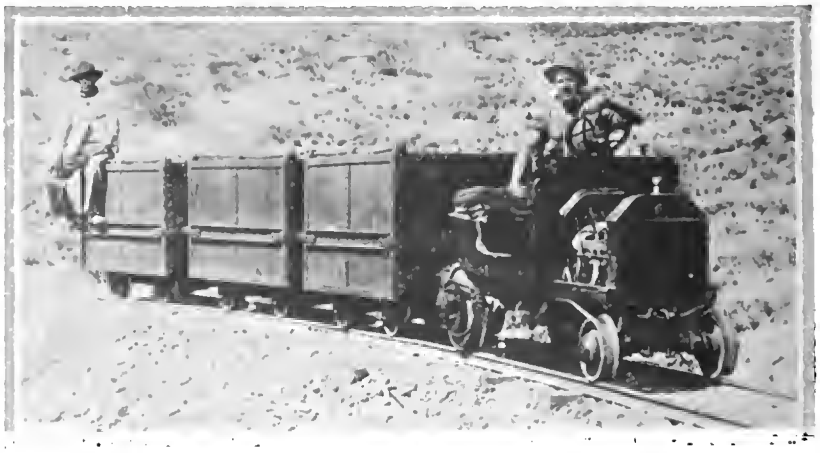
In the forge shop, the hammer equipment consists of thirty-one steam drop hammers of capacities ranging from 1500 lb. to 7000 lb. These are arranged along the outer wall near the windows that extend all the way up and comprise practically the entire wall, and hence the hammer men get a maximum of light and air. Considerable foresight was displayed in the placing of the furnaces for heating the parts to be forged, and in the location of the trimming presses with respect to the hammers. These trimmers have been put at about the positions the furnaces usually are placed, and the latter are arranged at the side of the hammers. When the air blows in from outside, it therefore does not first pass the furnaces before reaching the men, and hence there is no chance for it to become heated. The trimmers do not interfere with the free circulation of cool air. Motion study also had something to do with this placing of the hammer auxiliaries, for it was found that less time was lost in having the men swing around with the heavy forged pieces that had to be trimmed than would be consumed if they had to carry them to one side of the press. Placing the hammers and furnaces in the same line also made it possible to use a monorail satisfactorily in the manipulation of the very heavy pieces that must often be forged. This monorail carries a hoisting apparatus that is worked by hand.

The overhead crane has a capacity of about 40 tons, and it is of immense assistance in the placing of large dies in the hammers and for carrying hammer parts or other heavy machinery as well. When a piston or piston rod must be removed from a hammer, the crane again plays a useful part, for it cannot only pull these out of the hammer cylinder, but can transport them to the point where they are to be repaired. It is surprising that overhead cranes of this kind are not found more frequently in forge shops. Of course, the building must be laid out to accommodate such a device, but the service is of inestimable value.

In the construction of the new plant, ample provision was made for the proper foundations for the immense hammers, and the result is a plant that is strikingly free from jarring and shaking usually attendant upon huge hammers where foundations are none too solid. The concrete foundation running the length of the forge room and under the hammers is 5 ft. thick, while a special setting is given the hammers on 12 by 12 oak timbers that are set endwise and are 5 ft. long. These are bolted together and give a base for the big machines that allows a certain amount of cushioning with utmost rigidity.

Running the length of the center of the forge shop and in a tunnel measuring 8 ft. deep and 8 ft. wide are all of the pipes carrying the steam to the hammers and the exhaust away from them, the oil supply lines that feed the oil-burning furnaces, and the compressed air that goes to the machines. The hammers are oiled from a central supply tank of 75 gal., it being fed in pipes to each machine under steam pressure. Six 200-hp. Wickes boilers supply the power for the hammers. The coal for these is stored in overhead bins, and is fed to the boilers by an ingenious system of cars that operate on a runway and can be brought into position to send the coal into the hopper of any of the boilers as required.

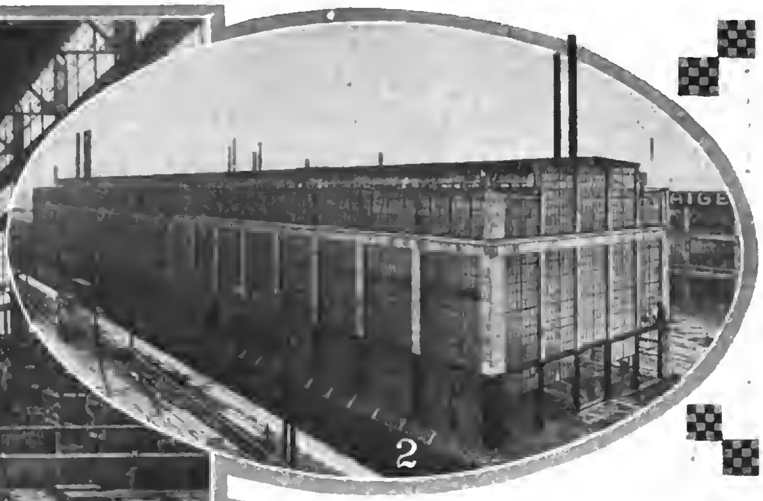
In the handling of stock that is going to the hammers and in the conveying of the finished forgings to the manufacturing departments, an interesting system is employed. The steel stock yard is located at the side of the plant, and a 5-ton crane brings whatever materials are required to a side entrance to the forge building where it is deposited upon an electric truck that conveys it to the hammers. A powerful shear is also conveniently placed in this stock yard for the cutting of the stock to the right length before it is transported to the hammers within. Finished forgings are placed in steel containers that are kept near the hammers, and when one of these has been filled, the overhead crane picks it up and deposits it on one of the electric storage battery trucks. It is then conveyed down an incline in the front side of the building and through a tunnel under the street that leads to the manufacturing departments opposite. Thus there is little or no delay in handling the forgings.



THE Presidio Mining Company has had in successful operation for more than a year a Ford automobile for hauling ore from its silver mine at Shafter, Texas, to the reduction mill. The car is equipped with low, steel flange wheels and runs upon a regular tram track. It is stated by E. M. Gleim, superintendent of the company, that it has proved to be one of the most inexpensive methods of ore transportation that could have been devised. The cost of operating the car, including upkeep, is nominal. It hauls on each out-going trip from the mine three two-ton side-dump cars, or a total load of about 16,500 pounds, without difficulty. The trock is of about 3 per cent grade.

Drop Forge Plant for Timken Axles


1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THE object of drop forging is to eliminate machining on the final products. A front axle, a connecting-rod or a large bevel gear blank would cause much waste of material, time and labor if cut from the solid bar. Thus it is economical to spend lavishly upon the plant for making and using drop forge dies. The first few hundred pieces struck by the die pay for the apparently high initial cost. The Timken Co. have one of the finest forge equipments and a large proportion of their front and rear axle parts come from the hammers almost in their finished state.


3


4

1. *Interior View of drop forge.* 2. *Exterior view of drop forge plant looking from roof of main Timken Detroit plant on Clark Street.* 3. *Interior of die shop.* 4. *Another view of die shop showing battery of planers.*

Delage Cars Make Strong Team

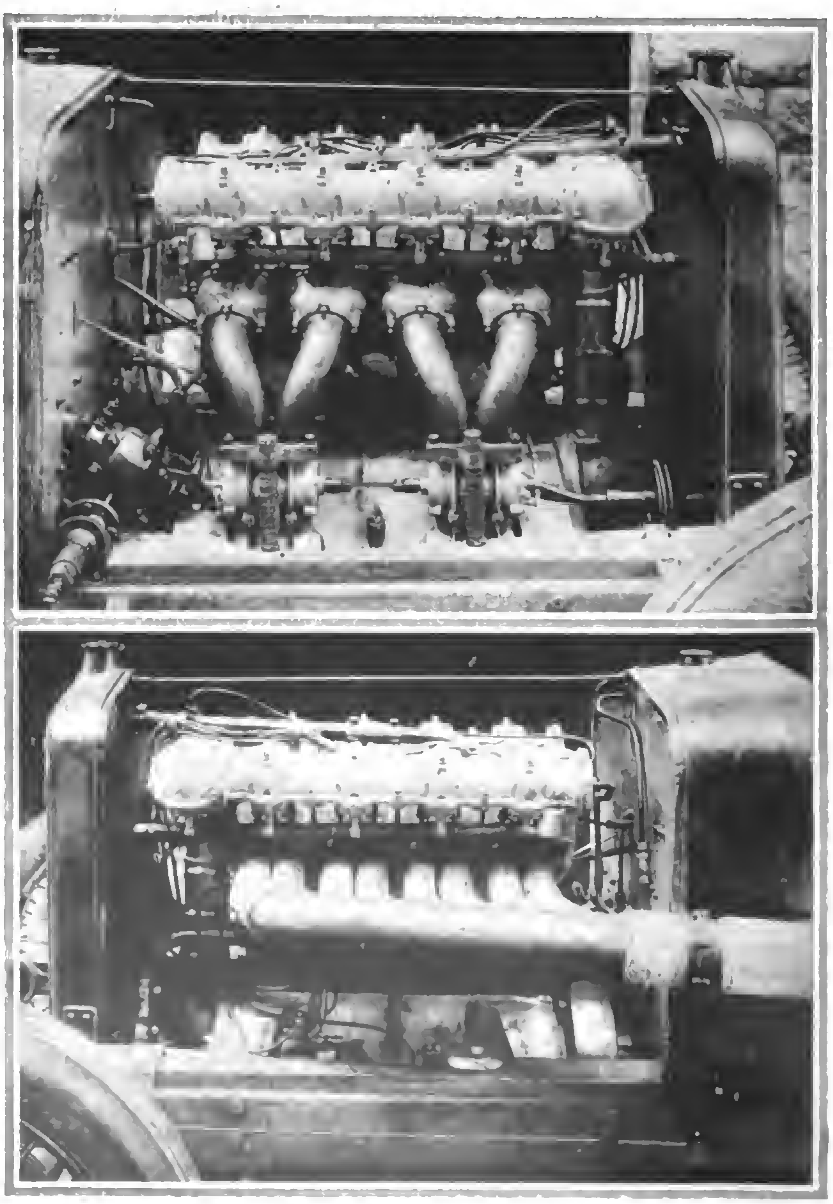
Harry Harkness Has Newest European Racing Cars — Have Run Only One Race—Should Be in Perfect Condition For the Speedways

As announced in THE AUTOMOBILE last week, the three Delage cars which took part in the last French grand prix are now in New York, and will make their appearance on the speedways very shortly. These cars have been imported by Harry Harkness, and will be managed by Carl Limberg, who will drive one of them. Drivers for the other two are not yet picked.

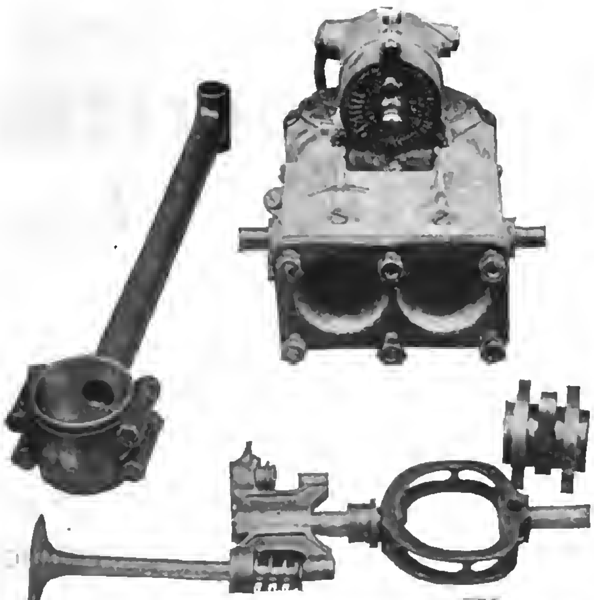
At the time of their first appearance, these cars were wrapped in much mystery, their details being kept very secret. Gradually it leaked out that their especial novelty was a set of sixteen poppet valves, each of which was both shut as well as opened by a cam, the spring forming only a cushion. Exactly how this was done has never been allowed to escape, though some diagrams were obtained showing the principle. One of these was published by THE AUTOMOBILE on July 9, 1914, and the photograph of the actual parts on the page opposite shows that the actual pieces are very much like the diagram. There are three cams to each pair of valves, the midmost lifts the valve by pushing down a stirrup that surrounds the cam, and the two outside cams bear upon the side pieces of the stirrup and pull the valves shut, acting through two springs.

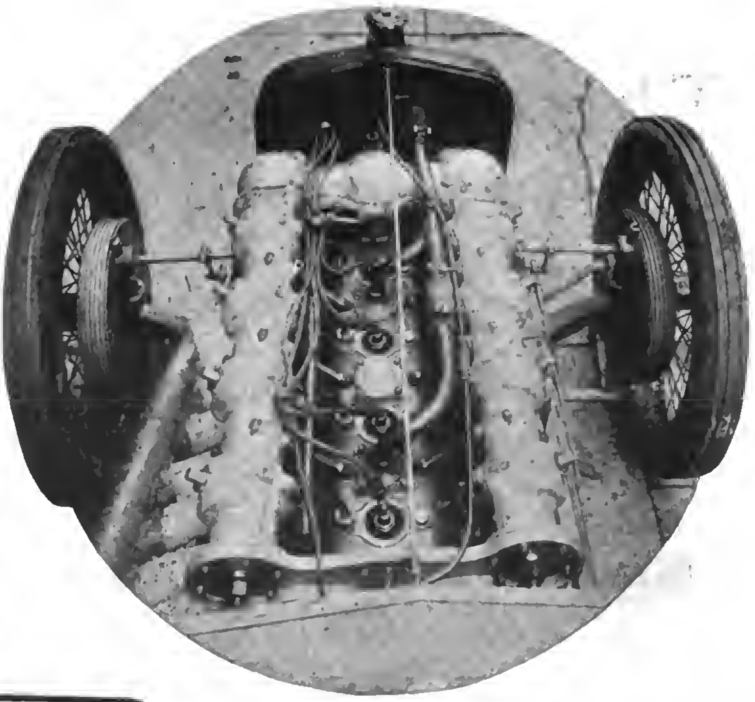
In the practice spins before the race Bablot, who had one of the trio, astonished the fans by making a lap in minutes less than most of the others, and from that time onward the Delage team was reckoned to be about the fastest in the field. On the race day, however, some petty maladjustment of the carbureters made at the last moment upset all calculations, and the Delages did little to justify the high hopes of their backers.

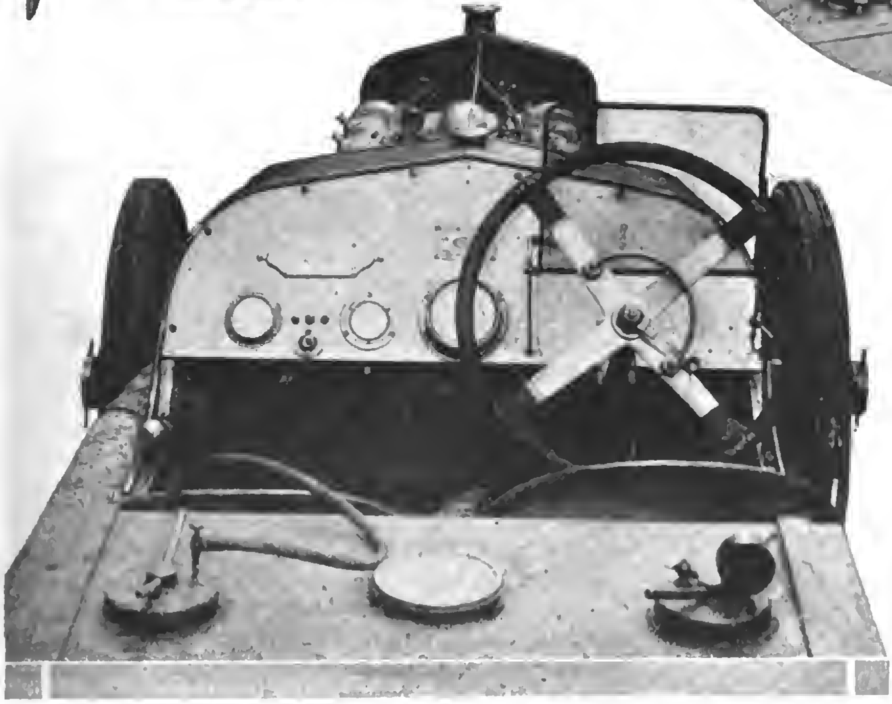
Still everyone recognized that it was an accident, and that it was no fundamental fault that had caused the trouble. Since July 4, 1914, the speed machines have been resting under a coat of oil. They are essenially as good as the day they left the factory; they are more nearly new than any European car in America to-day.



Alternate sides of the Delage engine giving a good idea of the valve mechanism







Above—Details of the valve gear, the cylinders and the hollow connecting rod. Below—The driver's view of the car. The long plate above the gages on the left is a lap recorder to be worked by the mechanic

Thus it is reasonable to expect great things of the team.

The photographs herewith show more detail of the cars than has so far been published. It will be seen that the two camshafts are driven by a single vertical shaft with a nest of bevel gears at the upper end, the spark plugs being in the center of the cylinder heads. A small peculiarity is that the cylinders are bolted on from beneath the studs fitting in the cast iron foot with the nuts inside the aluminum crankcase. The valve mechanism shown just beneath the cylinder has the stirrup turned at right angles to its proper position so as to show the whole part in one photograph. There are two Claudel carbureters on each engine, operating simultaneously with throttles interconnected.

Because of the very hilly nature of the last grand prix circuit in France five speeds are provided with direct on third, and the nature of the road also dictated the use of the large front wheel brakes. In addition to these there are a pair of brakes on the rear wheels and a transmission brake as well.

The engines are well within the 300 cu. in. limitation being 94 by 160 mm. or 3.7 by 6.3 in. This gives a piston displacement of almost exactly 270 cu. in. The wheelbase is 106 in., and the tires 34 in diameter on Rudge Whitworth wheels.

At present the bodies are little more than seats, as the many curves of the French course made the value of streamline tails quite doubtful. Just back of the seats there is an immense tank for gasoline and oil, the latter being fed by hand pump when desired, and circulated in the engine by a centrifugal system. It is planned to inclose this tank, and to provide each car with a body more suited for speedway racing.

Being more nearly new, the Delage team ought to prove much more formidable than did the Peugeot team last year, as in the latter the only really new car was Resta's, the others being already well worn. It is unquestionable that the presence of this new trio will make a substantial difference to the keenness of competition on the speedways this coming racing season on the speedways.

From an engineering viewpoint it will be very interesting to see how the latest Delage engines stand up to the strenuous requirements of speedway competition. Originally these cars were designed for road racing on a course where gears were shifted almost every quarter of a mile for a third of the circuit, but there was one very long straight, over eight miles, where speeds of 110 miles and over could be attained. There was a long hill, where the engines could revolve at their maximum speed on the lower gears, but there was a descent giving quite a respectable rest to the motors at the end of the long straight.

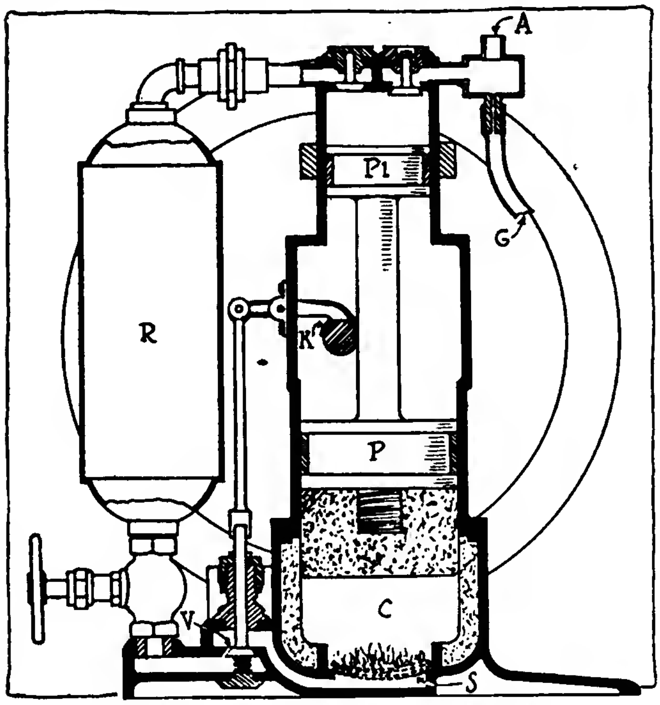
On the speedway where there is no rest period the conditions are more difficult for engine durability, but since the Peugeot engines proved equal to the stress, there is every reason to expect a corresponding performance from the Delage cars, and these machines were undoubtedly faster than the 1914 Peugeots when opened out to the full. They are almost sure to win something.

The History of the American Automobile Industry—22

Transition Period Between Old and Modern Development—Brayton Engine Taken by Selden as Basic Was Last Stage Before Otto Type Which is Used Universally Today

By David Beecroft

THIS week we reach what might be termed the transition point between the past and the present so far as the history of the development of the gasoline or explosion engine, as we know it to-day, is used. This installment brings us to the engine patented and built by George B. Brayton of Boston, Mass. The patent was taken out April 2, 1872, and the engine known as the Brayton was the popular and accepted type from that date until 1880 or later. Brayton had been working on his engine for over 20 years; in fact, from a few years after Stuart Perry issued his patents.



BRAYTON'S TWO-CYCLE ENGINE 1872

This engine with a single vertical cylinder used a compound piston, the lower portion P known as the working piston, and corresponding with the piston in a gasoline engine to-day and the upper portion Pl serving as an air pump to pump a mixture of air and an explosive gas into the larger reservoir R where it was stored under 60 pounds pressure. The reservoir was of approximately double the capacity of the cylinder. From this reservoir gas was admitted into the combustion chamber C through a poppet valve V. This valve was opened by the cam K through the medium of a rocker arm and vertical tappet. In the bottom of the combustion chamber C was a series of five or six thicknesses of wire mesh covering the large opening in the cylinder base. The mixture of air and gas entering the cylinder under pressure had to rise through these meshes. Above the meshes was kept burning a constant flame and which ignited all of the incoming gas. The piston P was driven upwards by the expansion due to the heat from the burning of the gas rather than from any explosion. The air pump piston Pl drew a mixture of air in through the opening A and the mixture of illuminating gas or some hydrocarbon vapor through the opening G. These were drawn in at the ratio of 12 volumes of air to 1 volume of explosive gas. In the top of the cylinder were the usual valves for regulating the openings between these pipes A and G and the reservoir R. Owing to the constant fire in the bottom of the cylinder it was necessary to carry on the bottom of the piston a substance such as soap stone capable of sustaining a high degree of heat without injury. The combustion chamber was also lined with a similar material. The illustration does not show the engine as being water-jacketed but in actual use it was water-jacketed.

It was in connection with the final settlement of the famous Selden patent suit in January, 1911, that the public got its first general introduction to the Brayton engine. The judges in that decision stated that George B. Selden based his patent on the Brayton engine which naturally Selden thought would be the eventual one for all automobile uses. Later events proved otherwise, and that the Otto design, which will be described later, was the real pioneer of the present explosion engine as we know it to-day. Had Selden selected the Otto design instead of the Brayton the American automobile industry would to-day unquestionably be paying its royalties. However, Selden in selecting Brayton in preference to Otto took the wrong direction, and while his patent was declared valid by the courts in 1911 it was also decided that the present type of explosion engine used in automobiles did not infringe it, rather that our engine to-day sprang from the Otto type.

Before describing Brayton's engine we should first realize that it was not an explosion engine as we understand it to-day. It is true Brayton ignited a mixture of air and a combustible gas, the mixture being a 12-to-1 ratio, but Brayton in his patent makes it particularly plain that the expansion in his cylinder was not an explosive force on the piston, but "a true pressure due to expansion on account of the fact that the piston is at the very commencement of its stroke when the expanding gases begin to act upon it." Brayton had the idea that the pressure as obtained in steam engines was the one for explosive engines.

Further: Brayton did not employ a carbureter device such as we understand it, but rather used a storage tank in which he mixed the air and gaseous vapor. He pumped them into this storage tank and kept them under pressure. He then let this explosive mixture flow into the working cylinder under its own pressure. As soon as the mixture entered the bottom of the cylinder it was ignited by a flame which kept burning all of the time. He did not have ignition as we understand it, but simply a constant-burning flame. Brayton had a regulated intake valve much as we understand it which controlled the entrance of the explosive mixture into the cylinder. This valve was opened and closed by a combination of cam, tappet, and springs, quite similar to systems employed to-day.

Brayton had to have with his engine an air pump which kept the reservoir filled with a mixture of air and explosive vapor under a uniform pressure. This air pump was really a part of his motor so that the piston of the air pump was really a continuation and integral portion of the piston in the working cylinder.

Not Strict Explosion Engine

It will thus be seen that although Brayton's engine proved a popular one in the 70's and gave every indication in those days that it might develop into the possible engine to be used on automobiles, still it was not a strictly explosion engine, but bore a striking resemblance to steam in that the charge of air and gas was carried in a separate reservoir to be drawn upon as necessary, just the same as steam is carried under pressure in a boiler and drawn upon as needed. Brayton did, however, get away from one feature of steam, namely, he used a single-acting piston; that is, the explosive mixture was admitted at one end of the piston only as is done to-day. Steam engines are double acting; that is, the steam enters at each end of the piston, and up to Brayton's time all inventors of explosion or gas engines used the double-acting system. Brayton thus marks the first radical step in departure from the double-acting engine to the single-acting engine of this date.

Brayton's engine was constructed in a thoroughly mechanical manner, and was unquestionably the best explosion engine yet produced. It, therefore, began to win approval wherever shown and one was exhibited at the Centennial Exposition in Philadelphia in 1876, where it was utilized to pump air for the Aquarium.

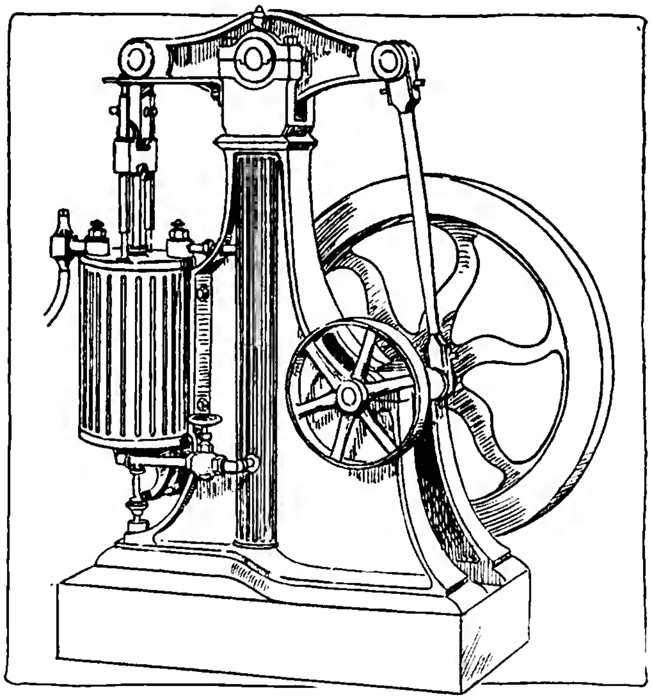
A section of the Brayton engine illustrated herewith shows its general scheme of operation, with its compound piston, the lower portion *P* forming a working piston and the upper portion *P I* being an air pump to store the mixture of air and explosive gas in the reservoir *R* under a pressure of 60 lb. The crankshaft does not appear, but how the engine was worked out can be judged from an external view of it, also shown. A very large-diameter flywheel was used. The mechanically operated intake valve *V* opened by the cam *K* through a rocker arm and tappet appears. The spring to close the valve is also shown. When this valve was opened the mixture from the reservoir *R* immediately rushed in to fill the space *C* below the piston, but on entering the piston through the large opening at the base it had to pass through five or six fine mesh screens. Above these screens was a constant ignition flame, also supplied with gas from the reservoir *R*. Thus the gas rising through the screens or mesh started burning and it was this burning coupled with the pressure of the gas that raised the piston. There was not any sudden explosion as we know to-day, but rather Brayton relied on the expansion due to the heat from combustion.

When starting the engine it was first necessary to open the throttle wheel shown below the reservoir *R*. The constant flame for ignition was next ignited. This done, the large flywheel was turned over by hand until the valve *V* opened. The inrushing gases then began burning and the pressure lifted the piston. The momentum of the flywheel was then sufficient to carry the piston down until the valve *V* was again opened. Thus the cycle of operation was continued. There was no cycle of operation, as we know it to-day, that is, induction, compression, explosion and exhaust. There were but two cycles, combustion and exhaust. When the engine had to be stopped the hand throttle wheel was turned, shutting off the supply of mixture from the reservoir *R*. The heat expanded the air to a much larger volume so that although working at a pressure no higher than the air pump pressure it, because of the larger piston area and larger volume, would not only drive the air pump piston but yield considerable power available for work besides.

Used Accurate Oil Pump

Brayton developed an oil pump that, although not of delicate construction, permitted accurate adjustment of the oil supply and to a large extent governed the engine by varying the amount of oil admitted. His great problem, of course, was to get a proper mixture and to continue the combustion from one admission of air to the next. His

(*Continued on page* 560)



External view of Brayton engine

The FORVM

ANALYZING FRONT END OF CHASSIS—SPRING ACTION AFFECTS STEERING—FUNDAMENTAL FAULTS IN CONVENTIONAL DESIGN

Faults in Front Spring Suspension

By H. H. Dyke

THE forward spring suspension of an automobile, to be mechanically correct, must serve three purposes: First, to act as a cushioning buffer between the front axle and the frame; second, to prevent side sway or lateral movement of the front axle and wheels relative to the frame and body; and third, to permit the spring or cushioning movement bebetween front axle and frame to take place without interfering with the proper action of the steering connection. A front spring suspension that does not do these things, and all of them, is mechanically defective.

The front axle suspension in substantially universal use to-day is illustrated in connection with the usual fore and aft steering link in Fig. 1. This arrangement prevails in 95 per cent or more of the maker's designs. There are several other types in use, to be sure, but this is practically standard construction.

This standard type fulfils the first and second conditions referred to above admirably, though even as to this a substantial improvement could be made at little or no additional expense. This improvement could be secured by the substitution of a pull shackle for a push shackle at the rearward end of the spring, as is already done in some makes of trucks and has been adopted just recently in at least one make of passenger car and as sketched in Fig. 2. A pull shackle naturally takes the right position, but a push shackle is always canted as far as it will go to one side or the other, and wear, once started, progresses with great rapidity. Any worn front spring bolt which has been in use with the type of suspension illustrated in Fig. 1 will be found to be worn as in Fig. 3. Such wear is due to this canting action of the push shackle.

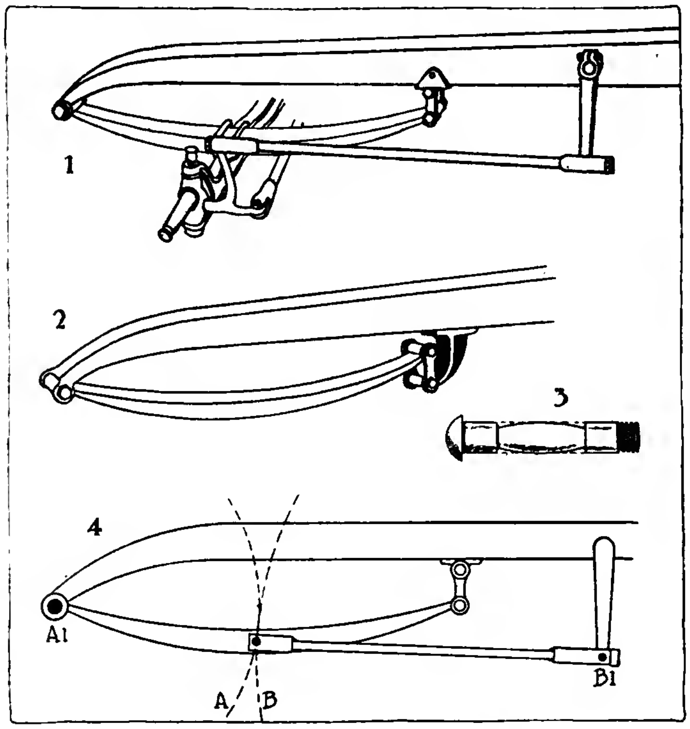
The Cause of Wobble

But where the type of either Fig. 1 or Fig. 2 fails, is in the third of the enumerated essentials for a front spring construction. Proper steering action is very seriously interfered with. With such arrangement the front wheels wobble from side to side every time they move up and down.

The steering connections enter into this matter along with the front springs and axle. The standard arrangement of steering connection from frame to axle, in all fairly good sized cars, at least, is to place the steering gear well back in the frame, with the steering link at its rear end pivoting on the steering gear arm and running forward from the steering gear arm to the steering knuckle arm on the front axle, and it may readily be assumed that this construction will remain standard, for with any alternative construction, the steering link must run crosswise or partly crosswise of the car, which is obviously undesirable.

The cause of the wobbling action of the front wheels is shown graphically in Fig. 4. It is due to pivoting the front axle by the forward ends of the springs to the extremities of the horns projecting forwardly from the frame about 18 in. *in front* of the axle and placing the steering gear on which the steering link pivots about 2½ ft. *back* of the axle, thus bringing these two pivotal centers nearly or quite 4 ft. apart. When there is any up and down spring action the front axle moves in the circle A because the spring has a fixed pivot at its front end at A′, the center of A, and the knuckle steering arm carried on the axle should naturally move in the same path A. The forward end of the steering link which is pivoted to the steering gear arm at its *rear* end would naturally move in the circle B which has B′ for a center, but the knuckle steering arm on the axle and the steering link are fastened together and must move together notwithstanding the upward and downward divergence of their separate natural paths.

How is this accomplished? The answer is rather complicated, for it is divided into a number of parts, but take the worst situation first. If we have a snug fitting, irreversible steering gear and a steering link without the customary flexible connections at its ends, the point or center B′ is fixed, and the forward end of the steering link and the end of the knuckle steering arm attached thereto must move on the curved line B notwithstanding the axle to which the latter is secured by the king bolt moves on the curved line A. Thus for any up and downward spring movement of the front wheels and axle there is also a wobbling or turning move-



Figs. 1 to 4—Analysis of front suspension ment of these wheels from side to side, just such a movement as you would get by grasping a front tire and turning the wheel back and forth pivotally on the garage floor, the car standing still meanwhile. This pivotal movement is responsible for much of the wear on the front tires. The best way to see clearly what this means is to examine the track of a car which has passed over a soft spot in the road where there is a deep hole causing excessive spring action. The front wheels make drunken tracks, which are covered only partially by the straight tracks of the rear wheels and show alternately on each side, this drunken wake gradually fading out and disappearing as the spring action decreases.

In ordinary practice, in addition to this castor or pivotal or wobbling movement of the front wheels the conflict of the circular paths A and B is distributed in several other places. The flexible socket joints in the two ends of the steering link take up some of it. The point B′ is never absolutely fixed in practice, but there is play in the worm and worm wheel of the steering gear, and this accounts for some of the movement, and, incidentally, is a prominent factor in steering gear wear; and finally, the steering wheel itself, particularly where the gear is not irreversible, turns every time there is any spring action between the front axle and the frame or body. Watch the steering wheel of any car with a bevel steering gear and you will see how the steering wheel turns every time you hit a bump with the front wheels. This has much to do with the popularity of the irreversible type of steering gear.

The present standard construction has, of course, certain advantages or it never would have attained its present almost universal use. It is simple and strong. The front axle is pulled by the spring and not pushed by it. It is generally considered to be of good appearance. At least the car-wise public has gotten used to its appearance and is satisfied on this score. The public acquiescing, car manufacturers have come to regard it as "good enough," and undoubtedly its substantially universal use is dependent on the fact that car makers are averse to trying to force something on the public which it does not want. Once the public comes to know the various evils that are inherent in this mechanically incorrect type of front spring construction, however, the wobbling of the front wheels, the extra wear on the front tires, the extra wear on the steering gear, and particularly the movement of the steering wheel itself making driving harder and more tiresome than it should be, we may begin to look for a different attitude and a demand for a construction which will do all that that now in use will do, but which will not have its many disadvantageous and unmechanical features.

Suggests Elimination of Left Door

By K. F.

J. E. SCHIPPER'S article has opened a very old subject for discussion from which we can all learn something by airing our opinions. Several comments are that the designers are overlooking the comfort of the drivers. This may be in a few cases, but I am sure if there is not some comfort in the cars the designers would have heard from the sales-manager a long time ago. Even if they have picked out a good average condition they will have had an adverse comment from some of their sales branches.

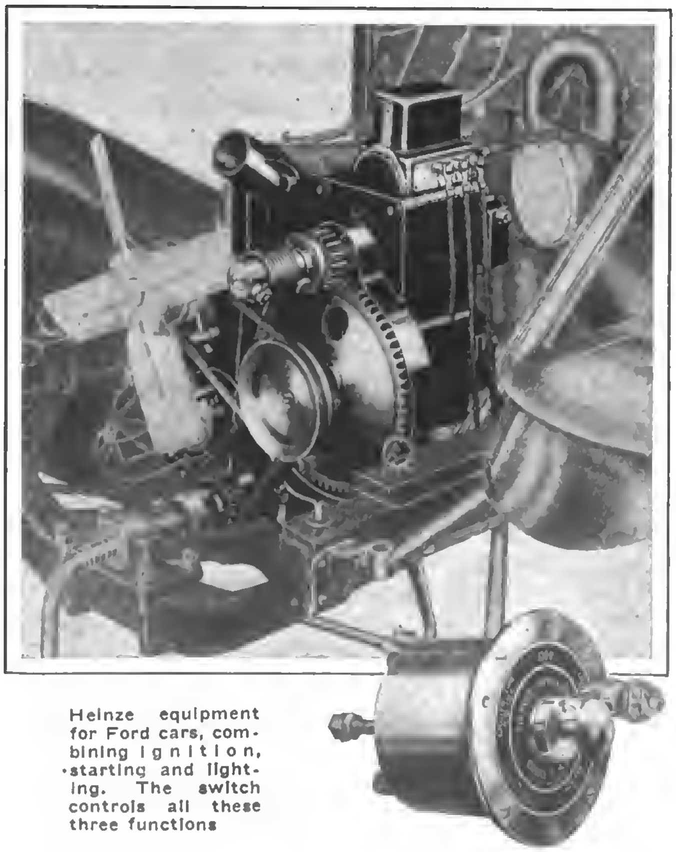
Room under the steering wheel, graduation of the cushion, hardness or softness of the trimming will be discussed as long as we turn out cars, and there will be a difference in opinion somewhere. Some cars permit of giving their customers a better range than others; some permit of adjusting these elements, but where the greatest rub comes, is in the highly developed cars that sell for a very low price and are made in large quantities. These are designed with every piece and fraction of an inch of material considered, as the hundreds of parts that go to make a car, with an excess of even a small amount on them multiplied by the thousands that are to be made of them comes to a very formidable figure. The wonders that are being accomplished with tin, imitation hair, and leather are seen everywhere in happy parties on all roads. They are testimony to the highest skill in industry.

In the modern cars the steering wheels are larger and the sides higher. The size of the wheel and seats being fixed, then unless the doors are made to open up the entire side of the seat or nearly so, we have the condition of a squeeze through for the driver if he wants to get in from the left side. On the cheap cars who not eliminate the left front door.

Heinze Installation for Fords

A TWO-UNIT electric lighting and starting system for Ford cars incorporating the Bendix automatic drive has been put on the market by the John O. Heinze Co. of Springfield, Ohio. The starting motor is a simple series-wound machine of the four-pole type designed to be compact and light. It is operated by a starting button dash switch, which completes the circuit and causes the automatic Bendix drive to mesh with the intermediate gear mounted on the generator shaft. This is connected to the crankshaft by silent chain through which the cranking drive is transmitted.

The Heinze-Springfield generator is driven by the chain through which the final starting drive is obtained. The generator is also a four-pole instrument, shunt wound and designed to deliver 6 volts. The cut-in speed is quite low, the maximum charging rate being attained at 10 m.p.h. The regulator is mounted separately in a small box on top of the starting motor. The installation is clearly illustrated on this page. A feature of interest is the dash switch which controls lighting, and ignition as well as starting.



Heinze equipment for Ford cars, combining ignition, starting and lighting. The switch controls all these three functions

The Rostrum

Timing of Sheepshead Bay Packard

Editor THE AUTOMOBILE:—How were the valves timed in the 102 m.p.h Packard used by Mr. Vincent at Sheepshead Bay?

2—What compression was used? What is formula for figuring same?

3—What is the valve timing of the special Stutz and Duesenberg motors?

4—Why do some motor manufacturers open intake valve before closing of exhaust?

New York City. J. B. W.

—The Packard used at Sheepshead Bay had its exhaust valve open 60 deg. instead of 45. The latter figure is standard on the Packard Twin Sixes. The inlet valves remained open 50 deg. late instead of 35 deg. The exhaust valve closed 40 deg. late and the inlets opened 9 deg. late, the same as standard. The valve lift was 7/16 in. instead of 5/16 and the pistons were crowned to give 90 lb. gage compression at 120 r.p.m. The standard motors carry 75 lb. compression.

2—This is answered under question 1 partly. Compression pressures are not figured by formula as a rule but tested by gage, as the theoretical compression is never equal to the true compression because the gas in the cylinder is not compressed either isothermally or adiabatically, but somewhere between the two.

3—The timing of the Stutz and Duesenberg motors was published in THE AUTOMOBILE for Feb. 3 on page 234.

4—So that the valve shall be fully open during the effective part of the suction stroke.

Manufacturers of Four-Wheel-Drive Busses

Editor THE AUTOMOBILE:—How many are there and what are the addresses of manufacturers making a four-wheel-drive truck, something large enough to put a hotel bus body on that would carry about fifteen passengers? What are the prices of same?

Plentywood, Mont. J. A. K.

Fifteen passengers, at 150 lb. each, close to the average, will weigh about 2250 lb. A bus body will weigh about 1200 lb. The total load will be 3450 lb. This load is not net, however, as you must subtract at least 500 lb. body allowance, leaving a net load of 2950 lb. This will leave a liberal baggage allowance on a 1½-ton chassis.

Four-wheel-driven trucks of 1½ and 2-ton capacity are made by the following, for the prices per chassis given:

Duplex—Duplex Power Car Co., Charlotte, Mich., $2,800.
F. W. D.—Four Wheel Drive Auto. Co., Clintonville, Wis., $3,600.
Hoadley—Hoadley Bros., Gosport, Ind., $3,000.
Robinson—Golden West Motors Co., Sacramento, Cal.
Weier-Smith—Weier-Smith Truck Co., Birmingham, Mich.
Jeffery—Thos. B. Jeffery Co., Kenosha, Wis., $2,750.

Kink for Putting Tires on Rims

Editor THE AUTOMOBILE:—After an unsuccessful attempt to put on a quick-detachable tire which would not allow the two q.d. rings to be put into place, I tied the shoe together in five or six different places, using strong brown cord for the purpose. This brought the two beads of the shoe close together and when I put the tire on the rim, the two q.d. rings were easily slipped into place without the use of a hammer. The pieces of cord were then cut and pulled out and the tire inflated. This scheme is particularly valuable when reliners are used. I make my own reliners out of the fabric of my discarded shoes, allowing a small strip of the tread rubber to remain on the finished reliners and I get over 10,000 miles of service out of my tires and no punctures or blowouts. Such reliners must, however, be carefully made and must have all edges well fastened down and new inner tubes must be used.

If strips of rubber from a discarded inner tube are placed between the leaves of springs, it will stop squeaks and will add wonderfully to the riding qualities of the car.

A very annoying rattle difficult to detect on a Ford car and which sounds like a mudguard rattle, is really caused by the brake rod striking against the rear support of the running board. This noise can be stopped by securely fastening a piece of rubber or fabric around the brake rod at the point where these two parts come together.

Brooklyn, N. Y. E. H.

Timing 1907 Fiat for Road Racing

Editor THE AUTOMOBILE:—I have a 1907 four-cylinder Fiat which I want to use for road racing. Bore is about 5⅛, stroke about 6¼. It has 36-in. wheels and is geared 2¼ to 1 on fourth gear.

1—What size and how far apart should I have holes in skirts of pistons?

2—Would it be worth while to bore holes in connecting rods? Would they stand it?

3—I can enlarge intake and exhaust valves ⅜ in. Is it worth while enlarging intakes?

4—Will you show drawing with dimensions of best cam action possible for my motor?

5—Can I enlarge intake and exhaust ports of my cylinders?

6—Are the Su-Dig spark plugs for obtaining two simultaneous sparks from a single point magneto successful?

7—Can I increase the stroke of this motor? If so, where can I get a suitable crankshaft?

8—Would it be advisable to set plates in cylinder heads to increase compression?

9—Is there any way of obtaining a vacuum in the exhaust pipe? I understand that some Mercedes racing machines had a sort of inverted megaphone attachment on the exhaust pipe that caused a suction at higher speeds.

Will you kindly offer any suggestions that may occur to you so that I may obtain a speed of 100 m.p.h. or better?

Great Neck, L. I. J. A. R.

1—Use ½-in. holes at least 1 in. apart.

2—This has been done with the result of lightening the rod ¼ lb.

3—Yes, this would help if it could be done.

4—This is a matter for experiment and one which THE AUTOMOBILE cannot handle without opportunity for making tests.

5—This is inadvisable.

6—Yes. It would probably be advisable to use a double magneto for high speed work.

7—It can be done but it is almost certainly inadvisable.

8—It is not necessary to increase the compression on this motor.

9—By arranging the exhaust to secure an injector action an injector effect can be created. The actual value of it is debatable.

There are two principal things which will help you in addition to obtaining more power. First, cut the weight wherever possible, and secondly, examine and adjust every bearing throughout the transmission and wheels so that the car rolls as lightly as possible. A good racing car can be moved with one finger on a smooth road.

Information on Stewart Vacuum Feed

Editor The Automobile:—Kindly give me the following information about the Stewart vacuum gasoline system.

1—Why is it that the vacuum tanks vary in size? I have seen some that looked about twice the size of others. As the tank is being filled as fast as the motor needs gasoline, I should think that the small size would work equally well, and have the advantage of light weight and compactness.

2—One of the advantages claimed for the Stewart system is the positive flow of gasoline on steep grades. But as the vacuum tank is placed on the inside of the dash in many cars, this being quite a distance from the carbureter, what advantage has this as regards the flow of gasoline over having the main tank in the dash?

3—Does every car have the vacuum tank so placed that it will work perfectly on the steepest grade a car can encounter?

4—What is the percentage of commercial vehicles having the Stewart system? R. B. W.

East Orange, N. J.

—Vacuum tanks vary in size because certain motors require larger capacity in the lower chamber of the vacuum tank than others do.

2—Gasoline flows from the reservoir chamber of the vacuum tank into the carbureter by gravity just as it flows from the cowl tank into the carbureter. However, it is usually possible to locate the bottom of the vacuum system higher above the carbureter than the bottom of a cowl tank. The vacuum system is particularly advantageous in that it allows the gasoline tank to be at the rear of the car.

3—As far as we have any record, no case has yet been reported of a car so equipped encountering too steep a grade.

4—Probably between 40 and 50 per cent.

Torsion Moment of Motor Shaft

Editor The Automobile:—I want to cut down the weight of a gasoline engine as much as possible. Can I replace a flywheel which is 2 ft. in diameter, the rim alone weighing 200 lb. with a flywheel which is 4 ft. in diameter, the rim alone weighing 50 lb. and get the same results? I am following the law of momentum. Is this correct?

2—If a shaft weighing 12 lb. to the foot has a transmitting capacity of so much power, would it take a shaft of same material weighing 24 lb. to the foot to transmit double power? In other words, is the size of one shaft to another as the powers are which they are to transmit?

3—Does adhesion of driving wheels become smaller or less as the speed of the automobile increases? Why? In other words, does an automobile become lighter to the ground and in what proportion?

4—Have you published anything on the subject of advantages and disadvantages of 12 and 6-volt lighting systems for automobile use in The Automobile? If so, what number of magazine?

5—Comparing engines one of 10-in. stroke, the other of 5-in. stroke and using same quantity gas, leaving other things aside, what would govern speed of engine? Is the expansion of a small volume of gas at a certain temperature the same as a large volume at same temperature?

6—What are the pressures at different points of a lever 100 lb. being applied at A? O. T.

Jersey City, N. J.

—Yes, the laws of momentum are followed.

2—The strength of shafts are not related in the way you state. The beam formula $M = \frac{S\ I}{c}$ can be applied to the shafts as it has a close analogy to the torsion formula, the letter M indicates the torsion moment in this case, S the maximum strength of the material, I, the polar moment of inertia and c the radius of the shaft. In other words the strength of a shaft varies as the polar section modulus.

3—No.

4—Only in reporting discussions of the Society of Automobile Engineers, particularly in June, 1914.

5—The law of gases and their expansion is the same regardless of volume. The valve timing would be the influential factor in regard to speed.

6—The pressure in any point on the lever you show would be equal to 100 lb. times the distance of A to the fulcrum divided by the distance of the point you wish to consider from the fulcrum.

Voltage Not Measured—Amperage Low

Editor The Automobile:—Will you kindly advise me the approximate voltage and amperage of the primary and secondary circuits in a DU 4 Bosch magneto? E. C. P.

Marysville, Ohio.

—Approximate amperage of the primary at 1000 r.p.m. 7 to 8 and the secondary about 1/10. It is impossible to give you an accurate idea of the voltage in the secondary circuit as this varies through a wide range with the speed.

Leak-Proof Rings Take Up Wear

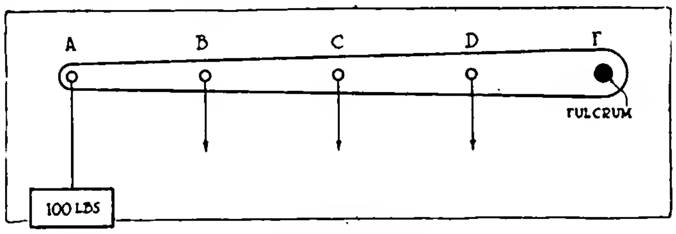
Editor The Automobile:—My engine is worn, I have leak-proof rings. Will these rings, not being fastened in groove, lap in to conform to worn shape of cylinder, or will they shift in groove and retain their perfect circular shape?

Humphreys, Mo. E. H. R.

—If your cylinders are not worn over .005 oversize or out of round the rings should conform very readily and be effective without pinning.

Shorted the Safety Spark Gap

Editor The Automobile:—I am the owner of a model A, E-M-F 30, 1911 automobile. Some mechanic at the repair shop placed a piece of copper wire under the porcelain which supports the copper terminals of the safety gap which is located on the top of the coil box, Splitdorf No. 1745 coil. Not being aware of the above act I tried several times to start the motor, but without success. After considerable trouble and expense I finally located the wire across the terminals short circuiting the safety gap, removed the wire and tried



Principle of leverage

to start motor, but found that I only received a small spark at the plugs. I am writing for information as to what effect on the windings of the coil had the placing of the copper wire across the safety?

2—Would you receive a spark at the plugs with safety short circuited as explained above?

3—What is the object of having this safety? Is it located in the primary or secondary, and how connected? J. B. K.

Kingston, N. Y.

—The shorting of the safety gap by the copper wire would cause no damage to the winding but would prevent the occurrence of the spark at the spark gap of the plug.

2—One terminal of the safety gap is connected to the inner end of the secondary winding and to the grounding terminal of the coil box. The other terminal of the gap is connected to the outer or high tension end of the secondary winding and with the high tension terminal on the box. The object of the safety gap is to protect the winding of the coil when a wire becomes disconnected from a spark plug—the spark in this case jumping at the safety gap instead of at some point inside the winding or within the coil box.

3—Feebleness of spark may be the result of a number of causes. The wiring should be carefully looked over and checked as to its correctness. Loose contacts should be tightened and the contacts within the dash switch should be examined and tested for good contact. Examine the breaker points on the magneto and observe if they open about .025 in. when the engine is cranked. Be sure there is no ground on either leg of the battery. If the cause of the feeble spark is not eliminated by these procedures, the coil with magneto should be examined by a Splitdorf service station.

Putting Vacuum Tank on Fiat

Editor THE AUTOMOBILE:—Kindly advise me how to fit a Stewart vacuum gasoline system on a 15-20 hp. 1911 Italian Fiat, on which the intake manifold is inside the cylinder casting. Also let me know how I may change the oil plate clutch on this car to a dry-plate one, and if this is impossible, please send me names of manufacturers from whom I can purchase a dry-plate clutch for this car.

Menlo Park, Cal. C. H. M.

—Fitting a vacuum system to a Fiat would be rather troublesome, as it would necessitate drilling a hole in the carbureter chamber in the cylinder casting, and this would have to be done in precisely the right spot. It is the kind of job which would be a risky undertaking except if performed by the manufacturers of the engine. You could not get a dry-plate clutch which would fit this car, but you ought not to have trouble with the original clutch, if you use the proper oil and not too much. If you will specify the trouble you are having with the clutch, what oil you use and how much of it, it might be possible for us to help you to obtain the best results from the lubricated clutch.

Fine Spray for Heavy Fuel

Editor, THE AUTOMOBILE:—The use of a hot air intake on a carbureter is a very good idea and so is the use of a hot water jacket around the carbureter. Now why not go still further and make the necessary connections, so that part of the exhaust gases will pass through this same hot water jacket instead of the hot water? This would make the carbureter very much hotter and it would be possible to use very inferior gasoline or even kerosene; or, if this is not practical, how about making a large jacket around the manifold and connecting up this jacket with the exhaust? Has this idea ever been tried out?

In using a mixture of kerosene and gasoline with ordinary carbureter, the engine smokes and carbonizes very badly especially when cold. Would the above idea eliminate this trouble and make it possible to use such a mixture with the idea of reducing the cost of fuel?

Brooklyn, N. Y. E. H.

—Many carbureters have the design to use an exhaust jacket instead of hot water. The principal advantage of the water is that the temperature is more even and there is a slight drawback in the use of exhaust gas, this being that it is liable to throw down sooty deposits so that it is necessary to clean everything out at regular intervals. The chief essentials in using the mixture of kerosene and gasoline are to have a carbureter giving a very fine atomizing spray and to have the intake manifold very warm, it being more important that this should be hot and that the carbureter itself should be so.

Starting Two-Cycle Engine

Editor THE AUTOMOBILE:—I own an American Simplex two-cycle automobile, and although the car is in perfect mechanical condition, I am unable to obtain any service from it because I find it almost impossible to start the motor. In the first place, the compression of this motor is so great that any person of ordinary strength is unable to crank the motor except very slowly. I have overcome this difficulty of fitting the car with a crank giving about twice the leverage obtainable with an ordinary crank. Can you suggest any way to diminish the compression when starting? I have tried cranking with the priming cocks partly open, and even if an explosion is obtained, all the energy escapes through the cocks.

The ignition system comprises a battery and coil, and high tension magneto, and both systems are in perfect condition, and correctly timed. After finally starting, which generally can be accomplished only by towing, the car runs very nicely, developing extraordinary power, showing the carbureter is in proper adjustment. Have you any suggestion to offer that you think will facilitate starting a two-cycle motor? Are all two-cycle motors difficult to start, and if so, what is the reason? After starting, this motor will not run idle without missing, although under load, as I stated above, the motor runs perfectly. Is this a fault common to two-cycle motors?

When shifting from low to second, frequently the gear lever will not slip in unless the clutch is allowed to slightly engage; then the gear slips in and the car proceeds in second gear. Should not the gear slip in with the clutch entirely disengaged, or is this a common occurrence on other cars? I do not have this trouble when shifting from second to high.

I would greatly appreciate any suggestion you have to make, because it seems a pity to scrap this car. If you desire, omit the name of my car when printing this inquiry.

Baltimore, Md. D. M.

—Your difficulty in starting is probably that you cannot get speed enough to compress the charge in the crankcase and get it to transfer into the cylinders without so much condensation occurring that the charge is weakened. It would probably help you if you could arrange to relieve the compression, which could be done by putting a valve in the cylinder about midway of the stroke. Rather careful work would be necessary in fitting the valve, which should be at about midstroke. The object is to have a small valve which is held open by a spring, allowing the first half of the charge to be driven out of the cylinder, so that only the last half is compressed and fired. The valve will close automatically on the firing stroke, but when the engine is started the nut on the top of the stem should be turned so as to bring it down tight on its side.

The difficulty with the clutch may be due to the fact that the clutch stops completely. If it comes entirely to rest the gears on the driving shaft in the transmission will be stationary and it will then be difficult to engage that with the other gears on the shaft which is being driven from the back wheels by the motion of the car. If you have a clutch brake it may be that this is adjusted to be too strong.

ACCESSORIES

H. & N. Carbureter

A FEATURE of this carbureter, which is of the central draft type, is a dashpot balanced annular floating air valve *D*, and integral fuel metering pin *M*, which measures with precision the quantity of gasoline and air required for maximum motor efficiency under all conditions of speed and load. All incoming air travels in a single column, the aim being to produce a perfectly homogeneous mixture, eliminating stratification and loading.

The working vacuum in the chamber *C*, which equalizes the vacuum above and below the dashpot, can be regulated by moving the ball *B* in and out by turning the adjustment screw *S*. Moving the ball in reduces the vacuum in the chamber, allowing the air valve *D* to move up and down more easily and weakening the mixture. Reversing the adjustment, of course, produces the opposite effect. When the correct adjustment has been determined it is fixed by tightening the lock nut *L*.

High Air Velocity

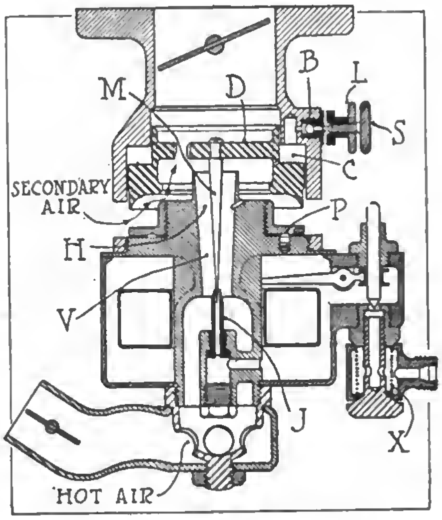
The gasoline jet adjustment is made by turning the threaded ring which forms the base upon which the dashpot rests, raising or lowering the dashpot and with it the metering pin *M*, which varies the jet opening. The ring may be easily turned through a slot. A spring plunger *P* holds the ring in position.

Starting with a cold motor and the present low grade of fuel is facilitated by the extremely high air velocity through the venturi *V*, which has been designed to be scientifically correct. Acceleration is very rapid because of the momentary retarding effect of the variable dashpot on the secondary air intake.

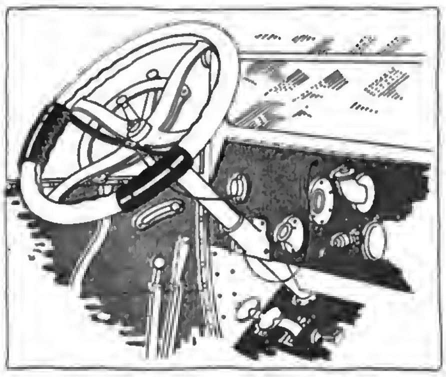
Condensation Prevented

The gasoline enters the float chamber after being strained through the screen *X* and passes through the jet *J* to the venturi where it is mixed with the hot air taken in at the bottom of the carbureter. After leaving the venturi it passes through the mixing chamber, where it is thoroughly mingled with the auxiliary air and passes on to the combustion chamber of the motor. Holes *H* prevent condensation on the walls of the venturi.

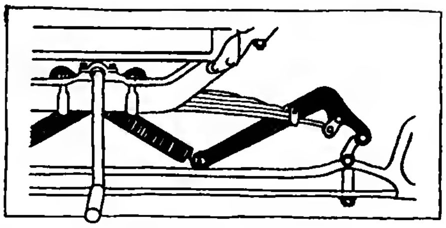
The manufacturers claim that the carbureter produces 1 hp. for every 5 8/10 cu. in. piston displacement in a four-cylinder 4⅛ by 5½ stock motor at 1700 r.p.m. The manufacturer guarantees material and workmanship in the carbureter for one year from the date of purchase and will make repairs or replacements due to defects free of charge if the carbureter is sent prepaid to the factory for inspection. Prices of H. & N. carbureters vary from $12.50 for the ¾-in. size to $100 for the 3-in. size, hot air connections being extra.—H. & N. Carburetor Co., Inc., New York City.



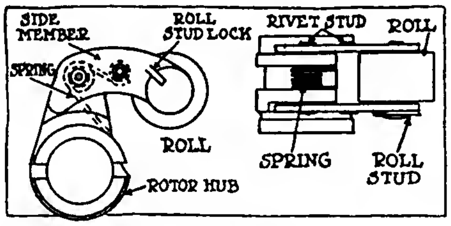
H. & N. central draught carbureter



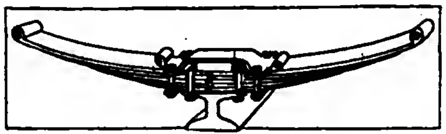
Mounting of Electric Grip Warmers



Dixie shock absorbers for Fords



Rotor of J. & B. Ford timer



Badlat spring clamp for emergencies

Electric Grip Warmer

Two electrically heated grips are laced to the steering wheel rim, one at each side, and these are connected by a cable which runs down the steering column to the storage battery. When installed on Ford cars, they may be connected directly to the magneto. The equipment includes wiring and switch. Price $4.50.—Electric Heating Element Co., Minneapolis.

Dixie Shock Absorbers

This shock absorber is only for Fords and combines a lever and a long coil spring in its construction. The lever is placed between axle and spring end and the load is carried by the long coil spring. Price, $10 per set of four.—Dixie Mfg. Co., Indianapolis, Ind.

J. & B. Timer for Fords

This special timer is interchangeable with the regular Ford timer. The rotor has a cast hub and a jointed arm carrying the contact roller, the latter being pressed outward by a music wire spring of several convolutions. The roller and studs are of hardened and ground steel; the roller stud is locked so that it cannot rotate in the side members of the arm. A feature of the housing is that it has an oil-hole of sufficient size to permit the insertion of the point of the oil-can spout so that oil will not be slopped; the hole is automatically closed against ingress of dirt. The timer sells for $2.—J. &. B. Mfg. Co., Pittsfield, Mass.

Badlat Emergency Spring Clamp

One of these clamps, it is claimed, will fit and repair any broken spring in ten minutes, no matter where the spring is broken, and after it is applied will not break or bend under the heaviest loads or over the roughest roads. The clamp is of forged steel and the wooden block used is of hard maple with leather face and a suction cup at the center of the block, so that it will adhere to the broken spring. The clamp weighs 7 lb., is 12 in. long, ⅛ in. thick and 2 in. wide between the bolt lugs. When the spring is broken off at the shackle bolt one of the eyes at the ends of the clamp will fit the shackle bolt, thus rendering the spring serviceable for an unlimited period. The clamp sells for $3.—James Badlat, Archbald, Pa.

The Automobile

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Fuel and the Future

WHATEVER may be the truth as to the necessity for the present price of gasoline, the fact is abundantly clear that the law of supply and demand necessitates a price considerably above that of a few years ago. If the present price is not just it is still obvious that it is merely a matter of time until it becomes just. In other words, the supply of gasoline as originally obtained by very easy methods is lessening.

There are two alternatives. One, which is being developed rapidly, is to find means for making gasoline by processes more elaborate, more troublesome and more costly than the old method of simple distillation. The other is to use heavier oil.

The first procedure offers us ultimately a supply of fuel which may be described as "good gasoline," as this term is usually understood. To establish the necessary cracking plants is going to take time; is going to need expenditure of considerable money; so relief from the present state of affairs cannot come that way quickly, even though its arrival by this road were certain to take place ultimately. There is no doubt about this whatever. There are in existence several cracking processes which enable kerosene to be converted to gasoline. Kerosene today is a drug on the market—it is almost a waste by-product—and commercial common sense will compel its conversion to some useful end.

Meanwhile, however, it is not wise to put off consideration of the direct use of unconverted kerosene in automobile engines. There is no impossibility in a kerosene carbureter, but it will probably be difficult to find a design which will absolutely replace the gasoline type and give exactly the same results. Heat for starting, or some other new function, will be necessary, which means that the automobile user will have some small new thing to learn if he is to utilize kerosene economically.

Hitherto the thing which has acted most against the kerosene carbureter is this very detail: that it cannot be handled *precisely* like a gasoline carbureter. Added to this is the second fact that it is difficult to obtain very slow speeds with the heavier fuel. These things are not serious. To-day the advantage of a much cheaper fuel is sufficient to make it worth while to have a little more elaboration in the carbureter system. The truck, at all events, can be converted easily, for it does not need the same refinement of performance as a high grade touring car.

No Need for Fear

A wide and general use of kerosene has been withheld in the past, largely by reason of the engineer's and manufacturer's fear of putting out anything abnormal. Later developments in automobile engineering have shown that the abnormal is not to be feared as long as it is well tried out before it goes upon the market, and there is absolutely no reason why the same should not be true of the kerosene carbureter.

Electrical equipment has given the careful automobile user, and the majority are fairly careful, a great deal more to keep in proper order. To the necessity for learning to look after something new and strange the average owner has risen capably; why, therefore, should he not do equally well with a kerosene carbureter which would be far less complex than an electrical outfit?

It is sometimes argued that fuel forms so small a proportion of the total cost of running an automobile that a high price does not matter, but this is a short-sighted view. Firstly, it is not true of commercial vehicles, and, secondly, every year sees the other costs of running reduced. Tires cost less than they used to do and will cost still less as weights are reduced and better methods of construction are found. Depreciation grows smaller as prices are lowered, so that a steadily rising fuel price will soon bring the fuel cost up to a position of much greater importance.

Apart from kerosene carbureters, there is another way in which manufacturers can save the ultimate owner of their car a good number of dollars, and this is by making a regular practice of fitting an additional air supply controlled from the steering wheel or steering post. An adequate supply of additional air when used intelligently can increase the miles per gallon nearly 25 per cent on the majority of automobiles. It requires intelligent manipulation of the control, but such handling is not difficult to learn and the accomplishment is very well within the power of any man possessed of normal brain power.

To Cheapen Automobile Fuel

Examination of Sources of Supply Shows Urgency—Need for Improving Cracking Processes and for Kerosene Engines—Problem Not Difficult if Tackled Now

NEW YORK CITY, March 17—The automobile fuel situation was the topic chosen as the subject for the March meeting of the Metropolitan Section Society of Automobile Engineers, held at the Automobile Club of America last night. The importance of the subject drew an audience of about 150 to the meeting, and of these a little over 100 attended an informal dinner given at the club just before the session opened.

The discussion of the experts left no room for doubt that the situation is a serious one, although it also made clear the fact that it is far from desperate. The concluding opinions were that more gasoline would be available by better exploitation of the oil fields, and that, simultaneously, it was highly desirable that automobile engines should be developed and adapted to utilize efficiently a standard kerosene. Kerosene burning seems to be the easiest way to secure a substantial drop in the price of automobile fuel.

E. S. Foljambe presented the paper entitled "The Automobile Fuel Situation," which was in the nature of a review and forecast, with information as to the use of low-grade fuels and suggestions to the automobile industry and the S. A. E. as to the methods best qualified to solve the problem. Among the prominent men who discussed the situation and Mr. Foljambe's paper were Dr. Rittman, inventor of the Rittman cracking process; his associate at the Bureau of Mines, W. A. Williams, who has the title of chief petroleum technologist; Harry Tipper, advertising manager of the Texas Co.; R. H. Johnson of the White Co. and Prof. Charles E. Lucke of Columbia University.

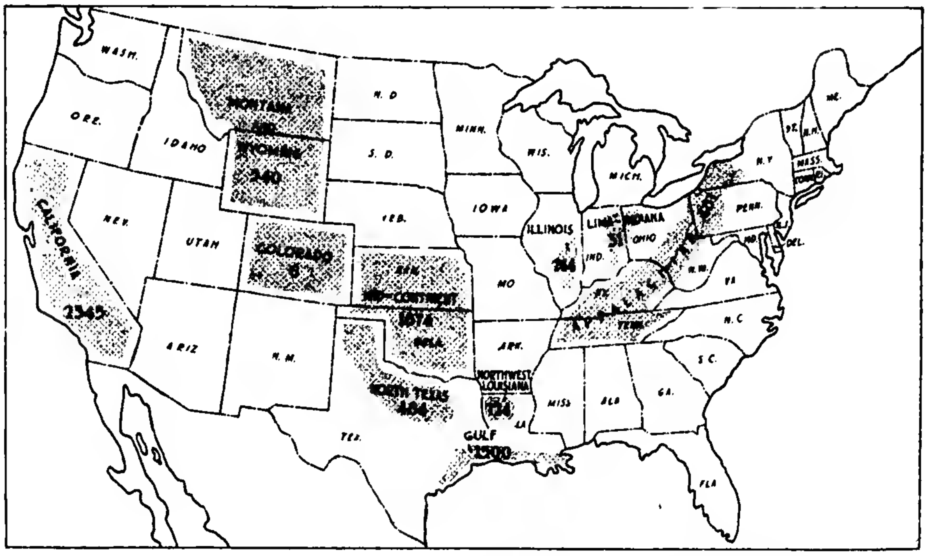
The dinner which preceded the meeting was an informal affair tendered by the Metropolitan Section to Russel Huff, president of the society, and the council. Mr. Huff was the only speaker who was introduced by Leonard Kebler, the chairman of the Metropolitan Section. Mr. Huff spoke a few words of greeting from the Detroit Section of the society and asked the co-operation of the members of the Metropolitan Section in securing a greater enrollment in the S. A. E. for the purpose of furnishing the necessary funds for carrying on the ambitious program which has been entered upon by this year's administration.

Must Use Low-Grade Fuel

The keynote of the evening seemed to be that we are coming rapidly to the point where the low-grade fuels which are now stored or wasted, and in a few cases used for fuel in stationary or similar power plants. must be rendered adaptable to automobiles. Two methods are self-evident to meet this situation, either the present means of vaporization must be so improved as to be able to take care of the lower grade fuels or the fuels themselves must be cracked to form higher grade volatiles.

Mr. Foljambe's paper is a study of existing production, the possibilities of future production and the amount now on hand balanced against present consumption and future consumption if a normal rate of increase in the number of motor vehicles continues. The conclusions he reaches are that we must find better methods of refining the crude in order to produce a larger supply of fuel from the existing supply of crude, that we must create competition in the marketing of fuel products, and furthermore, that vaporizing instruments must be developed which will be capable of using the hydro-carbons of lesser volatility. He turns to the Society of Automobile Engineers as the logical body to solve at least two of the three problems outlined, and states that this situation now ranks in importance to the industry with standardization.

Historically, the paper points out that the first wells were sunk in Pennsylvania in 1859, and subsequently crude oil was used as a medicine and as an illuminant in crude lamps, the oil being used without refining until the time it was discovered that by distillation the products could be separated into high and lower grades of more or less volatility. This distillation led to better illuminating products, but the more volatile liquids were a drug on the market, and for years were turned into the streams until this became a menace to the communities in which the early refineries were located. In 1859 crude sold for $20 per barrel of 42 gal. In 1874 the price of crude had dropped to $3 a barrel. Fluctuations between 1874 and 1914 show the maximum to be $4.23 and the minimum 49 cents.



Showing the distribution of oil in the U. S. A. fields. The figures indicate the comparative amounts remaining to be extracted.

GASOLINE PRODUCED AND EXPORTED IN UNITED STATES

Year	Production, Bbl.	Exported, Bbl.	Difference, Bbl.
1899	6,680,000	297,000	6,383,000
1904	6,920,000	594,000	6,326,000
1909	12,900,000	1,640,000	11,260,000
1914	34,915,000	5,000,000	29,915,000
1915	41,600,000	6,500,000	35,100,000

Mr. Foljambe pointed out that the actual production of oil at the wells is unknown even to the government, and that so-called production is in reality *marketed* production, there being no authentic record from month to month or year to year as to the amount of oil in storage.

The cause for the increase in price of fuel given by Secretary Lane of the Interior, in his report, is divided into six headings, as follows:

1. Increase in consumption of gasoline in the United States during 1915, 25 per cent greater than in 1914 and a similar increase in 1916.
2. Increase in exports, the figures showing the exports of naphtha and lighter products of 1914 to have exceeded those of 1913 by 500,000 barrels, and the exports for 1915 to have exceeded those of 1914 by 1,500,000 barrels. (No government figures are available since these, but the exportation to Europe continues to increase.)
3. The depletion of gasoline stocks, due to increased domestic and export demands. On Jan. 1, 1915, the refiners' storage stock of gasoline amounted to approximately 2,000,000 barrels. Inquiry at this time indicates that there is little or no gasoline now in storage.
4. Decreased production of crude containing a large percentage of gasoline as partially caused by the falling off in output of the Cushing pool, one of the oldest of the modern wells.
5. Increase in the price of crude oil, from which the gasoline is made.
6. Re financial influences: The recent rapid increase in the prices of crude oil and gasoline have been accompanied by rapid increases in the market quotations of oil company shares. The market values of the capital stocks of thirty-eight corporations, of which thirty-five are in the Standard Oil group and three are typical large independent companies, have increased remarkably in the last six months. The stocks of other oil companies probably show a similar rise, but the quotations are not at hand. The thirty-eight companies selected are believed to represent all phases of the oil industry. These rapid increases might be ascribed to the general condition of prosperity and the general upward trend of the stock market but for the fact that during the last quarter of 1915 the oil company stocks did not rise and fall with the market.

Regarding the conservation question, Mr. Foljambe states that it is necessary to have legislation to prevent increased exportations at high prices, to increase the production of the gasoline from the crude by improved methods and to design smaller engines which will be more economical. For immediate relief it is necessary to develop devices to make possible the use of low-grade fuels.

Regarding alcohol, Mr. Foljambe stated that it gives no hope for immediate relief. The reason for this is that even without governmental restrictions for economical use the present type of automobile engine would have to be entirely reconstructed. Instead of using from 65 to 70 lb. compression for efficient alcohol burning, from 150 to 175 lb. compression is necessary. This at once eliminates it as a fuel for the two million vehicles already in use. New engines could be built, however, were it necessary, which would show, on alcohol as a fuel, practically as efficient performance as with gasoline. The horsepower, however, would be less in proportion as the thermal units per pound or less with alcohol than gasoline. Even present types of engines *can* burn alcohol, but they do so very uneconomically, approximately 50 per cent more fuel being required per horsepower hour than were the engine designed for its use. This puts alcohol out of the present reckoning.

Regarding benzol, the author points out that, although it is prevalent in Europe as a fuel, it can only be obtained in this country in limited quantities. Approximately 14,000,000 gal. of benzol were produced in coke ovens in the United States in 1915 with a possible output of 22,000,000 gal. for 1916. This fuel at present sells for 75 cents a gallon and not lower than 65 cents in 1000-gal. lots. It is in great demand for the manufacture of dyes, explosives and carbolic acid. A ton of coal yields 2 gal. of benzol. As long as the war continues benzol is in as great demand as gasoline, and therefore offers no relief, but in the future may well be considered as a possible part of the fuel supply.

Kerosene Holds Good Prospect

Kerosene holds out prospect of immediate relief, as the production of gasoline has caused an immense over-production of kerosene. The latter fluid is being stored at present in vast quantities and means for the disposing of it are being sought by the refiners, who are resorting to marketing it under special trade names. As a matter of fact, even while theoretically burning gasoline, according to Mr. Foljambe, carbureters have recently been provided to handle a mixture of gasoline and kerosene which on the Baume test is often as low as 54 and practically none of it over 60. Commercial kerosene contains 35 per cent of medium and 10 per cent of heavy kerosene.

The paper states that the Rittman process will yield 200 per cent more gasoline than by any other known method, and also states that, although seven plants are in the United States, none of them is producing any appreciable quantity of gasoline.

Kerosene carbureters were next discussed by the author, who showed several types which have been marketed heretofore, and which involved various means for either breaking up the fuel at the jet, completely gasifying it by heat or even in one case igniting it before it entered the cylinder.

In concluding his address Mr. Foljambe drew the deductions that in view of the phenomenal increase in the automobile industry, its accompanying demand for gasoline, together with the increase in the use of tractors, motor boats, farming machinery and stationary engines, and, furthermore, with an exportation many times that of any previous period, something must be done immediately in order to change conditions.

The remedies he suggests are a control of the distribution, and exportation of fuel either by a tax on exports, as now before Congress in the Britten bill, or by some other method not yet devised; also the improvement and general use of more economical distillation processes, and the development of crude oil fields and oil-bearing shales and the natural gas districts.

Hope in Cracking Process

Shale Oil and Other Low Grade Fuels Can Be Commercially Vaporized by This Method According to Bureau of Mines Expert

DR. W. F. RITTMAN of the Bureau of Mines stated that in investigations he had made he had collected samples of gasoline distilled from the crudes in all the different fields. The difference is amazing, and the variation no doubt explains much of the trouble that has been had in vaporization. One company, for instance, sold four different kinds of gasoline. This concern used kerosene as a base and added casing head gasoline to bring it up to the required grade.

Dr. Rittman stated that he had found automobile designers quite willing to design an engine or carbureter to operate on any kind of standardized fuel. He specifically mentioned some experiments that have been carried on in the Bureau lately with the assistance of C. F. Kettering, vice-president of the Dayton Engineering Laboratories Co., covering these points; the Bureau had supplied the chemical information, while Mr. Kettering had worked out the mechanical side.

"America has not unlimited supplies of fuel," continued Dr. Rittman. "Shale oil does not hold great possibilities. It is hard to get it, and in Scotland it has only been possible because of the value of the ammonia also obtained; and now that much of this ammonia is being supplanted by methods for extraction from the atmosphere it is going into further disuse. Benzol and toluol are out of the question."

Cracking Saves 5 Cents a Gallon

Dr. Rittman referred to the cracking process as having been developed by Dr. Burton, and stated that if it were not for these processes gasoline would be selling for 5 cents more per gallon than it does now. He predicted that gasoline would continue to rise until the cracking process or the use of kerosene is able to catch up to the demand. The cracking of crude oil is a reality. Great numbers of intelligent men are now working on the problem, and therefore there can only be one result. There are two sides to the question—one is the chemical and the other is the mechanical—and with both chemists and practical mechanical men on the job at the same time, there can be no doubt the solution will soon be reached.

A graphic description of the cracking process was given by Dr. Rittman, who pictured the molecule of crude, stating that the further down in the vaporization scale we go the larger become the molecules. When there is no restraint on this larger molecule it breaks into smaller molecules of *gas*, but by applying proper restraining influences it can be broken into gasoline instead. The reason he gives for operating his process in the gaseous state is that in this condition it is possible to secure any variations of pressure and temperature. There was a time when crude carried the gasoline price, but to-day gasoline carries the price of crude.

In the Rittman process no heat is applied to the liquid itself in the container. The liquid to be distilled, speaking particularly of petroleum, is contained in the feed tank from whch it is fed into the still. There it is vaporized, and the vapor, not the liquid, is then distilled at a temperature of 550 deg. C. and pressure of 250 lb. per square inch.

The new form of still is, generally speaking, cylindrical in shape, and an inlet tube leads into the still from the container holding the liquid. This tube is equipped with a cock by means of which the flow of the liquid (petroleum) is regulated. In the upper part of the still is placed a number of small iron balls, which are heated to a temperature sufficiently high to vaporize the oil as it flows over them from the inlet tube. The vapor thus formed is forced down into the lower portion of the still by the continual formation of more vapor above.

A series of wires, conveying a powerful electric current, are wound about the lower portion of the cylindrical still with resistance coils, which furnishes the heat for distilling this vapor. The heat can be regulated to any desired temperature. The fact that the expansion of vapor under heat is a definitely known equation, whereas nobody ever knows what a mixture of vapor and liquid is going to do, illustrates the value of the gas factor in the new process. Vaporized oil distilled at the above temperature is then passed into the condensing apparatus.

Regarding the matter of competition, Dr. Rittman said that the little fellow has been forced to put up the price simply because he could not afford to store the crude oil and consequently had to pay for it on a rising scale. He predicted, furthermore, that the price may go to 40 cents or only to 35. Regarding the percentage of gasoline which to-day is made by the cracking process, he stated that it did not exceed 15 per cent and consequently was not enough to offset the rising tendency.

W. A. Williams, chief petroleum technologist of the Bureau of Mines, stated that at the present time we have exhausted about one-third of the visible supply of crude. At the present time, of the products manufactured 20 per cent are being exported, 25 per cent are being burnt under boilers and another 20 per cent sold for cost of production. The better use of the remaining two-thirds is the stepping stone to immediate relief. We are producing now 20,000 bbl. less crude than in 1913 and 40,000 less than in 1915. The 1915 production was particularly rich in gasoline, due to the Cushing pool. There are possibilities in Kansas. Two fields have been discovered which have been very productive, although later drillings show less oil than was indicated in the first borings.

Wastage Now Eliminated

Mr. Williams spoke of Mr. Foljambe's reference to waste, and stated that in some places as much as 50 per cent of the crude oil is left in the sand. This wastage is now being eliminated by the use of water and other methods. The wastes in the Cushing field were eliminated largely by improved drilling which enables the operators to secure the crude practically without waste.

Another interesting reference made by these speakers was the possibility of local fields caring for local demand. For instance, the California situation or that of the Pacific Coast can be taken care of by California production. The necessities of the Rocky Mountain district can be met by the production of the Wyoming and Colorado fields, while the big demand of the Eastern States should be met by the great mid-continent fields which produce 75 per cent of the refinable oils.

Casing-head gas, according to Mr. Williams, will probably never amount to more than 10 per cent of our fuel. Probably the cost of this will go up until the supply catches up to the demand, and this is the case throughout the entire gasoline situation.

Kerosene Vaporizer Easy Problem

No Fundamental Difficulty—Needs Careful Application of Principles—Good Atomization and Correct Air Temperature

PROF. CHARLES E. LUCKE of Columbia University spoke of the practical development of means for using the lower grade fuels. According to him the subject of devices of a mechanical nature to meet the problem have been studied intensively during the past few years, and that while hundreds of schemes had been submitted, there is fundamentally no difficulty, and the final results will not differ much from present types. In fact, he expressed himself as being surprised at the delay in reaching some definite conclusion on the problem and stated that in his belief the difficulties to be overcome are, first, unwillingness to take trouble; second, the patent situation, and third, the problem of making a proper mixture of kerosene and air.

Regarding the first, kerosene as a fuel is fundamentally different from gasoline, and therefore fundamentally different means of vaporizing it must be used. "An engine," he stated, "need not start on the first turn, nor yet on the second or third, as long as a satisfactory start is obtained. It is merely a case of changing from the familiar to the unfamiliar."

In regard to the patent situation, there are thousands of devices of all sorts, of which all are defective. In making the final kerosene carbureter it would possibly be necessary to make element A from one patent, element B from the next, and this, of course, renders the situation complex. The final device must be worked out on proper thermo-chemical lines correctly proportioned.

Professor Lucke states his belief that the problem of making a proper mixture of kerosene and air is not difficult. The engine is a variable speed and variable power machine. It is a multi-cylinder engine, and to make a mixture from a single-header equally distributed under all conditions of weather, temperature and density, may seem quite difficult. Practically, however, it is not insurmountable. Such mixtures can be vaporized. Measured supplies of kerosene and air can be brought together, and by proper heating a dry mixture result. Therefore, the problems consist in arranging a proportioning device and securing the proper temperature. This also is not difficult, for while it is true that the temperature must not be too high or too low the range is not less than 100 deg. Therefore, it is only a question of having first the correct proportion, and secondly, the correct heat supply.

Given these two conditions, the machine will run, but will not perform engine for engine like the power plants of to-day. Car for car, there will be no difference.

An important point brought out by Professor Lucke is the necessity for intimately associated mixtures. An intimate mixture will vaporize at 300 deg. Fahr. readily, while one not so closely intimate under the same conditions will not vaporize at 500 deg. In fact, close to 200 deg. is good enough in some correctly designed headers with proper intermixture. It is simply a question of simple design and of following the laws of vaporization.

Harry Tipper, advertising manager of the Texas Co., stated that in his practical experience he had found plenty of competition in the oil field, and that the market has never agreed. He also stated that the term gasoline was never used by men in the oil business, as it was only a word coined when the more volatile fuels were used for lighting purposes, and never represented a definite cut. Gasoline never meant the same to two companies, while kerosene is a more standardized product. The New York State law requires a definite flash point in an Elliot tester in order that the name kerosene may be used to define the product.

Regarding kerosene, Mr. Tipper said that since it was made when gasoline is made, what can you do with it unless you pay for it with the gasoline? The small refiner suffers and must use the kerosene in order to get rid of it, and he cannot afford to store it.

Fuel Cost Small Percentage

"Do not magnify the part that fuel plays in the cost of running an automobile," said Mr. Tipper. "It is only a small percentage after all. Automobiles were operated successfully in Europe when 35 cents was paid for a gallon of gasoline, and I remember riding in a taxi for 25 cents a mile at that time. Kerosene is the real answer.

R. H. Johnson, president of the New York Dealers' Association, warned against unduly alarming motorists with the predictions of a shortage of fuel in fifteen years. "We do not have to depend on the United States for oil," he said. "Look at the rubber situation, nearly all the crude we use coming from South America. We must remember Mexico, where there are probably the greatest reservoirs in the world, and one well of Mexico has been producing 60,000 bbl. of oil per day for seven years. They have had to cap the wells for lack of facilities for distribution, and several times the production listed in the tabulations in Mr. Foljambe's paper can readily be obtained from the Mexican wells. The Republic of Mexico has enough oil. All it needs is the facility to work the wells."

Dr. Rittman stated that Mexico holds no hope unless it is from the cracking process, but that with this there is room for considerable optimism, since whereas only 5 per cent of the Mexican crude can be refined into gasoline by straight distillation 40 per cent is secured by the cracking process.

Herbert Chase, chief engineer of the Automobile Club of America, suggested that engines may be built on other than the Otto cycle. He pointed out that the Otto cycle is theoretically 35 per cent efficient thermally, whereas in practical motors from 15 to 18 per cent is all that is secured with wide open throttle.

The History of the American Automobile Industry

(*Continued from page* 549)

structures show evidence of much work along these lines. In some cases the air and liquid passed through wicks much as were employed in kerosene lamps. In others, the oil was thrown on several layers of woven wire through which the air was obliged to pass and which wire by its heat absorbed from the flame of combustion quickly vaporized the liquid. The ignition was originally started by applying a torch to a peep hole after a plug had been removed, the plug being quickly inserted thereafter. That the flame might continue from one combustion period to the next a very slight by-pass hole was provided in the inlet valve or near it so that a little fresh air from the air tank continually flowed. This resulted in a little waste of air and fuel during the exhaust stroke, but there would be enough fuel left in the wick or gauze between admissions to burn with this air and keep a small flame alive until the next entrance of air and fuel.

Experience showed that the composite layer of gauzes gave better results if one or more of the wire sheets were perforated so that the air could pass through more freely at the perforated point. This arrangement insured some variety to the mixture, in that it would be more nearly pure air where the perforations were and much more nearly all vapor at the edges of the wire layers where they were held in the cylinder walls and therefore much cooler and more slow in vaporizing the fuel. The result of this arrangement was that it was practically certain a combustible mixture of air and vapor would exist at some point between these extremes and this insured the flame being continuous and the engine certain in operation.

Brayton's engines were frequently built in two-cylinder form and up to 40 hp. Like all engines of that day they were neither high-speed nor lightweight as modern ideas go, but they were really very creditable creations.

In 1873 Brayton arranged with a street car company at Providence, R. I., to apply his engines to one of its cars, but the city authorities refused to allow the car to run on the streets by its own power unless horses were attached to it, so most of the use and testing given the car took place on a short private length of track near a fair ground, after which the experiment was abandoned. In 1876 he licensed Joshua Rose and A. R. Shattuck to make road vehicles driven by his engines.

At Philadelphia a James Fawcett of Pittsburgh, operating bus and hack lines in Pittsburgh, saw the Brayton engine, talked with Brayton and decided to equip an omnibus with this form of power, which was done in 1878. The first form of transmission being a hydraulic one and proving unsatisfactory, the engine was remounted with shaft projecting toward the rear and with bevel gear to drive a cross-shaft. A friction clutch and reversing arrangement were also provided, but like the street car, the project had to be abandoned because the city authorities would not permit its use.

British Prohibit Car Imports

No More Passenger Cars To Be Shipped To the British Isles for the Duration of the War

LONDON, March 21—At a meeting of the Privy Council, King George signed a proclamation prohibiting the importation of automobiles, motorcycles and various other articles. This prohibition has been expected for several weeks, and it is understood that the purpose is mainly in order that shipping may be free to carry necessaries for which the need is urgent. It is in logical sequence to the imposition of the 33 1/3 per cent duty placed upon automobiles by the British government last October. Full information is not yet available, but it is understood that the prohibition does not apply to motor trucks or vehicles to be used solely for commercial purposes.

The immense effect of this decree upon the British industry is difficult to appreciate. It will bear very heavily upon the numerous dealers who have existed for the past year almost entirely by the sale of American automobiles. If the prohibition is maintained for twelve months or more, several of the big London agencies will be forced to close down. It will mean almost complete stagnation in the highly-developed British branches which are maintained by several of the larger American manufacturers.

Regarding the other side of the question, prohibition of imports is bound to have the effect of starving the market, which means that when the ban is removed there will be a tremendous rush to obtain cars, and it will probably be difficult to export them fast enough for months after the imports are made free again.

Four Changes in Timken-David Brown Staff

DETROIT, MICH., March 17—Several promotions are announced by the Timken-David Brown Co., manufacturer of worm-drive axles:

Engineer C. T. Myers is promoted manager of the company.

F. T. Zollinger becomes assistant manager, in charge of purchases, sales, receiving, shipping and accounts.

C. S. Dahlquist becomes general superintendent in charge of manufacturing.

M. Voelk is made general foreman and Mr. Taylor assistant engineer.

United States Rubber Elects E. B. Davis a Director

NEW YORK CITY, March 21—The annual meeting of the stockholders of the United States Rubber Co. was held in New Brunswick, N. J., today. Edgar B. Davis of Brockton, Mass., was elected a director. Mr. Davis is vice-president of the General Rubber Co.

The directorate now consists of eighteen, M. Bun and A. L. Kelley, former directors, having died during the year. The directors are as follows: W. S. Ballou, J. C. Brady, M. F. Brady, M. S. Burrill, S. P. Colt, H. E. Converse, E. B. Davis, James Deshler, J. B. Ford, F. L. Hine, H. L. Hotchkiss, Lester Leland, S. M. Nicholson, R. B. Price, H. E. Sawyer, W. H. Truesdale, T. N. Vail and E. S. Williams.

Saxon Six Price Raised to $815

DETROIT, MICH., March 18—Beginning to-day the Saxon Motor Car Corp.'s six-cylinder roadster and touring car will sell at $815 instead of $785. The reason for the increase in price is stated by officials to be due to the increased expense of manufacturing the car.

Koehler Truck Price Raised to $955

NEWARK, N. J., March 17—On account of the advance in price of materials the H. J. Koehler S. G. Co., this city, has raised the price of its Model K four-cylinder 1-ton truck, complete with body, to $955 and the chassis to $940, f.o.b. Newark. The former price of the chassis was $870.

E. R. Hall Dies Suddenly

MT. CLEMENS, MICH., March 17—E. R. Hall, experimental engineer to the Goodyear Co., died here to-day, having recently come to this city in the hope of recovering from an illness with which he had been afflicted for some time. Mr. Hall was a member of the Council of the Society of Automobile Engineers and a native of Somerville, Mass. Born in 1885, he was educated at the Massachusetts Institute of Technology and joined the Goodyear Rubber Co. on Sept. 1, 1908. His appointment as technical expert for the company was made in February, 1909. Since then the experimental development of Goodyear tires had been in his hands.

Mr. Hall's appointment to be a councillor of the S. A. E. was made in January of this year. He will be deeply regretted by his associates in the Goodyear Co., all of whom held him in the highest esteem.

Nehrbas Heads Premier Production

INDIANAPOLIS, IND., March 18—F. P. Nehrbas has joined the Premier Motor Corp., this city, in the capacity of production manager. Mr. Nehrbas has been in the automobile field since 1910, when he became factory manager of the E. R. Thomas Co. Later he joined the American Locomotive Co., Providence, acting there as works manager.

England May Curtail Gas Supply

Move on Foot to Prohibit use of Automobiles Except for Business Purposes

LONDON, ENGLAND, March 8—Claiming that gasoline must be economized, the British authorities are about to take possession of all stocks and control all sales to the public. Under this scheme the commercial vehicle users, and the army and navy, will have a preferential call, followed by doctors and other professional men. Private motorists will come last.

It is not known exactly how the details of the scheme will be worked out, but it appears probable that gasoline tickets will be issued by magistrates and judges, and that all automobile owners will have to make personal application to these authorities. Each case will be judged on its own merits and it will be decided whether the motorist is eligible for a supply of gasoline, and what quantity shall be allowed him. It is believed that those who have definite business to perform with an automobile will not suffer any great inconvenience, while those car owners who wish to drive for pleasure only will find that such a course is impossible.

In general the scheme is calling forth opposition. It is the opinion among English motorists that there is very little use of automobiles for purely pleasure purposes. The general tightening effect of the war has in itself been sufficient to stop all luxury use of cars. It is also claimed that such a scheme as proposed by the government will be very difficult of application, for it is hard to prove what is justifiable and what unjustifiable motoring. Local magistrates, too, usually possess very little knowledge on motoring matters and will not be competent to estimate the amount of gasoline different types of automobiles should consume for given distances.

This week official posters have been placed on the walls inviting the public to make as little use of automobiles and motorcycles for pleasure purposes as possible.

Walsh Briscoe Advertising Manager

JACKSON, MICH., March 18—R. T. Walsh has been appointed advertising manager of the Briscoe Motor Corp. Mr. Walsh is one of the best known men in the automobile advertising field. For several years he was advertising manager of the Maxwell Motor Co., and previous to this connection he was assistant advertising manager of the Ford Motor Co.

Edmunds & Jones Issue New Stock

$1,000,000 of 7 Per Cent Preferred and 5000 Shares of Common Offered

NEW YORK CITY, March 21—A syndicate of New York bankers is offering $1,000,000 of 7 per cent cumulative preferred and 5000 shares of common stock of the Edmunds & Jones Corp., the new corporation combining the Edmunds & Jones Mfg. Co., the Canadian Lamp & Stamping Co. and the Chicago Electric Mfg. Co. The syndicate, which is headed by White, Weld & Co., Hornblower & Weeks and Merrill, Lynch & Co., offers the 10,000 shares of preferred at 97, two shares of the preferred carrying the privilege of subscribing to one share of common at $30. The authorized issue of the common is 40,000 shares.

It is provided that at least 20 per cent of the surplus profits each year, after the payment of preferred stock dividends, shall be used to acquire and cancel at not more than 120 and accrued dividends the outstanding preferred stock. It is stated that net earnings for 1915 of the three companies are reported in excess of six times the amount required for the preferred stock dividend and combined sales for January and February are reported as more than 100 per cent greater than in the same period of 1915.

The combined balance sheet of the three concerns which make up the Edmunds & Jones Corp. shows that on Jan. 1, 1916, assets totaled $1,315,541.18, made up as follows: cash, $208,075.15; accounts receivable, $264,184.19; merchandise, $339,914.15; real estate, plants machinery, $503,367.69.

Liabilities consisted of current accounts, $114,602.24 on bills payable; preferred stock, $1,000,000 and surplus, represented by 40,000 shares of common stock of no par value but estimated at $200,938.94.

Of the earnings in 1915, those of the Edmunds & Jones Mfg. Co., totaled more than $360,000, and those of the two other concerns amounted at more than $80,000, a total of over $440,000.

Wilson Truck Offers Stock

DETROIT, March 20—The J. C. Wilson Co., which recently increased its capital stock from $20,000 to $225,000, is offering for sale $100,000 of its common stock at a par value of $10 per share. The company makes the Wilson truck and is now preparing for greatly increased production.

The assets of the company total $174,691 and the direct liabilities $42,587, including a mortgage of $25,000. The size of the property owned by the concern is 107 by 588 ft. and partly 142 by 670 ft. The three main factory buildings consist of a three-story structure 51 by 150; a two-story building 90 by 170; another two-story building 33 by 170 ft., and several smaller structures.

Besides making trucks the J. C. Wilson Co. has been a manufacturer of auto tops and has done general trimming since 1908, when the company began operations.

San Francisco Awards Cause Discord

SAN FRANCISCO, CAL., March 15.—That considerable discontent has arisen in connection with the awards in the motor vehicle and accessory department of the transportation exhibit at the recent exposition held here, is apparent from the rumors which have leaked out to the effect that Group Jury 101 which was appointed by the exposition management to specifically make awards in the automobile section of the transportation department, has been discredited in that its findings were materially changed after they were filed with the exposition authorities. It seems that not only have some of the awards made by Group Jury 101 been changed but that additional awards, not included in the regular schedule, have been created. The feeling is gaining headway that the great benefit, which should acrue to any exhibitors in connection with an exhibition of such magnitude, has been very materially reduced because of upsetting the findings of the jury originally selected to make the awards, and also because of the fact that adding additional awards has naturally robbed those primarily intended of much of their intrinsic value.

Want Changes in Ariz. Registration Law

PHOENIX, ARIZ., March 18—In his annual report for 1915, Secretary of State, Sidney P. Osborn emphasizes the necessity for vital changes in the Arizona motor vehicle registration law.

The cost of a license for a car of less than 25 hp., A. L. A. M. rating, is $5, and it is $10 if the engine has greater rated horsepower. Osborn says that this is unfair to the owners of old cars that are worth only a fraction of the prices paid for new models, and recommends that provision be made for a sliding scale of reductions on cars that have been in use over two years.

When the year is half over, half the regular charge for a license good till the first of the following year, is charged. Osborn thinks that a reduction of 25 per cent should be made after the close of the first quarter, and of 75 per cent after the third quarter.

Perlman Secures Two Plants

Perlman Co. Stated to Be Able to Supply All Demands of Industry

NEW YORK CITY, March 21—Following the announcement of the formation of the Perlman Rim Corp. in THE AUTOMOBILE for March 16, comes the statement of L. H. Perlman, president of the new company, that two plants have been secured and are already manufacturing demountable rims and two other factories are under consideration subject to investigation as to the value of the property. Officers of the Perlman company state that the concern is in a position to supply all demands of the car manufacturers, since if present plant facilities are inadequate, in spite of the addition of other factories, contracts will be let to other manufacturers.

In connection with the financial backing of the Perlman company, which is being financed by L. G. Kaufman, president of the Chatham and Phenix National Bank, it is stated that W. C. Durant is interested in the new enterprise.

The Standard Welding Co. has applied to the court to temporarily suspend the injunction until uncompleted orders can be filled, and also is seeking to have the mandate modified. The matter will come up in court on Friday. The company has several demountable rim constructions under consideration and its officials state that if forced to abandon the manufacture of demountable rims, the company's tubing and tube parts business will be greatly augmented.

To Pass on Sale of Bock Bearing Assets

TOLEDO, OHIO, March 18—A special meeting of the stockholders of the Bock Bearing Co. will be held on March 28 at the company's office in West Toledo, for the purpose of considering and taking action upon the proposed sale of the entire property and assets of that company.

Pierce-Arrow Machinists Back at Work

BUFFALO, N. Y., March 21—The plant of the Pierce-Arrow Motor Co., this city, was opened to-day after being closed on March 2, on account of a lockout, following a strike of machinists.

Maxwell Owners Offer Cars to Army

EL PASO, TEX., March 18—Owners of 140 Maxwells, living in and around El Paso, have offered their services and cars to General Pershing of the U. S. Army, for use as he sees fit in any movement of troops. The owners have all signed an agreement to place their cars at the disposal of the army.

S. A. E. Standards Meeting April 21

Cleveland Chosen as Meeting Place—Standards, Council and Section Meetings

New York City, March 18—At the meeting of the Council of the Society of Automobile Engineers held this week it was decided that the next general meeting of the Standards Committee should take place in Cleveland on April 21. It is laid down in the rules that the two meetings of the Standards Committee, which take place between the general meetings of the Society, shall be held on the second Thursday in April, and the second Thursday in October. Seeing that the Cleveland section has an important paper on carbureters by F. O. Ball scheduled for Friday, April 21, the Council thought it advisable to alter the date of the Standards Committee meeting so that a two-day session could include standardization work, the council meeting ing and the Cleveland section paper.

On April 20 three or four of the standards divisions will meet in Cleveland and the council will meet in the afternoon. It is expected that the whole of April 21 will be devoted to the discussion of standardization work, and a prominent subject will be further consideration of automobile lighting with particular reference to glare.

It is expected that practically all the divisions of the Standards Committee will hold meetings previous to the general meeting and the general meeting of the committee will have to consider a number of important matters. The nomenclature work is progressing very rapidly, and it is hoped to have this completed and ready for submission to the society at the summer meeting on board the Noronic.

A tabulation is at present being made showing the very extensive use of S. A. E. standards by automobile manufacturers and, although this is not completed, results to date show that acceptance of the more important standards is almost universal.

J. H. Utz, chairman of the Miscellaneous division, is arranging many of the details of the Cleveland meeting, and it is anticipated that the attendance will be very large.

Electric Storage Battery Has Gross Sales of $1,770,188

Philadelphia, Pa., March 18—The Electric Storage Battery Co., this city, for the year ended Dec. 31, 1915, had gross sales of $1,770,188, as compared with $1,395,793 in 1914. The 1915 income, amounting to $1,360,748, was equal to 8.37 per cent on $16,249,425 capital stock, compared with $1,103,237 in 1914, which was equal to 6.78 per cent on $16,250,000 stock. The surplus, after dividends, was $710,784, compared with $453,273 in 1914. The balance sheet showed $653,756 cash on hand and a reserve of $1,081,201.

The retiring directors were re-elected at the annual meeting in Camden, N. J. The board will meet for organization on Wednesday, April 5.

25,000 Cadillac Eights Shipped

Detroit, Mich., March 22—On March 16 the Cadillac Motor Car Co. shipped 25,000 Cadillac eights. This quantity has been produced since the company commenced manufacturing this model, October, 1914. They state that the twenty-five thousandth car would have been shipped earlier had more freight cars been available.

Overland Shipments Total 27,685 in First Two Months

Toledo, Ohio, March 18—Shipments of Overland and Willys Knight cars for the first two months of 1916, totaled 27,685 as against 10,240 for the corresponding months of 1915. During January, 1916, 12,393 cars left the factory, as compared with 4613 for the same month of 1915. During the whole month of February, 1915, 5627 Overland cars were shipped, while this year, this total was exceeded by 500 at the 18th of the month.

Fiat Patent Case Settled

New York City, March 21—The suit of the Fiat Co. against the Olds Motor Works, charging infringement of design patent No. 48,219, covering a radiator and hood design, has been settled out of court by the payment of back damages and the agreement of the Olds company to discontinue the manufacture of the design in question. The patent in the suit, wihch was in the U. S. district court for the southern district of New York, was issued Nov. 30, 1915, to Carlo Cavalli, Turin, Italy, who assigned it to the Fiat concern.

Bull Resigns as Cole Assistant Engineer

Indianapolis, Ind., March 16—A. A. Bull has resigned as assistant chief engineer of the Cole Motor Car Co., this city. Up to the present time he has made no other connection.

Morgan & Wright Enlarge

Detroit, March 18—The plant of Morgan & Wright, the automobile tire makers, was recently enlarged by two stories, giving the plant 45,000 additional square feet of floor space.

At present 3000 men are employed, but the force is to be gradually increased to 4000 or more. Production is also to be increased to 10,000 tires daily.

S.A.E. Summer Trip Details

Officials Appointed to Take Charge of Various Activities—June 12 Busy Day

Detroit, March 17.—Official headquarters for the Society of Automobile Engineers, previous to sailing from Detroit on its annual summer cruise, June 12-16, have been arranged for at Hotel Ponchartrain at this city. R. O. Gill, in charge of hotel arrangements has contracted for the ball room floor for Monday June 12. Up to sailing time of the Noronic at 2 p. m. all business of the S. A. E. will be transacted in this headquarters. A complete staff of officials to care for every need of S. A. E. members reaching the city on the morning trains will be on hand. Plans have been evolved for a committee in charge of W. B. Stout to care for all baggage of members sailing. A members' luncheon will be served in the ball room and each of the six S. A. E. sections will maintain headquarters in the ball room previous to sailing.

The volume of work incidental to handling a summer cruise of 550 engineers on the Great Lakes is nearly as large as staging a national convention to nominate a presidential candidate. The 1916 meetings committee, which has entire charge of this work, has nearly completed its organization to handle the various work, and its organization follows:

Purser and accounts—S. B. Dusibberre.

Transportation and baggage—W. B. Stout.

Hotel headquarters—R. O. Gill.

Papers for summer session—K. W. Zimmerschied.

Daily S. A. E. on boat—D. Beecroft.

Automobiles for factory visits—J. G. Vincent.

Badges and Souvenirs—K. W. Zimmerschied.

Wireless service—W. A. Brush.

Music and entertainment — C. W. Terry.

Treasurer W. H. Conant has complete charge of tickets and reservations.

S. A. E. members reaching Detroit, Monday morning, June 12, will have an opportunity of visiting the different motor car and other factories. Cars will be at the hotel at the convenience of members for this purpose. Other cars will be furnished for sight-seeing parties of ladies.

—J. D. Kaufman, who for the past several years has been sales representative for the American Die & Tool Co., Reading, Pa., has been appointed sales manager of that company.

Chicago Amateur Race Popular

Many Sportsmen Arrive for Practice on Chicago Speedway—Some Fast Laps Made

CHICAGO, March 20—That there will be a large entry list for the interclub professional drivers' race at the Chicago speedway, May 20, seems to be indicated by the number of amateur enthusiasts that were out for practice with their cars on the board oval yesterday. This was the first regularly observed practice for the unique event, and there were a total of fourteen of the Chicago sportsmen testing the speed possibilities of their mounts. Three weeks ago there was an informal practice staged and on the two days of practice there have been eighteen different cars on the track with amateur pilots at the wheel.

The best time made so far in practice is credited to A. W. Bronstedt, whose Mercer turned a lap in one minute and 36 seconds. This is a speed of 76 miles an hour.

The race as planned is an invitation affair and is open only to amateur drivers who own their cars and are members of some of the leading clubs of Chicago and vicinity. The invitations are extended through the clubs and the cars run under club colors. The mechanic as well must be an amateur and a fellow club member of the driver.

The qualifications committee of the speedway has drawn up the basis for the extending of invitations. According to these supplementary regulations the race will be limited to two, three or four-passenger roadster bodies on roadster chassis, as indicated by the manufacturers' catalog, and motors, while they may be of any piston displacement, providing the bore and stroke is the same as catalogued, and must be of the same general design as cataloged, may be altered as to ignition and carburetion equipment, lightening of piston and connecting rods, changing valve sizes and lifts, changing of timing, lubrication, fuel feed, a full electrical equipment must be carried with the exception of lamps, but may be disconnected electrically and mechanically, so as to take no power.

Corona Grand Prize Expects Twenty Starters

LOS ANGELES, CAL., March 20—The Corona Grand Prize, which the Citrus Belt Racing Association is promoting and which is scheduled for April 8, promises to eclipse all other California speed carnivals and is expected to be the greatest motor meet in the history of the sport in the West.

There will be twenty starters; and many of the drivers claim that all twenty cars will show a speed of 100 miles an hour in the elimination trials, which will be held on the Grand Boulevard the week before the great race. Practically all of the prospective entrants declare that not only will the record established by Eddie Pullen on the Corona course last year be boosted in the speed clash this year, but also that in order to qualify as one of the twenty speediest contestants an entrant will have to pass the century mark in the preliminaries.

The hour for the race has been changed from what it was last year. When the meet was held on Thanksgiving Day the days were so short that it was necessary to begin the race early in the morning in order that visitors would have time to get back to Los Angeles and other southern California points. This year the contest will start at 1:30 o'clock in the afternoon.

There will be one grandstand this year, but it will be large enough to accommodate thousands of people. Instead of having the official stand at the upper end of the course, as heretofore, it will be placed on the lower end near the depot.

In addition to the guaranteed cash prize of $12,000, the Flagler trophy, which is valued at $1,000, will also go to the winner.

Speedway for Birmingham

BIRMINGHAM, ALA., March 18—The Birmingham Motor Speedway Co. to-day awarded a contract for a 2-mile speedway around the lake of the Birmingham Motor and Country Club. The road will cost $500,000. August Herrmann of Cincinnati is president of the speedway company.

Three Duesenbergs for Indianapolis Race

INDIANAPOLIS, IND., March 17—The first three official entries made for the Indianapolis Speedway 300-mile race this year were made by F. S. Duesenberg for three Duesenberg cars, to be driven by O'Donnell, Henderson and D'Alene.

Wilcox Quits Racing to Market Automobiles

INDIANAPOLIS, IND., March 18—Howard Wilcox has announced his retirement from automobile racing. He has entered the automobile dealers' field, with Don Herr, as State distributer of Case and White cars. He has been in the racing field for nearly seven years. Wilcox states that he is going to drive in one more race, but only because he has given his word to do so. The Rotarians in Indianapolis will hold a meeting in the fall, and as an entertainment a special race will be staged on the local speedway.

Wyman & Gordon Reorganized

Capital Now $3,000,000—No Change in Policy—Large Factory Extensions Under Way

WORCESTER, MASS., March 20—The Wyman & Gordon Co., manufacturers of drop forgings for the automobile trade has reorganized with a capial of $3,000,000 and changed its name to Wyman-Gordon Co. This reorganization does not mean any change in the policy of the company, but incorporates new interests represented by Robert F. Herrick, Boston, well known in business and financial circles because of his large investments in varied lines. Due to this reorganization and new capital large factory extensions are under way, these including a separate building housing a heat-treating department. In addition the factory enlargement will accommodate a new inspection department as well as added facilities for testing and laboratory work. A modern administration building is being built. These additions will permit of a large increase in the forge department.

The control and management of the company will continue with those who have been associated with it. The officers are: George F. Fuller, president; H. G. Stoddard, vice-president and treasurer; and Chas. C. Winn, assistant treasurer.

A. P. Warner Enters Trailer Trade

CHICAGO, ILL., March 21—A. P. Warner, founder of the instrument company, has re-entered the automobile industry, becoming head of the Warner Auto Trailer Co., Beloit, Wis., manufacturing commercial trailers and "Twentieth Century" prairie schooner trailers for touring. The Warner company has purchased the old Thomson plant in South Beloit, which has a capacity of 100 trailers a day. Equipment of prairie schooner trailer includes waterproof khaki duck tent, two berths, stove, table, ice chest, etc.

Marmon Increases Price $200

INDIANAPOLIS, IND., March 21—Owing to the increasing cost of material and of labor, The Nordyke & Marmon Co. announces an advance in price on the Marmon models 3 and 4, this advance to be effective immediately. Two hundred dollars has been added to the price of each model, bringing the five-passenger car to $2,900, the seven-passenger car and the three and four-passenger roadster to $2,950.

MUSKEGON, MICH., March 18—The Campbell, Wyant & Cannon Foundry Co., has increased its capital stock from $150,000 to $400,000.

Solid Tire Suit Ends

Court of Appeals Affirms $210,000 Judgment Against Diamond N. Y. Co.

New York City, March 21—The handing down, on Friday last by the Circuit Court of Appeals, sitting in New York City, of a decision against the Diamond Rubber Co. of New York in favor of the Kelly-Springfield Tire Co., and unanimously affirming the decision of the Lower Court, awarding Kelly-Springfield approximately $210,000 damages against the defendant for infringement of the Grant patent, marks the beginning of the end of a patent litigation that has become famous.

This litigation arose over Grant Patent No. 554,675, issued Feb. 18, 1896, to A. W. Grant, for improvement in solid rubber tires. It expired Feb. 18, 1913. This is the patent covering the internal wire Kelly-Springfield solid rubber tire. The litigation has extended over a period of twenty years and the books are full of decisions concerning it. The first suit was decided in December, 1898, in favor of the patent, by the Federal Court in New York City.

In 1901, Judge Wing, in Cincinnati, also found the patent valid; but the Court of Appeals for that Circuit reversed the Lower Court and found the patent void. The Supreme Court refused to take the case on appeal; thus the patent stood valid in the East and void in the Middle West.

In 1906, the question of validity was before the court in Milwaukee, and the patent was there held valid, notwithstanding the decision against it by the Circuit Court of Appeals in Cincinnati. In the same year, the trial court in New York again declared the patent valid and, finally, the Circuit Court of Appeals in New York and in Milwaukee affirmed the decision of the lower courts.

In June, 1907, the Diamond Rubber Co. of New York was sued and the merits of the patent came before the court on ten different occasions in this suit and each time was decided in favor of the patent.

Because of conflicting decisions, the Supreme Court allowed an appeal in the Diamond case, and in 1911 supported the contention of plaintiffs, declared the patent valid and the defendant to infringe. The defendant then refused to pay on the ground that it had made no profits and that plaintiffs had sustained no damages.

The accounting proceeded at great length and the master finally reported that plaintiffs were entitled to 5 cents a pound on all rubber that the defendant had sold.

An application then was made to increase these damages and for the allowance of interest. Judge Hand, sitting in the District Court of New York, allowed $50,000 smart money and $27,000 interest, which, together with costs, resulted in a judgment against the defendant for approximately $210,000.

In the meantime, numerous other alleged infringers have been prosecuted and several suits are now pending in the accounting stage. In one against the Republic Rubber Co., Youngstown, Ohio, the Master has awarded the plaintiffs $115,000, being at the rate of 5 cents a pound; and also in a case against the Goodrich company an award has been made on the same basis, amounting to $262,000 in favor of the Kelly-Springfield company.

The decision just handed down is particularly important to patentees, as it firmly establishes a new measure of damages in this class of cases; or, rather, firmly establishes an old measure of damages that had been hesitatingly advanced and had practically been discarded.

Formerly, a successful plaintiff in a patent case was limited either to the profits made by defendant or to such damages as could be distinctly shown, measured by license fees, loss of sales or forced diminution of price.

The measure of damages invoked by plaintiffs in the Diamond case was that a uniform license fee had been established; and also that they were entitled to recover what was reasonable as a royalty.

Waite Tractor Moves to Elgin

Elgin, Ill., March 18—The Waite Tractor Co., late of Chicago, has removed to Elgin, Ill., and has commenced operations in the Magnus Building, River and Kimball Streets. The Elgin Commercial Club has given the company a bonus of $1,000 and rent free for one year. In the past the company has contracted for the manufacture of its machine, but recently decided to establish a plant of its own and manufacture its product itself. The tractor can develop a speed up to 15 m.p.h., and can be utilized for farm machinery power as well as field or road work. Twenty-five men will be employed at the outset, and machinery is now being installed.

Quality T. & R. Co. to Change Name

Hartville, Ohio, March 20—At a meeting of the stockholders of the Quality Tire & Rubber Co., this city, April 8, the name of the firm will be changed to Besaw Tire & Rubber Co. The new name is given for C. A. Besaw, president. C. A. Besaw, J. C. Harmony, F. E. Schumacher, Hiram Carper, G. E. Munk, Oliver Brumbaugh and M. J. Herr are directors.

Approve Uniform Service

A.S.M.A.M. Think Manufacturers Should Adopt Standard Service Plan

Detroit, March 18—Not only are the members of the Automobile Service Managers' Association of Michigan in favor of the adoption by the manufacturers of a uniform or standard service plan, but local automobile distributors and dealers approve the idea and are hoping that an understanding will soon be reached for the adoption of such a plan.

At the meeting held at the Hotel Stattler, March 16, a plan was outlined and approved by those present from the service mangers' association. The matter has been taken up with General Manager Alfred Reeves of the National Automobile Chamber of Commerce, to be taken up by him with the members of the chamber.

Souther Leaves Ferro

Cleveland, Ohio, March 20—Henry Souther, vice-president of the Ferro Machine & Foundry Co., and past president of the Society of Automobile Engineers, has just severed his connection with the Ferro company. Mr. Souther joined Ferro early in 1914, having been consulting engineer to the Standard Roller Bearing Co., Philadelphia, Pa., for the previous four years.

Souther's knowledge of metallurgy is varied and extensive, his business and professional career commencing with the Pennsylvania Steel Co., which he left in 1893 to become engineer for the Pope Mfg. Co., Hartford, Conn. In 1899 he opened an office at Hartford as a consulting engineer, and it was in this capacity that he became prominent in connection with the automobile and allied industries. He was consulting engineer for the Association of Licensed Automobile Manufacturers during the life of that organization and was president of the Society of Automobile Engineers during 1911.

Tractor Show for Northwest

Omaha, Neb., March 22—A tractor-show circuit embracing some seven or eight cities of the best agricultural section of the Northwest has been definitely decided upon, and plans are rapidly nearing completion. The newly-formed circuit will be under the supervision of A. E. Hildebrand of Omaha, whose work will be directed by a committee representing tractor manufacturers.

Nearly 50,000 people attended the tractor show held in Fremont, Neb., last year, and this city will probably be one of the first places selected.

January Exports $8,262,434—Trucks Total $3,416,818—Cars $3,044,995

January, 1915, Total $4,473,865—January, 1916, Shows Gain of Over 84 Per Cent—Exports During Seven Preceding Months Total $66,822,383

WASHINGTON, D. C., March 18—According to statistics compiled by the Department of Commerce, 1269 commercial cars, valued at $3,416,818; 4520 passenger cars, valued at $3,044,995, and $1,800,621 in parts, not including engines and tires, were exported in January last. During the seven months ended January, 1916, the exports amounted to 12,391 commercial cars, valued at $32,559,354; passenger cars to the number of 27,376, the value of which was $21,471,078, and parts, not including engines and tires, to the value of $12,791,951.

During the corresponding periods of last year the exports were as follows: January, 1915: Commercial cars, 935, valued at $2,545,527; passenger cars, 1803, valued at $1,313,153; parts, not including engines and tires, $615,185. Seven months ended January, 1915: Commercial cars, 3972, valued at $10,989,442; passenger cars, 6904, valued at $5,808,099; parts, not including engines and tires, $2,789,246.

The United Kingdom's purchases of cars in January last numbered 1090 machines, valued at $1,718,886, while during the seven months' period the number was 13,571 machines, valued at $18,614,667. In January a year ago 1389 cars were shipped there, the value of which was $1,770,966, while during the seven months ended January, 1915, the number was 3448 and the value $4,758,702.

Shipments to France in January last amounted to 521 cars, valued at $1,358,115, while during the seven months' period the number was 3172 and the value $7,993,295. During January a year ago 236 cars were shipped to France, the value of which was $527,869, while during the seven months' period the number was 2024 and the value $5,017,488.

There were no exports of cars to Germany either in January last or during the seven months' period of this year. None was shipped in January a year ago, while during the seven months' period of that year sixteen cars, valued at $17,364, were exported to the Kaiser's land.

Russian Figures Large

One hundred and fifty-one cars were exported to Russia in January last, the value being $338,324, while during the seven months' period the number was 3261 and the value $12,824,047. There are no statistics available for the corresponding periods of last year.

Denmark is another European country that is now figuring in our automobile export trade, 105 machines, valued at $80,687, being shipped there in January last, while during the seven months' period the number was 442 and the value $269,437.

Italy bought nineteen American cars in January last, the value being $24,173. During the seven months' period the number was 184 and the value $127,586. Only three cars were shipped to Italy during January a year ago, the value being $2,412. During the seven months' period the number was twenty-six and the value $23,722.

The shipments to "all other European countries" amounted to 116 cars, valued at $100,372, in January last, and to 659 cars, valued at $673,928, during the seven months' period. For the corresponding periods of last year the number was 130 cars, valued at $229,065, in January, and during the seven months the number was 701 cars, valued at $1,894,278.

Increase in Canadian Imports

During January last 862 cars, valued at $581,563, were exported to Canada, while during the seven months' period the number exported was 3340, valued at $2,440,316. This is a big increase over the shipments for the same periods of last year, when 263 cars, valued at $226,533, were shipped in January, while for the seven months' period the number was 1378 and the value $1,890,693.

The number of cars shipped to Mexico in January last was thirty-nine, valued at $42,154, as against three, valued at $1,410, exported there in January a year ago. During the seven months' period the number increased from thirty-nine, valued at $48,427, in 1915, to 169, valued at $168,316, in 1916.

The West Indies and Bermuda continue to loom up large in the export tables, 266 cars, valued at $187,339, being shipped there in January last, as against 102 cars, valued at $66,980, exported in January a year ago. During the seven months' period the shipments increased from 468 cars, valued at $341,012, in 1915, to 2170 cars, valued at $1,345,896, in 1915.

Heretofore shipments of cars to South American countries have been grouped under the general head South America. In January a year ago the number of cars exported there was 104, valued at $54,276, while during the seven months' period the number was 471, valued at $270,685. The growing importance of this trade is seen in the following fig-

Exports of Automobiles, Trucks and Parts for January and Seven Previous Months

	January				Seven months ending January			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Commercial	935	$2,545,527	1,269	$3,416,818	3,972	$10,989,442	12,391	$32,559,354
Passenger	1,803	1,313,153	4,520	3,044,995	6,904	5,808,099	27,376	21,471,078
Total	2,738	$3,858,680	5,789	$6,461,813	10,876	$16,797,541	39,767	$54,030,432
Parts (not including engines and tires)	.....	615,185	......	1,800,621	......	2,789,246	......	12,791,951
Total	......	$4.473,865	......	$8,262,434	......	$19,586,787	......	$66,822,383
BY COUNTRIES								
Denmark	......	....	105	$80,687	......	....	442	$296,437
France	236	$527,869	521	1,358,115	2,024	$5,017,488	3,172	7,993,295
Germany	......	....	......	....	16	17,364	......	....
Italy	3	2,412	19	24,173	26	23,722	184	127,586
Russia	......	....	151	338,324	......	....	3,261	12,824,047
United Kingdom	1,389	1,770,966	1,090	1,718,886	3,448	4,758,702	13,571	18,614,667
Other Europe	130	229,065	116	100,372	701	1,894,278	659	673,928
Canada	263	226,533	862	581,563	1,378	1,890,693	3,340	2,440,316
Mexico	3	1,410	39	42,154	39	48,427	169	168,316
West Indies and Bermuda	102	66,980	266	187,339	468	341,012	2,170	1,345,896
South America	104	54,276	......	....	471	270,685	......	....
Argentina	......	....	576	245,376	......	....	2,555	985,535
Brazil	......	....	24	15,069	......	....	110	66,056
Chile	......	....	69	40,935	......	....	486	338,094
Venezuela	......	....	30	18,452	......	....	277	184,175
Other South America	......	....	44	25,290	......	....	254	146,834
British East Indies	......	....	399	286,872	......	....	1,629	1,230,243
British Oceania	155	124,751	576	441,306	1,354	1,084,885	3,407	2,806,256
Asia and other Oceania	293	808,793	551	685,391	683	1,246,244	1,727	2,370,204
Other Countries	60	45,625	351	271,509	268	204,041	2,354	1,418,547
Total	2,738	$3,858,680	5,789	$6,461,813	10,876	$16,797,541	$39,767	$54,030,432

ures: Argentina, 576 cars, valued at $245,376, in January last, and 2555 cars, valued at $985,535, during the seven months' period; Brazil, twenty-four cars, valued at $15,069, in January, and 110 cars, valued at $66,056, during the seven months; Chile, sixty-nine cars, valued at $40,935, in January, and 486 cars, valued at $338,094, during the seven months; Venezuela, thirty cars, valued at $18,452, in January, and 277 cars, valued at $184,175, during the seven months; other South American countries, forty-four cars, valued at $25,290, in January, and 254 cars, valued at $146,834, during the seven months.

British East Indies took 399 cars, valued at $286,872, during January last, and 1629 cars, valued at $1,230,243, during the seven months' period. Shipments to British Oceania during January last amounted to 576 cars, valued at $441,306, while during the seven months' period the number was 3407, valued at $2,806,256. During these same periods the shipments to other Asia and Oceania numbered 551 cars, valued at $685,391, in January, and 1727 cars, valued at $2,370,204, during the seven months.

Shipments to all other countries amounted to 351 cars, valued at $271,509, in January, and to 2354 cars, valued at $1,418,547, during the seven months' period.

The table opposite shows the exports in detail.

Shuler Axle Incorporated

DETROIT, March 16—The Shuler Axle Mfg. Co. has been incorporated, with a capital stock of $100,000, to make automobile axles. Temporary manufacturing quarters have been secured in the premises of the West Side Fuel & Supply Co., Dragoon Avenue and the Wabash Railroad.

Frank A. Shuler, who is president and general manager of the new concern, started with the Timken-Detroit Axle Co. several years ago. Later he joined the Metal Products Co., became production superintendent, and after four years again joined the Timken organization, becoming master mechanic and assistant superintendent.

The other incorporators and officials of the new company are J. J. Kern, secretary-treasurer, and who is connected with the West Side Fuel & Supply Co., and R. H. Dewey, who is vice-president.

Butler Co. to Move to Indianapolis

KNIGHTSTOWN, IND., March 17—To better its shipping facilities and service the Butler Mfg. Co., this city, will move its plant to Indianapolis. This company will devote its time to the manufacture of three types of pistons, cylinder regrinding and special machine-shop work.

Freight Car Situation Still Serious

Detroit Manufacturers See Need for Use of Convertible Flats for Months Ahead

DETROIT, March 20—With hardly any exception local automobile manufacturers say that the railroad freight car situation is no better to-day than what it was a month ago. Several traffic department officials claim that it is even worse, while a few others say there has been a slight improvement.

All who were seen on the subject agree that the railroads are trying their best to remedy the conditions, but that the roads are practically powerless to overcome conditions which they do not and cannot control.

In the first place there is the weather. There have been so many storms in the East this winter, and when a road had partially cleared its tracks and started to move its long line of waiting freight cars, a new storm, more violent than the preceding one, again tied up the whole system.

Cars Tied Up in East

The second reason why there is so little relief is the fact that thousands of cars loaded with freight are tied up, in the East, and cannot be released. This applies to almost all the roads to New York and New England.

It is not alone the automobile industry which is greatly hampered in the moving of its products. The condition is general in all industries. The railroads receive as many complaints from steel manufacturers, from ammunition makers, from furniture makers, etc., as from automobile manufacturers.

One of the big railroad freight traffic managers stated that no one is to blame because no one, either manufacturer or railroad, has foreseen that such a condition would arise. Had the roads been advised by the automobile manufacturers that their production will be double in 1916, then they would not have hesitated to take steps for additional automobile equipment. As it is the manufacturers, with a few exceptions, have not and do not post the railroads.

Cannot Get New Cars

The Michigan Central railroad ordered 4500 special 40-ft. automobile freight cars in September. Up to date only about 225 have been delivered. The delay is caused owing to the shortage of material.

The Packard and Chalmers companies say that there has been practically no improvement in the freight car situation. Both concerns had to put on about seventy-five extra men who are used in making improvised boxes, or wooden coverings, over the automobiles when the latter are on the flat cars. Dodge Brothers say they are short at least 40 per cent of the number of railroad cars they need daily. The Hupp Company cannot get enough flat cars and these come in irregularly and in very small number. Cadillac finds conditions somewhat better as far as shipping West is concerned, but no improvement in the East. Paige-Detroit says the conditions are a little better. Studebaker has found hardly any betterment. All of these concerns had to put on extra help either in making wooden housings on the flat cars or to take care of other special work which, under normal conditions, would not be necessary, which means a big additional expense in shipping, but they are content to get whatever cars they can.

The Detroit Board of Commerce has decided to open a special freight traffic school, under the direction of Traffic Commissioner Arthur T. Waterfall, from March 21 to May 23.

Traffic and operating officials from the different railroads will, from time to time, be present at the lessons, and will explain various different subjects, concerning their respective departments.

That the school is expected to bring about good results and that it will be well attended is the opinion of Mr. Waterfall.

Studebaker Boosts Output

DETROIT, March 20—Additions to the Studebaker Corp. plant here, involving an expenditure of $1,000,000 for buildings and equipment, are now practically completed. It means that production will soon be increased to at least 400 cars a day, instead of 300 as now, and that this year's output will probably be 100,000 cars.

Extensions to the plant consist of a new building for the manufacturing of heavy forgings, such as six-throw crank shafts and front axles; a three-story warehouse, 52 by 335 ft., with accommodations for 150 carloads of raw material; a three-story addition to the main manufacturing plant, adding 35,000 sq. ft., of floor space, to be used for wheel, chassis, painting and assembly; seven large double chambered furnaces to replace smaller types in the heat treating and carbonizing departments; seven forging machines for making gear blanks are being added, also two additional 500-hp. water tube boilers; a 2000-hp. low pressure turbine generator is being added to be operated by exhaust steam available from the forge plant. In the manufacturing machinery department seventy-five pieces of equipment are also being added to take care of six-cylinder engine parts.

Detroit Section of the S. A. E. Discusses Rear Axle Design

J. G. Perrin's Paper Provokes Lively Discussion—Transmission Brakes and Truck Axles Without Differentials Are Leading Subjects

DETROIT, MICH., March 17—Before the usual large crowd that overflowed the convention hall of the Pontchartrain Hotel, J. G. Perrin, chief engineer, Timken-Detroit Axle Co., read a paper on the Evolution of the Rear Axle, and provoked a spirited discussion of a topic that is of utmost importance to-day. Much interest was displayed in the hints that before long we may have cars without differentials, as experiments are now being conducted along this line.

Previous to the reading of the paper of the evening, a constitution, by-laws and rules were adopted by the Detroit Section. The offering of these for adoption was the occasion of a rather spirited discussion in some quarters.

Up to this time the Section has operated with no constitution and by-laws other than those of the national S. A. E., and the action simply puts the Section upon a firmer business basis.

Perrin's paper began with an historical sketch of rear axle development and considered some of the more prominent constructions of the day. Mostly it will be valuable for purposes of record and is a useful reference for engineers who are contemplating the design of a new axle. Toward the end the following statement was made regarding materials suitable for use in rear axle construction.

Materials Use in Rear Axles

Malleable iron is used in differential housings in the carrier units that hold the pinion-shaft and differential bearings, brake spiders and some of the hubs. This material has the following average physical properties:

Maximum strength	43,790 lb. per sq. in.
Elastic limit	30,540 lb. per sq. in.

Drive-shafts are made from chrome nickel steel with these physical properties.

Maximum strength	145,000 lb. per sq. in.
Elastic limit	120,000 lb. per sq. in.
Elongation in 2 in.	15 per cent
Reduction in area	52 per cent

This material in a shaft of 1 5/16-in. diameter, the size used in large production, when subjected to torsion shows the following ability:

Torsional moment

Maximum strength	54,000 lb.-in.
Elastic limit	33,000 lb.-in.
Angle of twist	1,300 deg.
Fiber stress	74,600 lb. per sq. in.

The sleeve used in the full-floating type of axle is made of either carbon or chrome nickel steel, according to the size and load capacity of axle. The chrome nickel steel shows the following physical properties:

Maximum strength	105,500 lb. per sq. in.
Elastic limit	81,000 lb. per sq. in.
Elongation in 2 in.	25 per cent
Reduction in area	66 per cent

The bevel gear and pinion have to be of a steel of high physical properties with a hard wearing surface and tough inner core. This necessitates the use of a case-hardening low-carbon steel alloyed with chromium and nickel. The core shows the following average physical properties:

Maximum strength	107,000 lb. per sq. in.
Elastic limit	60,000 lb. per sq. in.

Everybody who has had the experience in testing case hardened specimens, knows that it is very difficult to get uniform tests. We know that we get certain results, but the physical tests of case hardened pieces generally are very unsatisfactory, and they vary a great deal, so that we have to judge of the results we are getting by other than the actual physical tests of the case hardened specimens.

Discussion Lively

Chairman George W. Dunham, in opening the discussion, called attention to the great variety of stresses to which the rear axle is subjected, and said that after analyzing them you wonder that the unit stands up at all. It carries the torque, transmits the power, and also has to do the work of propelling the vehicle, which is in another direction, and is subject to side strains as the car skids or drops into ruts or sudden obstructions. And it is doing its work right down in the dirt and mud all the time. A great many axles to-day, he commented, are still subject to oil leakage trouble.

McCall White Expects Development

D. McCall White, Engineer for the Cadillac Company, read a very interesting commentary on the paper. It is given in part below:

We have to-day reached great heights of development in engine design, and I think that now is the time for engineers to turn their fertile brains to the development, and further refinements in other portions of the chassis, notable among which is the rear axle.

Mr. Perrin has mentioned that the stamped steel type of axle is probably the most universally used type of any form of axle construction, as regards number of car makers who have adopted it.

I would like to ask Mr. Perrin, if the reason for the almost wholesale adoption of this type is not rather, because of the quantities which are being turned out by his company, than the fact that it is the best type of axle design having the maximum strength for the minimum weight.

The banjo casing or pressed steel housing is, as Mr. Perrin describes, made from carbon steel which has an elastic limit of 34,000 lb. per square inch, and therefore, cannot be stressed above 7000 lb. per square inch without disastrous effect.

The approximate greatest stress in a floating axle is near the spring seat, and is caused by the combined cantilever loads from the weight of the car, the tractive effort, and torque reaction.

The diameter of the casing here cannot be very great, so the tubular portion of the casing must either be somewhat thick to withstand the stress or an inserted tube made from alloy steel must be used.

This inner alloy steel tube must in its turn be carried in, and adequately supported, towards the center of the casing, so that we really have a comparatively heavy construction.

British Design

This particular design of the banjo casing originated, if I remember correctly, in England, at the plant of the Daimler Motor Car Company, around the year 1905-1906, and has since, as Mr. Perrin states, been largely used in this country.

In view of the large size of that part of the casing which surrounds the bevel gears, the stress is extremely low, with the result that a thin casing could reasonably be employed were it not for the fact that it would not be a manufacturing possibility to weld the halves of the casing together satisfactorily, if they were less in thickness than about 5/32 in.

This then, forces us to arrive at the fact that, were the axle scientifically designed, without manufacturing prohibitions, we could have a pressing of varying thickness made from alloy steel to suit the moduli of the sections employed, and the stresses which come upon those sections.

The different forces which rear axles require to resist are of a most complex form, varying from minimum to maximum with the greatest frequency, and it behooves us, in view of the fact that this part is unsprung weight, to exert as much ingenuity as we possibly can, to make this important assembly as light as possible, combined with rigidity.

Engineers who have been seeking the greatest reduction of weight in rear axle design, are, I think, rather inclined towards swaged alloy steel tubings, flanged and bolted to an aluminum center piece or differential casing.

It is a matter of considerable doubt as to whether an axle designed on those lines will be able to withstand the continuous vibrations, caused by the pounding on rough roads even though it be supported by a tie rod of sufficient strength, although, I understand that one prominent manufacturing company originally used an aluminum center piece with success, and upon the price of the commodity going beyond the reach of its purse reverted to malleable iron or steel castings, and was confronted with the problem of the axles breaking, due evidently to the increased weight pounding on the rough roads.

On the other hand, I have an authentic statement that another company found that the aluminum center went to pieces due to fatigue after a given mileage, which I understand extended possibly over two years.

It may have been that this latter casing was stressed too highly although history does not say so.

Favors Aluminum Case

Sufficient to say that my experience in Europe leads me to believe that aluminum would be perfectly safe, provided it was not overstressed.

I believe that to-day, considering that we are on the threshold of an era of quieter axles, due to the introduction of spiral bevels, the need of designing a rear axle, the differential of which can be removed almost as easily as a spark plug, is almost gone, more especially as most of us obligingly mount the gasoline tank behind the axle cover, thus making a difficulty of examination in any case, and we could therefore design a stronger and more rigid aluminum casing if such openings were no longer necessary.

I have in past years been an exponent of worm axle design, and still believe that there is some future before it, believing also, from very extended experience, that a slightly lower gear ratio with a worm than with a bevel is necessary in order to compensate for the very slight difference in mechanical efficiency.

Regarding Mr. Perrin's statement about the De Dion Company's axles, I can say that this company still employs the axle with universally jointed shafts, and the differential casing bolted to the frame, to reduce unsprung weight, on their large heavy cars, where the axle would naturally be considerably heavier than in its light cars where the orthodox design is used.

As regards the bevel pinion, I am of opinion that no fewer teeth than eleven should be used if one wishes a sufficiently strong and quiet construction, and with reference to the mounting of same, I am more partial to the overhung pinion than to the pinion supported on both sides, and although this latter would appear to be more correct, the former has given me the quietest rear axle.

Using materials such as Mr. Perrin suggests, the stress, in my opinion should not exceed on the pinion teeth 22,000 lb. per square inch, and on the axle tubes 13,000 lb. per square inch.

Possibly these stresses may seem high, but one must remember that there are the stresses due to such loads as weight of car, weight of axle itself, reflex engine torque, reflex brake torque, tractive effort, inertia of the axle itself, etc., to be considered.

Brush Dislikes Unsprung Weight

A. P. Brush, Brush Engineering Assn., touched upon the matter of unsprung weight, saying that he is a crank on its elimination as well as in the elimination of other things that prevent the tubes from having only pure torsion.

The possibility of running axles without differentials was dilated upon. Mr. Perrin said that it is being experimented with all over the country. In Europe they are running some of the ambulances without differentials, and they find that the efficiency of the truck is increased a great deal, as regards straight-ahead going. The only limiting factor, so far, has been the short turning radius, as trucks so equipped cannot turn around in such close quarters as conventionally built types, because the friction of the parts is too great. The binding effect in trying to turn around in too short a circle has been too great to be satisfactory on the rough ground. One prominent electrical concern building electric cars, said Mr. Perrin, has tried the non-differential construction out in New York City and found that the ampere draw either with or without differential was practically the same.

F. E. Moskovics, Nordyke & Marmon Co., said that he noticed several concerns are in the habit of making differentials without adjustment, and asked for the comments of the author of the paper on this subject. Mr. Perrin said that the other arrangement that would have to be used, if there were no screw adjustment in the meshing of the bevel gear, is the fitting of variable thicknesses of spacers back of the pinion, back of the main bevel gear. That has been tried, he said, and it is continued to-day in some cases, and while it is perfectly feasible in small productions, it has not proved a commercial possibility in large outputs.

Alex Churchward asked as to the relative efficiency of the spiral bevel, the straight bevel, and worm on passenger car installations, and Mr. Perrin's reply was that neither type has shown enough loss of efficiency to cut any figure. All the figures show that under normal conditions they all run over 95 per cent.

C. C. Hinckley, Engineer Chalmers Company, brought up the questions as to why the grease runs out, why does a brake squeak, etc. Each engineer has a different answer to every question, he said. Hinckley is of the opinion that the biggest development so far in rear axle construction has been the two-pinion differential, believing that it is good for any average practice. He also raised the question as to how to get a big enough ring gear in a car with small wheels, and still have sufficient road clearance.

Regarding this latter point, Mr. Perrin says that you cannot eat your cake and have it too. The thing is a compromise. If you are going to have the power, you must have adequate means of resisting it, and that necessitates teeth of certain sizes. You cannot get away from that, and if you are going to have the ratios, you must have big ring gears. He thought Mr. Hinckley knew as much about brake squeaks as he (Perrin) does.

Cleveland S. A. E. Also Discusses Fuel

CLEVELAND, OHIO, March 18—The meeting of the Cleveland Section of the Society of Automobile Engineers, held here last night, was very successful, the attendance totaling 125, of whom ninety-five dined together immediately before the meeting. Mr. Kettering, the speaker of the evening, did not have a prepared paper, but talked concerning the chemistry of combustion with respect to the major problems of carburetion. Dr. Rittman and Mr. Williams of the Government Bureau of Mines contributed to the discussion, repeating some of the information which they gave the previous evening to the Metropolitan Section. Other speakers were President Russell Huff and general manager C. F. Clarkson.

Settle Details of Columbia Car

DETROIT, March 18—So far have the plans of the Columbia Motors Co., recently organized in Detroit by some prominent men in the industry, among whom are W. E. Metzger and J. G. Bayerline, been completed that a preliminary idea of the type of car thas is to be manufactured is now given out. Built upon a wheelbase of 115 inches, the new Columbia is a six that should claim a position for itself due to its very pleasing outline and general good looks. The ultra-modern type of body design is used in continuing the hood on exactly the same slope as the rest of the body, using a cowl at the back of the front seat, rounding the front of the body over, and slanting the windshield.

The car will be constructed of standard units with the motor, a 3 by 4¾ block-cast six having a multiple dry-disk and three-speed gearset in unit with it. There will be a two-unit starting and lighting system, the name of which is not yet divulged. Other specifications include Tinkem front and three-quarter floating rear axles, cantilever rear springs and semi-elliptic front suspension, chrome-nickel steel frame, and Stewart vacuum feed from a tank at the rear. Some of the equipment features are 32 by 3½ tires on demountable rims, crowned fenders and other features that go with the up-to-date vehicle.

Roominess of the body is made one of the features as well as the general body appearance. The back seat measures 46 in. across, outside of the upholstery. Weight is said to be in the neighborhood of 2150 pounds.

Hupp Addition Nearly Completed

DETROIT, MICH., March 18—Within a few weeks the second of the two stories which are being added to the plant of the Hupp Motor Car Co. here will be completed. It means that nearly 26,000 sq. ft. of additional manufacturing floor space will be added to the plant and that the working force will be increased by several hundred men. Production will be greatly increased.

Silver Has New Sales Plan

NEW YORK, March 17—The C. T. Silver Motor Co., this city, handling Overland, Willys-Knight and Peerless cars, has formed a plan to increase sales by overcoming the present hesitation of buyers on account of the high price of gasoline. This company will furnish gasoline at 25 cents a gallon to retail purchasers from March 20 to Sept. 20. A ticket will be presented to each retail purchaser of a new car entitling him to gasoline at the above price at either of the Silver branches.

Paige Makes Record Order

DETROIT, March 18—On the first day of March the Paige-Detroit Motor Car Co. reports that it had orders on hand for 3748 Paige cars, of a total value of about $4,000,000. Orders from dealers are coming in at such a rate that the Paige company does not believe it will be able to make as many cars as its distributers request. Compared with the business done last year in February, the past month was several hundred per cent better.

M. & S. Capital Now $1,750,000

Increased $750,000—Amount All Subscribed for by Stockholders

DETROIT, MICH., March 18—The capital stock of the M. & S. Gear Co., manufacturer of the M. & S. differentials, has been increased from $1,000,000 to $1,750,000 and the issue of $250,000 of preferred stock was authorized. This amount was all subscribed for by the stockholders.

The following officers have been elected: Lewis H. Scurlock, continuing as president and general manager; W. H. Kirn and Wm. H. Hill, vice-presidents; W. H. Holden, secretary and treasurer; and C. C. Wolf, Parkersburg, Ia., and O. W. Smith, New York City, directors.

The M. & S. company is now manufacturing its new design which is an improvement over that previously used in that it does not employ a spider for holding the gears. These improvements have greatly reduced the cost of manufacture.

The business of the company has greatly increased during the last six months, and steps were taken some time ago for increasing the output. The Detroit plant on Lycaste Street has been in course of enlargement and will be ready by June 1, when the daily production here will average 200 differentials or more. Officials say that orders on the books now will keep the plant running to its full capacity for many months.

Steel Reaches Record Prices

NEW YORK CITY, March 21—A continuation this week of record-breaking prices in the steel market has been the cause of many inquiries as to how high the market will go. Prices now on Bessemer and open-hearth steel are double those of 1914. Last week both grades of steel jumped $5 per ton to $45. Another metal which is quoting now high, is lead. Prices on this metal are now at double what they were a year ago. This week lead jumped to $8 per 100 lb., the highest it has reached. Beams and channels rose to $2.62 per 100 lb. at a gain of 20 cents.

Pennsylvania crude oil supplemented the rise of the metals by going up to $2.60 a barrel. This high price has been equalled only once before, that being in 1895, when it was maintained for only 24 hr. On that occasion it reacted to $2.40, but there is no such movement in prospect now, according to leading oil interests. Failure of repeated advances through the last several months to increase the supplies of crude available for refiners is given as the cause for the advance. Refiners, however, expect to replenish their tanks, from the oil held in storage, and which they felt was being held by producers for $2.50. They now feel that little short of $3 a barrel will move this reserve.

There was no material change in the rubber situation last week, though trading was a little more active. Prices held steady with Ceylon first latex, a little lower. Para rubber went down to 74 cents a pound on Thursday, but picked up gradually again to 76 cents.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.65	.65	.65	.65	.65	.65	...
Antimony	.44	.44	.43½	.43½	.43½	.43½	— ½
Beams and Channels, 100 lb.	2.42	2.42	2.62	2.62	2.62	2.62	+ .20
Bessemer Steel, ton	40.00	40.00	45.00	45.00	45.00	45.00	+5.00
Copper, Elec., lb.	.27½	.28½	.28½	.28½	.28½	.28½	+ .01
Copper, Lake, lb.	.27½	.27½	.28½	.28½	.28½	.28½	+ .01
Cottonseed Oil, bbl.	10.40	10.42	10.49	10.57	10.69	11.00	+ .60
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb.	7.75	7.75	7.75	8.00	8.00	7.87½	+ .12½
Linseed Oil	.78	.78	.78	.78	.78	.78	...
Open-Hearth Steel, ton	40.00	40.00	45.00	45.00	45.00	45.00	+5.00
Petroleum, bbl., Kansas, crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pennsylvania, crude	2.50	2.50	2.50	2.60	2.60	2.60	+ .10
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.76	.76	.74	.75½	.75½	.76	...
Rubber, Ceylon First Latex	.93	.92	.90	.92	.91	.91	— .02
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	55.00	54.00	52.00	51.00	51.00	50.00	—5.00
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Detroit Axle Capital Stock Increased to $150,000

DETROIT, MICH., March 18—The capital stock of the Detroit Axle Co. has been increased from $50,000 to $150,000. This concern, which started here only a few years ago, has been growing steadily. Its business thus far this year has been several hundred per cent better than last year's.

Jacobson Machine Gets Saxon Order

WARREN, PA., March 17—The Jacobson Machine Mfg. Co., this city, has received a half-million-dollar order from the Saxon Motor Co., Detroit. It is for 7500 rear axles and transmission gears.

Another Overland Building for St. Paul

ST. PAUL, MINN., March 17—A new $700,000 plant is to be erected in St. Paul by the Willys-Overland Co. It will be built west of the Overland assembling plant at Eustis Street and University Avenue, in the Midway district.

The present building is being used to capacity. The structure which will be duplicated has ground dimensions of 200 x 500 ft., and is four stories.

J. I. Case Earnings Larger

RACINE, WIS., March 18—The annual report of the J. I. Case T. M. Co., Racine, Wis., just issued, shows that while gross sales fell somewhat below those of 1914 the earnings are very much higher. The gross sales of 1915 were, with one exception, the largest of any year since the company was established in 1842, and amounted to $14,058,631. Earnings for 1915 were $1,931,824, compared with $966,697 in 1914. After paying $850,000 in preferred dividends and making an appropriation of an additional $500,000 for contingent losses, the earnings were equal to 7 per cent on the $8,300,000 outstanding common stock. The preferred stock outstanding is $12,150,000. The company during 1915 liquidated $1,000,000 more of the $12,000,000 bond issue of Feb. 1, 1914, and thus far has redeemed $2,500,000, leaving $9,500,000 outstanding. This is to be taken care of by three annual payments of $500,000 in 1916, 1917 and 1918, followed by eight annual payments of $1,000,000. The record of gross sales for the last four years is as follows: 1912, $14,026,633; 1913, $13,417,405; 1914, $14,395,384; 1915, $14,058,631.

New Prest-O-Lite Battery Plant Nearly Completed

INDIANAPOLIS, IND., March 17—The large addition to the main factory of the Prest-O-Lite Co., this city, to increase the production of its storage batteries is practically completed. The building is 400 x 100 ft., one story, and adds 40,000 sq. ft. The construction is reinforced concrete.

The present output of 400 batteries a day will be increased to 1200 as soon as the addition is completed.

White Declares Initial Dividend of 1¾ per Cent

CLEVELAND, OHIO, March 18—The White Motor Co. has declared an initial dividend of 1¾ per cent, payable April 8 to holders of record March 25.

In connection with the initial dividend of 1¾ per cent on the $16,000,000 stock, it is stated that the stock has been placed on a regular 7 per cent per annum basis.

Dividends Declared

Kelly-Springfield Tire Co.; quarterly of 1½ per cent on 6 per cent preferred.

Automobile Securities Active

Chevrolet Reaches New High Mark of 160—General Motors Rises 15 Points

NEW YORK CITY, March 21—The automobile securities last week were featured by sharp gains ranging from 1 to 15 points. Following quite a protracted period of reaction, another boom is on in Wall Street. Not in months has there been such a display of activity and strength as was witnessed on the Stock Exchange this week. Those who held onto their automobile shares during the reaction will find gratifying gains for this week. Especially in Chevrolet and General Motors issues, will those who held for a turn for higher quotations be rewarded for their patience. Last week both Chevrolet and General Motors saw a sharp rise of 13 and 15 points, respectively. Chevrolet reached a new high mark of 167 on Wednesday, an advance of 30 points within two weeks. At times the demand for the stock was such that offerings had to be made by controlling financial interests to prevent a runaway market.

The week's development included a revival of the proposition by certain interests in General Motors management for the creation of a stock voting trust. The new circular, which had thirteen signers owning 8047 shares, or 2½ per cent of the total outstanding stock, urged the voting trust for the protection of the stockholders. The attempt to create a voting trust in that company's stock does not seem likely to succeed. W. C. Durant and his associates, against whom the voting trust is aimed, own 162,437 shares of General Motors stock out of a total of 316,000, or 51 per cent. Of this holding 104,000 shares are of common stock, and the balance preferred. The Durant interests, it is stated, have refused offers of additional shares and have officially announced that no more stock would be accepted under the terms of the original offer of exchange.

Studebaker, Maxwell and Overland issues were strong at the closing on Saturday. Maxwell common went up 12½ points to 72½ points; its second preferred rose 2 points to 85; and the first preferred rose 1 point to 46½. Studebaker common closed at 146, a gain of 6 points. Willys-Overland common, after a gain of 12 points during the previous week, again rose, reaching 234, just 6 points higher. Paige-Detroit stock was strong at 690, just 15 points higher than last week.

Tire issues within the past two weeks have shown strength with substantial gains. Last week Ajax rose 3 points; Goodrich common went up 2 points as did that of Goodyear; Kelly-Springfield's new common rose 5¼ points to 74¼, and U. S. Rubber common closed at 53½, a gain of 2 points.

Chalmers Show Rise

Saturday, which is generally an off day on the Detroit Stock Exchange, was a very lively day. The cause was the demand for Reo Motor Truck Co.'s shares and for Chalmers shares. The former, which was quoted at 25¾ and 27 on Friday, was at 28½ bid and 29½ asked at the close of the exchange to-day. Rumors that the company may declare an extra dividend soon and that its business was exceptionally good, have been going around the brokers' offices all week. The big business of the Chalmers company is also said to be the reason for this stock making a gain of 6 points. Demand continues to be steady for Continental Motor stock. From Muskegon comes the report that Detroit brokers are asking owners of the stock there for 30-day options at $40 a share, which is $5 higher than the stock quotes now, and also offer $1 a share to bind the option. Although much of the stock is held by Muskegon people very little is being offered for sale.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	70	71	+3
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	78	82	85	87½	+1
Chalmers Motor Co. com	..	82	150	170	+10
Chalmers Motor Co. pfd	91½	93	98½	100	..
Chevrolet Motor Co	..	..	160	162	+13
Electric Storage Battery Co	49	50	63½	66	+ ½
Firestone Tire & Rubber Co. com	400	403	745	755	..
Firestone Tire & Rubber Co. pfd	108	109½	113	115	..
General Motors Co. com	95	96½	480	485	+15
General Motors Co. pfd	96	96¾	113½	114	+ ¾
B. F. Goodrich Co. com	34	35	74½	75½	+2
B. F. Goodrich Co. pfd	98½	100½	116	117	..
Goodyear Tire & Rubber Co. com	192	194	340	344	+2
Goodyear Tire & Rubber Co. pfd	104½	105½	115	117	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	..	..	22	25	+3
International Motor Co. pfd	..	..	35	40	+3
Kelly-Springfield Tire Co. (com)	111	112	..	..	..
Kelly-Springfield Tire Co. (com. new)	..	..	74¼	75	+5¼
Kelly-Springfield Tire Co. 1st pfd	83	85	96	97	+1
Kelly-Springfield Tire Co. 2d pfd	118	125	..	..	..
Maxwell Motor Co. com	30⅜	31¼	72½	73¼	+12½
Maxwell Motor Co. 1st pfd	73⅛	73½	85	87	+2
Maxwell Motor Co. 2d pfd	30¼	30½	46½	47½	+1
Miller Rubber Co. com	163	170	235	250	..
Miller Rubber Co. pfd	101	103	112	115	..
New Departure Mfg. Co. com	128	130	172	175	..
New Departure Mfg. Co. pfd	105	108	111	..	..
Packard Motor Car Co. com	..	97½	165	175	—5
Packard Motor Car Co. pfd	93½	97½	102	104	..
Paige Detroit Motor Car Co	..	..	690	715	+15
Peerless Motor & Truck Corp	..	..	27⅛	27½	+ ⅝
Portage Rubber Co. com	34	36	70	75	..
Portage Rubber Co. pfd	85	95	106	108	..
Regal Motor Co. pfd	..	..	..	..	..
*Reo Motor Truck Co	11½	12½	26½	28½	+2½
*Reo Motor Car Co	28½	29¼	33	34	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	54½	56	88	90	+1½
Stewart-Warner Speed. Corp. pfd	101½	..	108½	..	..
Studebaker Corp. com	47	47¾	146	148	+6
Studebaker Corp. pfd	93	95	112	114	—1
Swinehart Tire & Rubber Co	73	75	87	90	—1
Texas Co.	132	133	201½	204½	+10
U. S. Rubber Co. com	55½	56½	53½	53¾	+2
U. S. Rubber Co. pfd	102½	103	109¼	110	+1¾
Vacuum Oil Co	180	181	224	228	+4
White Motor Co. (new)	..	..	..	..	..
Willys-Overland Co. com	115	116	234	235	+6
Willys-Overland Co. pfd	100	101	105½	106	+1½

*Par value $10.

The Week in the Industry

Motor Men in New Roles

Murray Duplex Power Secretary—Fred Murray has been appointed secretary of the Duplex Power Car Co., Charlotte, Mich., succeeding the late M. J. Lampson.

Biggam Detroit Trailer Sales Mgr.—H. F. Biggam has been appointed sales manager of the Detroit Trailer Co. He was formerly with the Troy Wagon Works, Troy, Ohio.

Scothorn Joins Steel Products—R. J. Scothorn, formerly manager of the Detroit office of the Columbus Bolt Works, has joined the sales department of the Detroit Steel Products Co., Cleveland, Ohio.

Baily Body Adds—The Baily Mfg. Co. North Wales, Pa., which manufactures automobile bodies, is extending its plant to more than double its present capacity.

Baumbach Appointed Manager—W. L. Baumbach, secretary and treasurer of the Badger Tire Repair Co., 454 Jackson Street, Milwaukee, State agent for the Kelly-Springfield tires, has taken active charge of the business as general manager.

Los Angeles Cole Changes Hands—The Cole Motor Car Co., Los Angeles, Cal., which has been operated as a factory branch under the management of Ed. F. Harris, has been taken over by J. L. Irving, who has been distributer of the Enger in southern California and Arizona for the past year. The Irving Motor Car Co. is now distributer of both lines, and Ed. F. Harris has been appointed sales manager by the head of the concern, Mr. Irving.

Morehouse Joins H. A. L.—J. C. Morehouse who during the past two years was a traveling representative of the Maxwell Motor Co. has been appointed sales manager of the H. A. Lozier Co., Cleveland, Ohio, which makes the H. A. L. twelve.

Bayless Joins Champion Plug Co.—B. H. Bayless, formerly in charge of the advertising department of Berdan & Co., Toledo, Ohio, has joined the advertising department of the Champion Spark Plug Co., Toledo, Ohio, where he will assist H. L. Corey, advertising manager.

Wheeler Bowser Advertising Manager—C. D. Wheeler of Philadelphia is to be advertising manager of S. F. Bowser & Co., tank and pump manufacturers, Fort Wayne, Ind., to succeed G. A. Townsend, who resigned a short time ago. Mr. Wheeler for a number of years was advertising manager of the Fort Wayne Electric works; later he accepted a responsible position with the Santo Vacuum Cleaner Co., Philadelphia, where he has since resided.

Niblette Forms Tire Co.—The Niblette Rubber Co. has been organized, with H. B. Niblette at its head, to handle the products of the Rubber Products Co., Barberton, Ohio, manufacturer of Stronghold tires. The Niblette Company will be located at 1777 Broadway and will open for business immediately. Mr. Niblette severed his connection with the Goodrich Rubber Co. Jan. 1. For 5½ years he served as manager of the Goodrich branch at Buffalo, and for 11½ years previous to his Buffalo connection, he was connected with the New York branch of the same company.

Maus Joins Fisk Staff—J. B. Maus, for the last two years Eastern district manager of the Batavia Rubber Co., has joined the Fisk Rubber Co. of New York, where he will have charge of the export department at the general offices in Chicopee Falls, Mass.

Mr. Maus has been in the tire business for ten years.

The Automobile Calendar

March 18-25	Pittsburgh, Pa., Twelfth Annual Show, Automobile Dealers' Assn., Motor Square Garden.
March 25	San Diego, Cal., 50-Mile Automobile Track Race at Fair Grounds.
March 21-25	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
March 22-25	Lexington, Ky., Show, Woodland Auditorium.
March 25-April 1	Wheeling, W. Va., Show, Market Auditorium.
March 27-April 1	Danville, Ill., Show, Eastern Illinois Dealers.
March 27-April 1	Johnstown, Pa., Show, Auditorium; Johnstown Auto Show Promoters. A. E. Oldham, manager.
March 27-April 1	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 1-8	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 3-8	Twin Falls, Idaho, Show, Oliver Tabernacle, B. H. Fuller, Mgr.
April 8	Corona, Cal., Race, Citrus Belt Racing Assn.
April 10-15	Seattle, Wash., Show, Arena.
April 12-15	Champaign, Ill., Show, Gymnasium Bldg., University, Ill.
April 14-16	Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
April 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power & Automobile Show, Automobile Industries Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway Race.
May 31	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 28	Des Moines, Iowa, Speedway Race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
Aug. 5	Tacoma Speedway Race. Tacoma Speedway Assn.
Aug. 11-12	Pikes Peak, Colo., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race. Riegel-Hiller Co.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Race.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City Sheepshead Bay Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race. Indianapolis Motor Speedway.

The AUTOMOBILE

Vol. XXXIV,
No. 13

NEW YORK, MARCH 30, 1916

Ten cents a copy
Three dollars a year

GRAY & DAVIS

Establish a Laboratory

In Detroit

IN order to afford maximum co-operation to manufacturers in Detroit and vicinity, Gray & Davis have established an engineering laboratory at 1602 Woodward Avenue, Detroit. In the past, engineering problems connected with electric starting-lighting were handled at the Boston plant, but under the new plan automobile designers will have the services of the Detroit laboratory at their disposal.

The laboratory will be under the management of C. M. Tichenor, long associated with Gray & Davis as engineer and factory superintendent. He will be assisted by a capable staff. A complete line of Gray & Davis systems are part of the laboratory equipment, and these units will be available for instant attachment on various engines, thus expediting experimental work in connection with new installations.


Ford

Vol. XXXIV New York—Thursday, March 30, 1916—Chicago No. 13

The Automobile

The Problems of Kerosene

Turning Kerosene into a Readily Combustible Gas, Less Easy Than to Vaporize Light Petroleum—Engines Easier to Make Than Carbureters

By A. Ludlow Clayden

TAKE an ordinary atomizing spray such as is used for medicinal spraying or for perfume, fill it with good light gasoline and then, whether the bulb be operated gently or vigorously, a fine blue flame will be obtained on placing a match to the nozzle.

Repeat the experiment with kerosene and the same clear flame will result, if the spray is worked vigorously, but, if it is operated gently the character of the flame will change; it will grow colored and finally, smoky.

Carry the spray close to a furnace wall and it will be seen that the clear flame is still obtainable from the kerosene with a fairly gently spraying, but the impure combustion is still produced by a very slow action of the bulb.

A well-known British engineer who had given much study to the kerosene carbureter problem was once asked what was the fundamental difficulty; why was it that an engine would run well at a good rate of speed on so many kerosene carbureters, but commence to misfire and choke directly the throttle was closed? He answered by asking another question. "Suppose," he said, "you had a furnace designed to take small knobs of coal at the rate of twenty a second and suddenly you changed the supply to lumps as big as your head at twenty a minute, what sort of a fire would you expect to get?"

That, in a sentence, is the explanation of the fundamental difficulty of kerosene carburetion.

The Process of Carburetion

In an automobile engine we take a liquid, spray it into fine particles, mix it with air, compress it and set fire to it, all within a small fraction of a second. In this small element of time four distinct things have to happen: First, the spraying of the fuel; second, its admixture with air; third, its compression; and fourth, its ignition. One might add a fifth requirement which is that the final charge shall burn completely in the small space of time taken by the piston to make its descent on the power stroke.

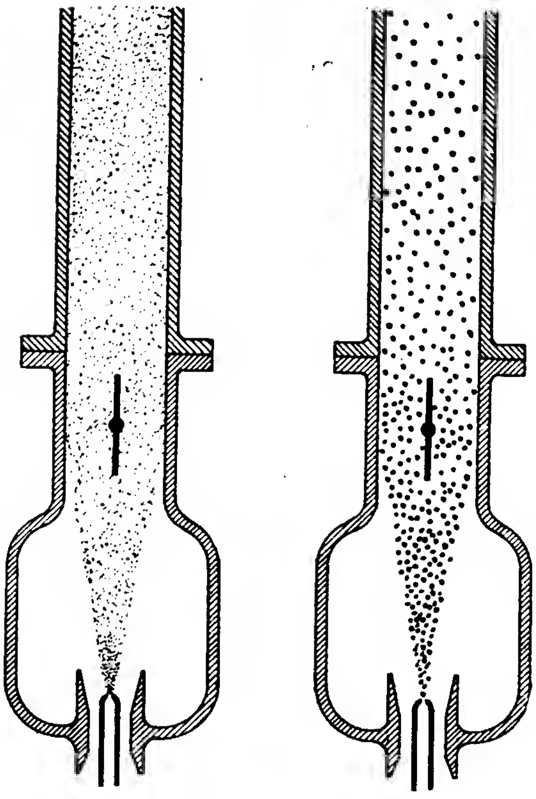
Gasoline, the old sort that we used to get some years ago, is a liquid that is easy to divide into fine particles by spraying; the spray once formed mixes readily with air, and the resulting mixture burns rapidly when compressed and ignited. Kerosene, being denser, is more difficult to separate into fine particles, is less easy to spread evenly throughout a bulk of air after spraying and does not burn so easily after ignition.

In other words, kerosene is more difficult to convert into an explosible gas and burns less readily when so converted. It is a matter of degree, there is no sharp line between gasoline and kerosene, but carbureting systems that work perfectly with a really light spirit, operate less successfully with a heavier grade, and the point where they will cease to operate with even moderate satisfaction is reached eventually as we increase the specific gravity of the petroleum.

The Human Analogy

To stretch a point it is possible to make a human analogy between gasoline and kerosene carburetion. The primitive South American Indian lived a life where nature supplied his every need. The climate caused his food to fall from the trees and spring from the ground without the need for tillage. The civilized man, developing sterner countries, struggled with nature and won by his skill in raising crops from less productive soils.

So with this problem of carburetion, gasoline converts to gas without coercion, kerosene resists until compelled by forces greater than its inherent powers of resistance.



Diagrammatic representation of difference between gasoline and kerosene spray at full throttle opening

The Effect of Temperature

Imagine a rain cloud letting fall small drops of water gently. If the air beneath is below freezing the drops will reach the earth as globules of ice. Assume the air warmer, a trifle above freezing up to say 60 deg., and the rain will fall as such, reaching the ground in drops and wetting the earth on which it falls. Raise the temperature still further, to 100 deg. say, and the rain, if fine enough, will dissolve in the air as it falls; it will merely create humidity and will not reach the ground till the air is saturated or chilled by the fall.

Air is to gasoline hot; to kerosene it is in the intermediate stage, to crude oil it is little better than freezing.

There is another thing to be remembered in this connection. Following the same analogy, imagine the air above 212 deg. Then the falling rain would turn to steam and we should have an atmosphere composed of mixed air and water in gaseous form, *not* wet air. In vaporizing gasoline or kerosene the aim is to have air wet with the fuel, but not dripping wet. To have air that has picked up oil and holds it in suspension, air that is neither hot enough to boil it nor cold enough to let it recondense into drops. With the first product of petroleum distillation commonly called gasoline, air at normal atmospheric temperatures is at just about the correct degree of heat. For kerosene it is considerably too cold.

Density a Problem of Its Own

So far it might seem that the solution of the kerosene carbureter problem consisted merely in the provision of enough hot air, but this is not entirely all. If the expansion and compression of air had no effect upon its ability to hold liquids in gaseous suspension, then heat would supply every need; but air entering an automobile engine is first expanded and then compressed and this upsets the condition of any liquid suspended within it.

Air enters the engine because it is sucked in, which means that the descending piston makes a "hole in the atmosphere" so to speak, and the outside air rushes through the inlet valve to fill the "hole." To do this it has to pass through the carbureter and by the valve and these things put resistance in the way, which means that the pressure inside the cylinder at the middle of the intake stroke is smaller than the pressure in the manifold, and the pressure in the manifold is smaller than that of the atmosphere outside. If this were not so there would be no inward flow whatever.

Now, air saturated with a liquid, as it is in passing the spray nozzle of a carbureter, throws down some of that liquid in the form of drops immediately it is rarefied, which means that air entering an engine and saturated at the nozzle, deposits some of the fuel in the manifold and still more inside the cylinder itself.

Liquids form drops when they condense because of the surface tension which is present in all liquids. The size of the normal drop formed depends upon the tension, which is variable, and the surface tension of kerosene is greater than that of gasoline. This means that when saturated air carrying kerosene vapor expands and so throws down some of the kerosene, the drops formed are larger than would be drops of gasoline deposited under similar circumstances.

Again, when deposition occurs inside the cylinder, the heat resulting upon compression tends to cause re-vaporization. Here the kerosene is at a further disadvantage for two reasons. Firstly it needs a higher temperature to vaporize a drop of kerosene and secondly, the drop being larger a given temperature takes longer to accomplish the vaporization.

With gasoline as a fuel there is no doubt but that substantial drops of liquid do actually enter the cylinder or are deposited there; they are either vaporized during the compression stroke and then burnt as gas, or they are *both* vaporized *and* burnt during the explosion stroke. This can sometimes happen with kerosene; it need not always happen with gasoline. When the exhaust of an engine is smoky and strong smelling, not due to lubricating oil, it means that the exhaust contains drops of fuel that are still only partly consumed and are being wastefully burnt in the open atmosphere.

Thus it is obvious that it is fundamentally less easy to obtain a good efficient gas from kerosene.

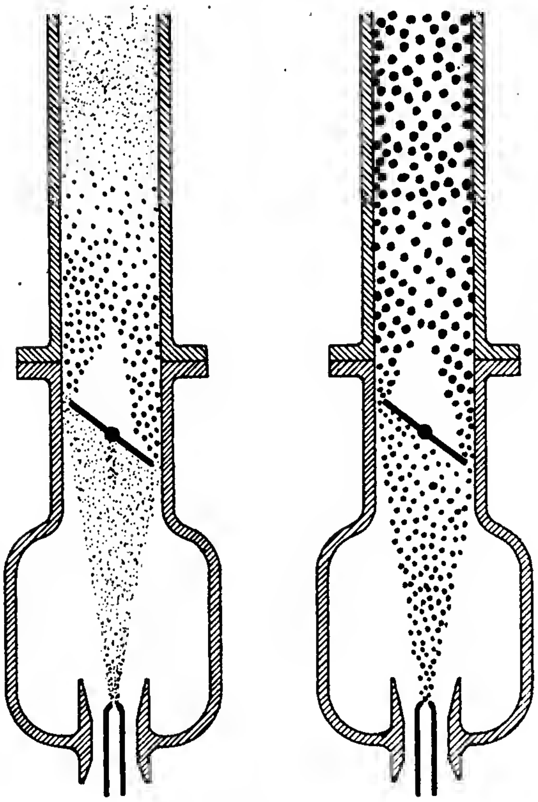
Disorganizing Effect of Throttling

This is not difficult of solution, if we consider only one condition of running. Assume a certain setting of the carbureter, a certain speed of inflow of air and consequently a certain degree of compression accruing in a definite time element, and it would be easy to find the right degree of heat to apply to the incoming air to secure proper vaporization of the kerosene; always providing that it was divided finely enough in the spray nozzle to enable the air to absorb it in the limited time.

But this is not the condition of running of an automobile engine for more than a few moments at a time. Suppose everything is arranged for running at 1000 r.p.m. with full open throttle, as for example climbing a moderate hill. When the top is reached the throttle may be closed, leaving the speed the same. If this happens the closing of the throttle restricts the passage of the air, the pressure within the manifold and the cylinder is lowered and the air inside has no longer the same retaining power for vapor. Of course the air is picking up less kerosene from the nozzle because less air is passing it, but we must remember that the rarefied air is all the time trying to throw down the liquid; the liquid is trying to form into drops. To hold any liquid whatever at the lowered pressure the air must be hotter than it required to be with the throttle fully open and, the compression being lowered, there is less heat instead of more available for re-vaporizing such fuel as does condense. Furthermore, the fuel is sprayed no more finely on account of the lessened velocity past the nozzle, rather the contrary is true.

Suppose the throttle is left open and the speed increases as the level road is reached. This also upsets the equilibrium for increasing the speed of flow is accompanied by a drop in pressure in the manifold and the cylinder, while also affecting the character of the spray. These same changes in condition occur whether the fuel is gasoline or kerosene, but the ease of dividing the lighter liquid into a very fine spray together with the wide range of temperature during which it will remain suspended in the air make it possible to run an engine on gasoline at all the speeds and throttle positions required in automobile service without special provision for supplying heat. Kerosene being a less amenable fluid cannot be so used unless the proper amount of heat is supplied at the proper point and kept under proper control.

This sounds simple, but how far from simple it really is the thousands who have tried to overcome the problem can tell. There are all sorts of ways which will *approach* a solution, which will give a passable result, but no device has yet been shown to be capable of giving *exactly* the same results as a good gasoline carbureter fed with good gasoline, and applied to an ordinary type of gasoline engine in the conventional way.



Diagrammatic representation of difference between gasoline and kerosene spray at low throttle opening

The foregoing has given only some of the reasons for the difficulty of proper kerosene carburetion. Another cause, which is frequently overlooked is the fact that the limits of proportion for a combustible mixture of kerosene and air are much narrower than those for air and gasoline. Various experimenters who have studied the question scientifically have decided that ignitible gas is formed by gasoline vapor mixed with air in the proportion of anything between 1 per cent and 5.3 per cent; whereas vaporized kerosene has only about half this latitude. This means that if we design a carbureter to give a normal mixture of 3 per cent gasoline vapor to air, it can run weak down to 1 or rich up to 5 per cent and still fire regularly in the engine. A kerosene carbureter designed for the same normal could not operate weaker than 2 per cent nor richer than 4 per cent. This, of course, means that the valves or compensating jets making up a kerosene carbureter must be just twice as accurate in functioning as they need to be in a gasoline instrument.

Limitations of Heating

It has been stated that the solution of the problem is not merely the supply of very hot air, and the reason for this has been explained partially. It is now time to point out a chemical reason why the degree of heat that can be employed is limited.

Kerosene is a mixture of oils of all sorts of density and all sorts of characteristics from the vaporization viewpoint. Each of these oils has its own igniting temperature and the range covered is a wide one. Thus, if kerosene is fed into air that is hot enough to vaporize the heaviest fractions in it, the lighter fractions can easily be ignited and partially burnt before the charge enters the engine.

In the process of making gasoline from kerosene by cracking, the oil is subjected to considerable heat and also to pressure, the products being gasoline plus some heavy oil plus some tarry matter. If, therefore, a kerosene vaporizer is designed so that it gets hot enough to start cracking it is inevitable that trouble will arise from tarry deposits, either in the vaporizer or in the engine itself.

Two Lines of Possibility

So far the term kerosene carbureter has been used in a loose sense and it is now time to define more accurately the difference between a carbureter and a vaporizer. In a carbureter the liquid and air are simply mixed by mechanical spraying and there is no temperature regulation. In a vaporizer heat is utilized to convert the fuel into vapor in the presence of a small quantity of air which thus becomes saturated or nearly so, and this saturated "gas" is then mixed with more air before passing into the engine. In the case of the carbureter we mix air and fuel direct, in the vaporizer we mix air and vapor and require an additional piece of apparatus to convert the liquid into vapor.

Those who have attacked the problem scientifically are frequently of the opinion that the most satisfactory basis for working out a kerosene carbureter is to pass something less than 20 per cent of the air through the vaporizer and to mix this with the remaining 80 per cent immediately before the charge passes into the engine cylinder. The effect of this is, theoretically, much the same as the direct admixture of a volatile spirit and air. Suppose the kerosene vapor to be hot and perfectly dry, as soon as it meets the cooler main air supply the liquid immediately turns to a fog or an infinite number of minute particles, forming much the same mixture as is obtained through the direct spraying of gasoline into the whole air charge in a good carbureter. It is at this very point that the greatest difficulty occurs. The fog of kerosene is very unstable and sudden changes in temperature or pressure can make it throw down big drops of liquid very rapidly. Remembering the furnace analogy, if the fog of correct mixture resembles the many small pieces of coal evenly spread over the grate it needs very little to instantly change the charge to the few scattered lumps "as big as your head" whereupon combustion either ceases altogether or becomes very imperfect.

This means that there are two distinct difficulties in using kerosene. Firstly, in order to form a proper fog we have to do something besides spraying the fuel; we have to apply just the right amount of heat and to control the proportions of air used in forming the vapor and air used in diluting the vapor with great accuracy. Secondly, having thus obtained the fog, or readily combustible mixture of kerosene and air, we have then to so control its pressure and temperature that it does not lose its character until the actual instant of ignition.

Trouble Caused by Throttling

In a gasoline carbureter the amount of fuel picked up is controlled by the amount of air passing through, and by closing the throttle we restrict the amount of air. This restriction, as already mentioned, causes a considerable drop in pressure in the manifold. Even with gasoline this pressure drop causes some to condense, but this can be prevented by warmth as supplied by a water-jacketed manifold.

With kerosene the drop in pressure caused by the throttle produces a much heavier condensation and the simple application of heat cannot cause re-evaporation. Once let the "fog" turn to large drops and those drops must go through the vaporization process of mixing with a little air and proper heat before they can be returned to the fog condition. Worse than this, heat cannot prevent the condensation from taking place if the drop in pressure is severe unless the temperature is so high that it will start cracking the kerosene. Thus to get perfect combustion it appears that we cannot superimpose a throttle upon a kerosene vaporizer in the same simple manner that is possible with gasoline carbureters.

Many Possibilities

All the foregoing may give the impression that this problem of kerosene burning is terribly difficult and might suggest that there is little hope for a vaporizer that is nearly as simple as a gasoline carbureter. In a sense this is the truth, and in another sense it is not so. There are many different devices which have been tried from time to time, and many that are now being experimented with, which give fairly good results. If we are prepared to sacrifice some of the flexibility of the engine, as can be done on trucks and to a still greater extent on tractors, it is easy to buy a vaporizer that will do its work well and economically. It is a matter of the difference between that which is perfection and that which is sufficiently satisfactory for use. With good gasoline and a good carbureter we can obtain a perfect gas for a wide range of speed and load. With kerosene we cannot obtain as good a gas over as wide a range., and the purpose of this analysis of the problems is to show in general terms why kerosene is so much more difficult to handle.

There is no fundamental, insurmountable difficulty preventing the general use of kerosene in automobile engines. It is possible to design a vaporizer to give perfect results, but such an instrument would be quite elaborate and would probably need the manipulation of more than one control lever or pedal when altering the speed of the engine while running.

The gasoline carbureter began in a very simple form because of the highly volatile spirit that was then obtainable. The kerosene vaporizer is beginning in complicated shape, but the whole history of engineering goes to show that a proper study of both the chemical and mechanical problems involved will enable simplifications till the ideal is attained.

Special Types of Engine

Hitherto it is the problem of making a vaporizer for the ordinary kind of automobile engine that has been considered, but there is another way of attacking the question and this is by devising a complete engine for the use of kerosene or some oil heavier than gasoline.

Fundamentally the gasoline automobile engine is a gas engine, its power being obtained from the explosive force of a mixture of *gas* and air. There are other oil engines which use the liquid fuel as a liquid, without previous vaporization. There is also an intermediate type burning part gas and part liquid.

These engines are all heavy, are clumsy as compared with automobile engines and have a narrow range of speed with a low maximum. Yet this was also true of the gas engine from which the automobile motor has been developed. There is no reason why the true oil engine should not be capable of development into a high speed, light type also. It has taken twenty years and more of concentrated effort to produce the automobile engine, most of the development taking place in the last ten years. In the light of the knowledge obtained regarding the materials, the lubrication and the mechanical things generally which we now possess, it should not take long to develop a high speed *oil* engine if a number of our automobile engineers gave the problem their sincere attention.

In the Diesel engine, which is the most economical engine ever made, the power is derived from the heat of the combustion of a liquid and not from the force of explosion of a gas. Into the cylinder pure air is drawn; this air is compressed to a high degree and, when fully compressed, oil is injected in a fine spray. The temperature of the high compression is such that the oil takes fire and burns, evolving heat and driving the piston down. The injection of the oil continues for a large part of the power stroke being maintained long after combustion has commenced.. Power is controllable by variation in the duration of the injection; whatever oil is injected is burned up completely and either a small amount or a large amount can be employed by varying the cut off of the injector valve. The hot bulb engine, sometimes called the semi-Diesel (a peculiarly inapt term) draws in pure air and compresses it to a much lower degree than is done in the Diesel cylinder. Part of the cylinder head, usually an attachment of globular form, is kept at a temperature something below red heat and against this surface a jet of oil is injected by a small pump as the piston passes over the top dead point. This oil catches fire and burns, but it is also partly cracked by contact with the hot bulb and the lighter fractions may explode as a gas. Similarly the heavier fractions may fail to burn altogether. In the Diesel engine there is no time for cracking, the oil lighting as it emerges from the jet.

Has Internal Vaporizer

The hot bulb engine is really an engine with a vaporizer contained within the cylinder, and though this inclosure reduces the trouble of vaporization while the load is steady and the temperature and pressure in the cylinder also fairly constant, as soon as an attempt is made to vary the power very much by altering the amount of the oil supplied all the usual vaporizer troubles enter and imperfect combustion results.

The difficulty of applying either Diesel or hot bulb engines to any service requiring greatly varied power small in total amount is that the only control is on the quantity of fuel delivered into the cylinder during the power stroke. A big Diesel engine taking perhaps a wineglass full of oil per stroke can be controlled easily, for there is no mechanical difficulty in dividing that amount of oil into two equal parts or even cutting it down to a tenth or less of the total. When, however, we want a drop or two per stroke it is a very different mechanical problem to provide ready means for cutting down to a tenth of a *drop* or less. However, there is no impossibility. Given sufficient money and permitting a large amount of delicate apparatus a small, high speed Diesel engine with a delicate control could be built without very much trouble. It would be too complicated and probably too heavy for automobile use, but that does not mean it is essentially so. Development ought to enable simultaneous reduction of both weight and complication.

Needs Combined Effort

Whatever may be done to develop kerosene carbureters for existing types of automobile engine, and whatever may be done to develop new and better types of true oil engine, there is no doubt that it will necessitate the combined efforts of all automobile engineers. There is no great discovery to wait for that will show us a royal road to success. It is a matter that can be solved by work, and a matter that calls for the freest interchange of thought.

Every man to-day who holds what he thinks to be a valuable secret and tries to keep it to himself is a traitor to his industry. The automobile industry is a big thing to-day; if we can solve this heavy oil question it is going to be infinitely bigger to-morrow.

Increasing the Thermal Efficiency

Possibilities of Altering the Otto Cycle Engine to Obtain 15 or 20 Per Cent Better Fuel Economy

By C. E. Sargent*

IN order to properly comprehend the problem of increasing the thermal efficiency of internal combustion automobile engines $\left\{\frac{\text{heat converted into useful work}}{\text{total heat supplied in fuel}}\right\}$ we will refer to diagram Fig. 1, in which, of the 100 per cent of heat supplied, 20 per cent is converted into work and 80 per cent lost or rejected in friction, cooling water radiation and exhaust.

To convert more heat into work it will be necessary to decrease one or more of the losses indicated, all of which are characteristic of internal combustion engines.

Mechanical Efficiency

With good workmanship, force-feed oiling and light reciprocating parts the mechanical efficiency $\left\{\frac{\text{b. hp.}}{\text{i. hp.}}\right\}$ is about as high as can be expected, and we may look for no further appreciable gain from that source; as a matter of fact, but 5 per cent of the total heat supplied seems a small amount for engine friction.

Waterjacket Losses

The loss of heat to the water jacket depends on the *difference* in temperature between the burning gases and the cylinder walls, the *time* the cylinder walls are exposed to the heat of the flame and the surface *exposed.* If we could maintain the combustion chamber at the same temperature as the inclosed gases there would be no difference in temperature and no transmission of heat, consequently no loss to the walls and water jacket, but such a temperature would not only destroy all vestige of lubrication, but would melt the cylinder walls and pistons.

The time per working stroke in which the difference of temperature exists is cut down by high speed, wherein lies the advantage of high piston speed in an engine of this type. The thermal efficiency of big guns lies in the missile speed—nearly 3000 ft. per second—while the maximum piston speed obtained in an engine cylinder probably never exceeds 40, and seldom averages over 20 ft. in the same unit of time. One of the most economical internal combustion engines ever designed had a free piston, which, returning to the cylinder by gravity, converted more heat units into work than has any engine with a restricted piston.

While the ratio of the explosion chamber surface to the volume it contains is one efficiency factor, and the requirements of a minimum quotient the rational reason for valves in the head, the advantages of multi-cylinder engines with their high speed, light reciprocating parts and minimum angular velocity variation seem to offset any thermal losses due to increased surface per unit of volume, a characteristic indigenous to this type.

Exhaust Losses

While small gains in efficiency have been made by reducing the mechanical friction and decreasing the losses to the water-jacket, loss of heat to exhaust is little considered.

Several compound engines of the internal combustion type have had a mushroom existence, but when one considers the added surface of a larger cylinder and the time in which the pressure after ignition drops to less than the pressure of compression, we see the improbability of reducing the losses by this means.

The ordinary engine is more efficient at full load then at partial load, but unfortunately the automobile engine operates at partial load most of the time, therefore, if we would increase the b. hp. per unit of fuel or the miles per gallon, it should be so designed that its thermal efficiency is greatest with average or partial loads, or at least is no less than with full load. In order to thoroughly comprehend our problem let Fig. 2 represent an indicator diagram of an internal combustion engine developing its full power, in which *AB* represents the piston stroke and atmospheric line; *C* the highest compression; *CD* the firing line; *DE* the expansion line and *E* the exhaust opening.

A cylinder full of mixture (*AB*) is compressed to *C* and ignited, raising the pressure to *D*, and as the piston moves down the pressure drops to *E*, where the exhaust opens. It is necessary to open the exhaust valve from 40 deg. to 60 deg. before the end of the working stroke in order to get rid of the back pressure on piston during the exhaust stroke. The release of this pressure, 30 to 40 lb. absolute, with its accompanying "bark," visible flame and red-hot exhaust manifold, is ample evidence of thermal inefficiency, even without the proof deduced by a diagram analysis, or heat balance.

Increased Expansion

If, instead of releasing a less volume of hot gas than the volume of cold mixture at the beginning of compression by opening the exhaust at *E*, Fig. 2, we carry the expansion of the burning charge 50 per cent further; releasing the gases at a lower pressure, at a lower temperature and at a point nearer the end of the working stroke, more heat will be turned into work, because less will be rejected in exhaust, less power will be required to open the exhaust valves, and the function of the muffler will become extinct. Fig. 3 shows a full load diagram of an engine carrying the expansion 50 per cent longer than the compression stroke, in which *AB* represents the length of cylinder and atmospheric pressure. The piston, starting at *B*, the beginning of stroke drawn in a charge to *G*, when admission is closed, and the absolute pressure in cylinder drops to *F* when piston reaches *A* at the end of the stroke. *FC* represents the compression line which crosses the atmospheric line at *G*.

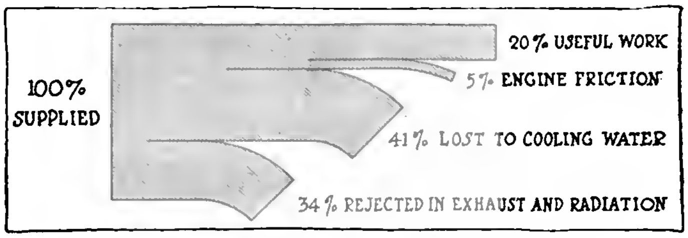


Fig. 1—Distribution of heat consumption

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*Chief Engineer Lyons-Atlas Company.

With the same clearance as an engine having a stroke *BG*, the compression *BC*, the firing line *CD* and the expansion line from *D* to *E*, with the same mixture and timing, would not vary from those of the ordinary engine, but the shaded portion of the diagram *EAG* would represent the gain in power, using the same amount of fuel, by expanding 50 per cent more than the induction stroke.

The shaded portion of the diagram averages 16 per cent to 20 per cent of the whole, indicating a 20 per cent to 25 per cent increase in thermal efficiency, or a corresponding increase in power from the same amount of fuel. An engine using such a cycle may weigh a little more per horsepower output, just as a long-stroke motor is heavier than an engine with a square cylinder, and on account of the long stroke per pound of m.e.p. may have more mechanical friction, but, while the cooling surface per heat unit introduced is increased, the difference in temperature during the last third of the working stroke is so slight that an additional transfer of heat seems improbable.

The exhaust of an engine expanding its burning charge 50 per cent more than its compression stroke shows but a trace of flame, an evidence of complete combustion in the cylinders, where it belongs, and a reduction of the terminal temperature of about 1000 deg. Fahr. If the thermal efficiency is increased, the disposition of the rest of the heat is immaterial, though observation indicates that, while the loss in friction and water jacket is but slightly increased, the exhaust loses what the thermal efficiency gains. The average heat balance of five full load tests from a 50-hp. 10 by 20-in. engine, cutting off at about two-thirds its stroke, using the high value of fuel, is as follows:

Thermal efficiency on b. hp.	26.02
Engine friction	4.86
Radiation and exhaust	22.59
Water jacket	46.48

Of course, this high efficiency would be obtained only at full load or with an open throttle, a condition that seldom occurs in an automobile engine.

Partial Load Inefficiency

With an advanced ignition and a throttled mixture with its low compression an ordinary automobile engine, the terminal pressure will approach atmospheric, but the loss from wire drawing and the low compression is probably more serious than the exhaust gas losses at full load.

Fig. 4 shows the diagram of the ordinary automobile engine developing but partial load with the ignition advanced to compensate for the slow burning mixture, in which *AB* represents the atmospheric line and the piston travel; *BF* the rarefaction during the induction stroke; *FC* the compression; *CD* the firing, and *DA* the expansion line. The shaded portion shows the back pressure or loss in every cylinder during the partial load. As the area of the shaded part of the diagram, or the negative load, must be offset by a like amount of area above the atmospheric line, the fuel consumption of an idling engine is necessarily great, and because the average load on an automobile engine in which the intake is throttled necessarily has some back pressure, the thermal efficiency must be low.

The Negative Load

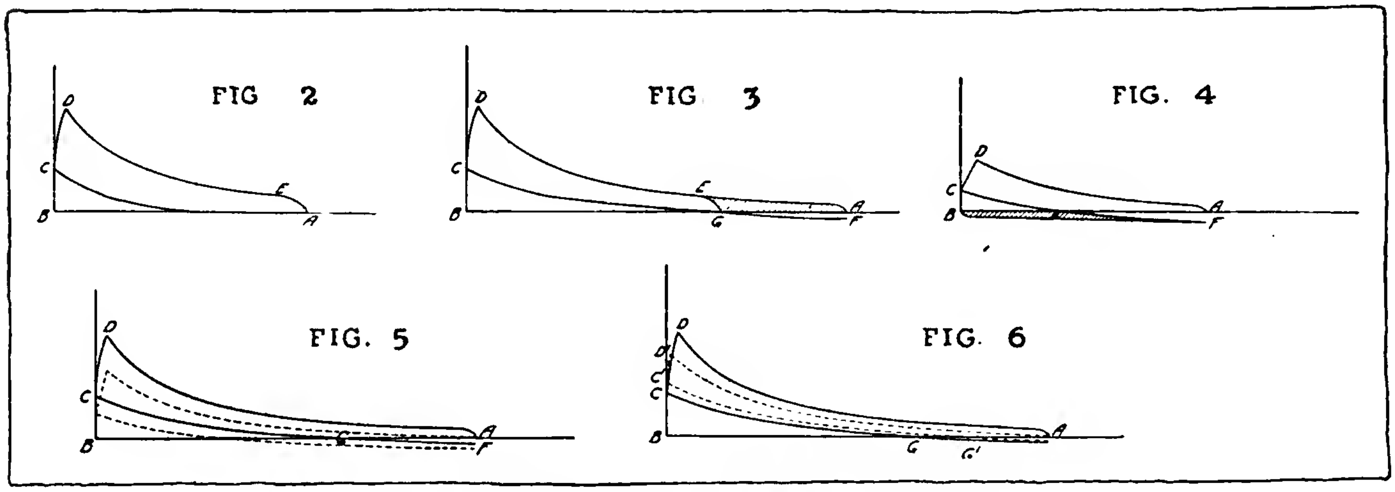
Tests have demonstrated that an engine driving a car on a smooth road at 20 m.p.h. will require no more fuel than when idling at the same speed. Every engine whose speed is regulated by the throttle opening develops a negative load which must be overcome by an equal positive pressure before it will deliver available power. This negative load decreases with a wide-open throttle, a condition, however, seldom obtained. The absolute pressure in the inlet manifold when car is operating at about one-half its maximum speed, or say 20 m.p.h., averages about 8 lb., therefore approximately 7 lb. more m.e.p. than the net load requires, is necessary under the average condition. When idling, an engine may be working against from 10 to 12 lb. back pressure, a sufficient cause for its high fuel consumption under no load. Tests of a 4½ by 5½-in. six-cylinder engine in 1912 by the Automobile Club of America showed the following thermal efficiencies:

Full throttle, r.p.m. 1113	17.8%
One-third throttle, r.p.m. 1039	15.1%
One-sixth throttle, r.p.m. 266	6.2%

The loss from low compression caused by a greater surafce for heat absorption per unit of volume is not shown on diagram, but manifests itself when a heat balance is obtained. As the load becomes lighter, the compression less, and the mixture weaker from having a larger per cent of carbon dioxide, the inflammation is necessarily slower, and the desirability of an earlier ignition is apparent if the maximum efficiency under adverse conditions is desired. While the car driver could, if he would, keep his ignition as early as possible consistent with smooth running, and in so doing maintain the highest possible efficiency, the ultimate solution of the timing problem for our present motors, in the author's opinion, is to automatically advance the time of ignition directly as the speed and inversely as the load—a combination which will insure the best economy during all ranges of load. With a late spark and slow burning mixture it is possible to generate more heat in the exhaust manifold than in the engine cylinders.

Cut-Off vs. Throttling

In order to prevent the wire drawing loss shown in Fig. 4, closing the admission valves earlier instead of throttling the



Indicator diagrams under varying load and running conditions mixture will reduce the m.e.p. without creating a back pressure, eliminating light load losses except those indigenous to low compression.

If the maximum cut-off is two-thirds the working stroke, Fig. 3, other conditions being the same, and we make this cut-off earlier as the load decreases, we will maintain a higher thermal efficiency during the whole range of load than is possible in the automobile engine controlled by a throttle in the suction pipe.

A carbureter properly designed for efficiency should provide a weaker mixture as the compression increases. A mixture too weak to ignite at atmospheric pressure will fire and do work if sufficiently compressed. A rich mixture is necessary in starting and with partial load, because the exhaust product content being constant and the compression less, the combustible molecules are not sufficiently close for proper chemical action, therefore there should be more of them in the same space to get rapid efficient firing. Blast furnace gas having as low as 90 B.t.u. per cubic feet, making 45 B.t.u. when mixed with a like amount of air, will not burn at atmospheric pressure, yet makes an ideal fuel when compressed to 180 lb. gage. Air containing less than 50 B.t.u. of gasoline vapor per cubic foot will not burn at atmospheric pressure, but when compressed sufficiently high will fire and do useful work.

If the molecules of a hydrocarbon are driven too close to the molecules of oxygen by compression, the generated heat will cause spontaneous combustion, but with a weak mixture high compression is necessary to bring them to a normal ignitable relation, therefore compression may be increased indirectly with the heat units supplied. In a Diesel engine in which the heat of compression is always sufficient for ignition, combustion takes place even with the smallest possible injection of fuel.

It is quite evident, therefore, for efficiency in automobile engines, that the fuel per unit should be less as compression increases to prevent spontaneous ignition and conversely should become richer as the pressure decreases for a high mean effective pressure.

The higher the compression, other things being equal, the greater the thermal efficiency, yet the compression must be below the critical point of premature ignition. If we weaken the mixture as the compression increases, the relation of the combustible molecules will remain constant, maintaining practically the same rapidity of inflammation. If a motor is designed to give a maximum compression and full rated load at two-thirds cut-off, as shown in full line diagram (Fig. 5), a better efficiency will be obtained at full load than is obtained in the ordinary automobile engine, because less heat goes out with the exhaust and more is turned into work. It already has been shown that if the point *G* is moved toward *B* as the load gets lighter, there will be no loss from wire drawing, but as the compression decreases the efficiency will become less, the molecules further apart and inflammation slower. Therefore the ignition must be advanced to obtain the dotted diagram in which the firing line is practically parallel to *CD*. Such a method of governing would materially increase the efficiency at half or partial load, which is the load most usually required of an automobile engine.

As an internal combustion engine which has no compression and fires at atmospheric pressure requires about five times as much fuel per b. hp. hour as an engine compressing to five atmospheres running on the Otto cycle, the desirability of keeping up the compression can readily be seen.

Highest Compression with Light Load

If, instead of moving the point of cut-off *G* toward *B*, leaving the mixture practically constant but taking in less gas, as less load is required, we move the cut-off point *G* toward *A*, or to *G'* (Fig. 6), and at the same time decrease the fuel per unit of air, the compression will be increased, rapidity of inflammation will remain practically constant, premature ignition will be improbable, the thermal efficiency should be practically as high as at full load and the initial pressure should be less, insuring smooth running at light loads. If the fuel is diminished as the compression increases in such a manner that there will be just enough fuel at maximum compression to drive the engine idle, and at the earliest cut-off to give the maximum m.e.p., the adjustment is complete. Should the fuel diminish faster than the compression increases at the latest cut-off, there would be a negative m.e.p. of compression and the engine would stop. Between extremes, full and no load, the fuel compensation is automatic, incurring complete and smokeless combustion. Such a cycle provides for a maximum or at least an average efficiency through the whole range of load. It eliminates the inefficiency of wire drawing and low compression. It provides a fixed fuel adjustment for full load with speed compensation only required. As the load gets lighter the fuel valve is throttled and the closing time of the induction valve retarded, a most simple mechanical problem.

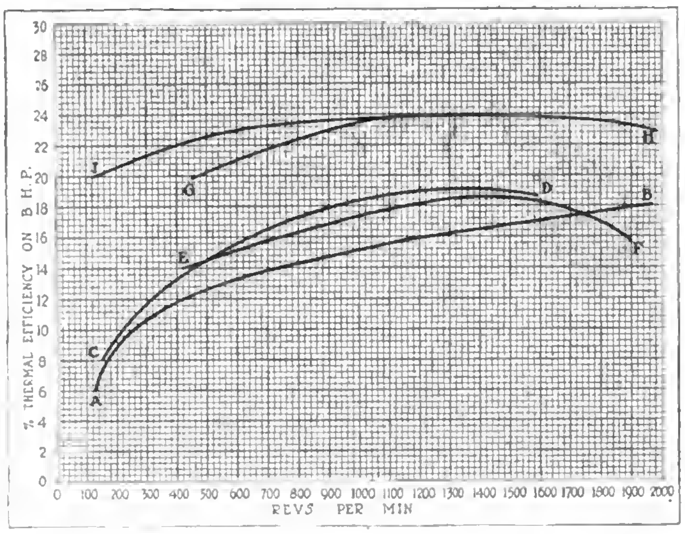


Fig. 7—Thermal efficiency curves from A. C. A. tests plotted against revolutions per minute

In such a cycle the molecular arrangement is such that the speed of inflammation is practically constant for all loads, therefore the time of ignition need be advanced only with the engine speed to get a uniform angle to the firing line.

Volumetric Efficiency

With such a cycle volumetric efficiency

$$\left\{\frac{\text{Volume of induction stroke}}{\text{Volume of gas induced}}\right\}$$

which governs the theoretical compression can be maintained at unity, as the flexible denominator of the equation can be readily varied.

If the compression at two-thirds cut-off and maximum load is 90 lb. absolute, the maximum compression at no load would be practically 144 lb., yet so attenuated would be the mixture that premature ignition would be impossible.

In Fig. 7 thermal efficiency curves *AB*, *CD* and *EF* were obtained from the tests by the Automobile Club of America of automobile engines, and probably show the average thermal efficiency of the majority of engines of this type.

While the available efficiencies of complete expansion engines are for full load and from larger cylinders, the total horsepower is practically the same as the horsepower of the engines from the tests of which the three curves were plotted.

The probable efficiency curve which would be obtained from an automobile engine expanding the working medium

(*Continued on page* 615)

Fig. 2—This interior of the Waltham speedometer shows guard G which protects the aluminum cup

Waltham Speedometer

World's Largest Watch Maker Develops Air-Friction Instrument—Deliveries Started

THE Waltham Watch Co., which five years ago took up the manufacture of automobile clocks and has since been marketing a complete line of these for motor cars and trucks, has further invaded the automobile field by the development of a new-principle speedometer, which it is about to start making deliveries of to automobile manufacturers. The company has taken up the development of this speedometer in the same systematic manner it did its automobile time pieces and has already organized a large department in its factory, the largest watch factory in the world, where it assembles all parts of the speedometer. These parts are being manufactured in the different departments of the watch factory, and watch standards of accuracy are applied to them. The development of this speedometer was started in the experimental department of the Waltham company three years ago and it has been going through the evolutionary stages since. The engineering departments of several large car builders have been utilized in a consulting capacity during this development stage. The instrument is to-day not an untried experiment but a known quantity and several manufacturers have been using it on test cars for months.

Production has already begun and the first lot of 25,000 is going through. The Waltham speedometer has been developed and is being manufactured to meet the demands of quality car builders yet lends itself to application on cars of all prices. That the Waltham company has entered the speedometer field in earnest is attested by the fact that negotiations are already well advanced for a country-wide selling and service system. The speedometer is being sold and guaranteed by the Waltham Watch Co. The Waltham speedometer will be sold separately or in various combinations with its time pieces.

The Waltham speedometer is an air-friction type and introduces a principle new in speed measuring and one which has not been previously used in any form of instrument. This speed-measuring part of the speedometer consists of two essentials called cups, one inverted and telescoping the other, with an air gap separating them. The driving cup is driven by a flexible shaft from the road wheel or transmission system. The driven cup, known as the indicating one, is inverted outside the driving cup. It is the air friction generated in the annular air space between the cups which constitutes the speed measuring medium of the instrument.

The relationship of these two cups is best shown in the lower right, Fig. 3. Each cup is in reality a double cup. Thus the revolving cup, *K*, consists of two concentric brass cups, *K*1 and *K*2, having an annular space 0.108 cm. between the two vertical walls called ribs for convenience. The cups *K* and *K*1 are rigidly mounted on the vertical shaft *S* so that when one revolves both revolve.

The driven or indicating cup *C* consists of two aluminum cups *C*1 and *C*2 attached together so that to all intents and purposes they form a single cup. These cups are extremely light, being made of aluminum 8/1000 of a centimeter thick. This means that 313 of these cup thicknesses would be required to make 1 in.

The aluminum cup *C* when in position in the instrument has the inner rib *C*2 floating in the annular space between the ribs *K*1 and *K*2 of the brass cup. The outer rib *C*1 of the aluminum cup floats outside of the brass rib *K*1. There is an air space at all times of one-half millimeter between the ribs of the brass and aluminum cups. On the outer face of the aluminum cup are the calibration figures to indicate the speed in miles per hour.

Fig. 2 is a photographic reproduction of the interior of the speedometer with the dial removed and shows how the aluminum cup telescopes the brass cup. The revolving of the brass cup generates the air friction which would revolve the aluminum cup also were it not for a regulating hair spring shown in the upper left, Fig. 3. This hair spring is so adjusted as to permit the correct oscillation of the indicating cup according to the speed. This regulation between the hair spring and the tendency to rotate is so accurate that the instrument indicates immediately all speed changes, and indicates as low as one-half mile per hour.

The principle of air friction between revolving concentric cups has been proved to be directly in proportion to the speed of the revolving cup, in this case the driven brass cup. It is this fact that makes a uniform calibration possible without adding compensating devices to gain this end. The principle of indicating speed through air friction is covered

Fig. 1—Waltham speedometer as mounted flush in a cowl or dash, showing trip reset, press button and crown

by patents controlled by the Waltham company. Comprehensive laboratory tests have proved that air friction is not influenced by heat, cold, or altitude up to 10,000 ft. The revolving cups have not to be carried in an air-tight compartment, and no sealing is necessary.

Incorporated in the instrument, Fig. 2, are season and trip odometers, both characterized by having particularly large figures spaced closely together. The odometer figures are black excepting those indicating tenths, which are red on both the trip and season. The trip odometer registers up to 999.9 miles and the season odometer to 99,999.9 miles and repeats. A quick reset device for the trip odometer is featured and appears in Fig. 1. Close to the dial is a press button and adjacent to it a reset crown. By turning the crown, or ball, and without pressing the button you can reset the tenths and total trip; but by pressing the button also you can reset the entire trip mileage ten times as fast.

The separate indicating wheels in the trip and season odometer are placed close together which makes it possible to use large figures. This placing of these wheels so is made possible by the use of an internal sun-and-planet gear drive between adjacent wheels.

In every speedometer what is known as the head incorporating the odometer and speed measuring device, constitutes one part of the instrument and the second and equally important part is made up of the flexible shaft together with other fittings including swivel joint, angle joint, etc., Fig. 4. The Waltham company has given as much attention to this second part of the instrument. The flexible shaft is a patented design of the company, and is made up of a series of interlocking links *L* held in position by a series of steel collars *M* so that it is impossible for the links to come apart. The chain is asembled from one end to the other and it is impossible to take it apart in the middle or at any other point except from either end. No rivets are employed in it, and it is such that it can be assembled or taken apart by an inexperienced workman without the aid of any tools and in a very short time. The only tool necessary in dismantling the chain is a pair of pliers to remove the locking male member *N* in the driving connection at either end. This done the entire linkage can be taken apart. All of the links *L* are heat treated nickel steel stampings. The collars *M* are of the same material. Surrounding the chain thus formed is the usual flexible casing with a leather cover as optional.

The swivel joint at the driving end of the flexible shaft is a Waltham design. Gears and shafts are heat treated. Ball bearings are used. The swivel joint consists of two, a pair of spiral bevels *SB* and a pair of bevel gears *B*. A feature of this swivel is the quick means of dismantling, in that the housing cap *H* is

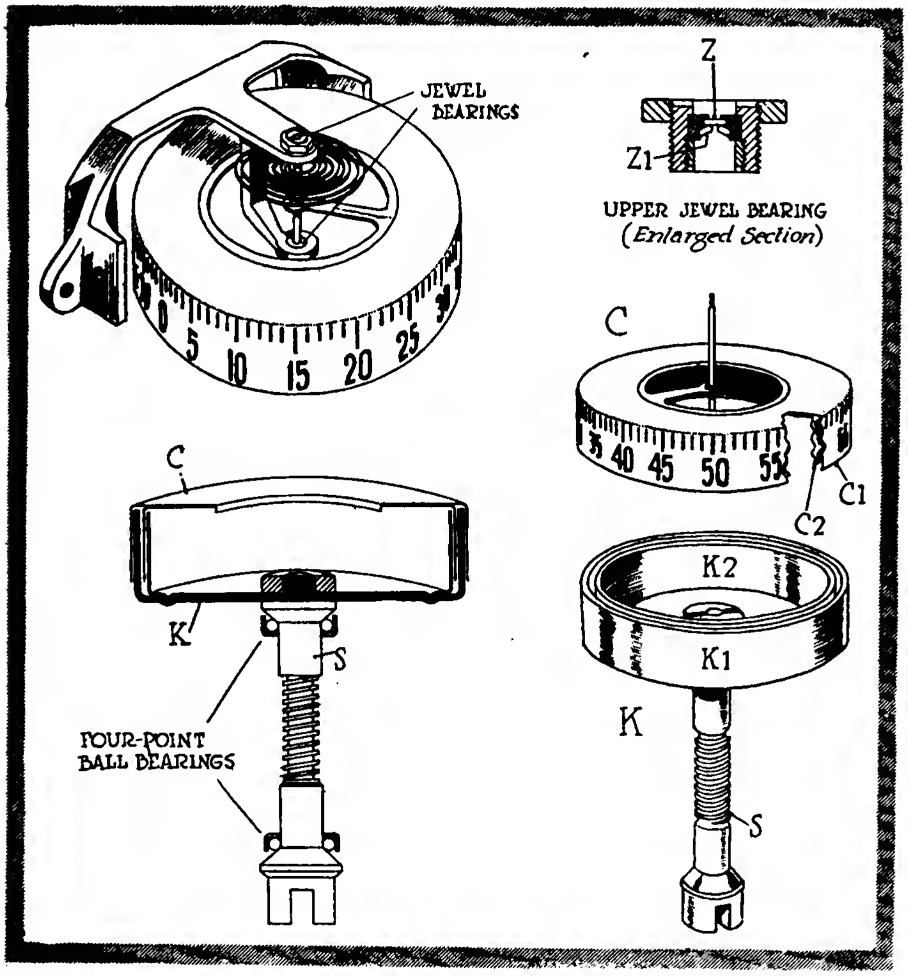


Fig. 3—Details of Waltham speedometer head:

Upper left—Aluminum indicating cup and supporting bracket, showing the use of sapphire-jeweled pivots supporting the cup. The sapphire-jewel bearing is shown in upper right and consists of two sapphires in each bearing. It is made up of an end jewel Z acting as a thrust bearing and a pivot jewel Z1. Both jewels are in settings. This complete double jewel bearing is used at the upper and lower ends of the shaft carrying the aluminum cup.

Lower right—The revolving brass cup K made up of two concentric cups K1 and K2 secured together, and above them the double aluminum cup C made up of the two parts C1 and C2.

Lower left—Section showing revolving brass cups carried on vertical shaft S, which revolves in two races of four-point ball bearings. The flexible shaft connects direct into the lower end of shaft S. The spiral on the center of this shaft is to drive the odometer mechanism.

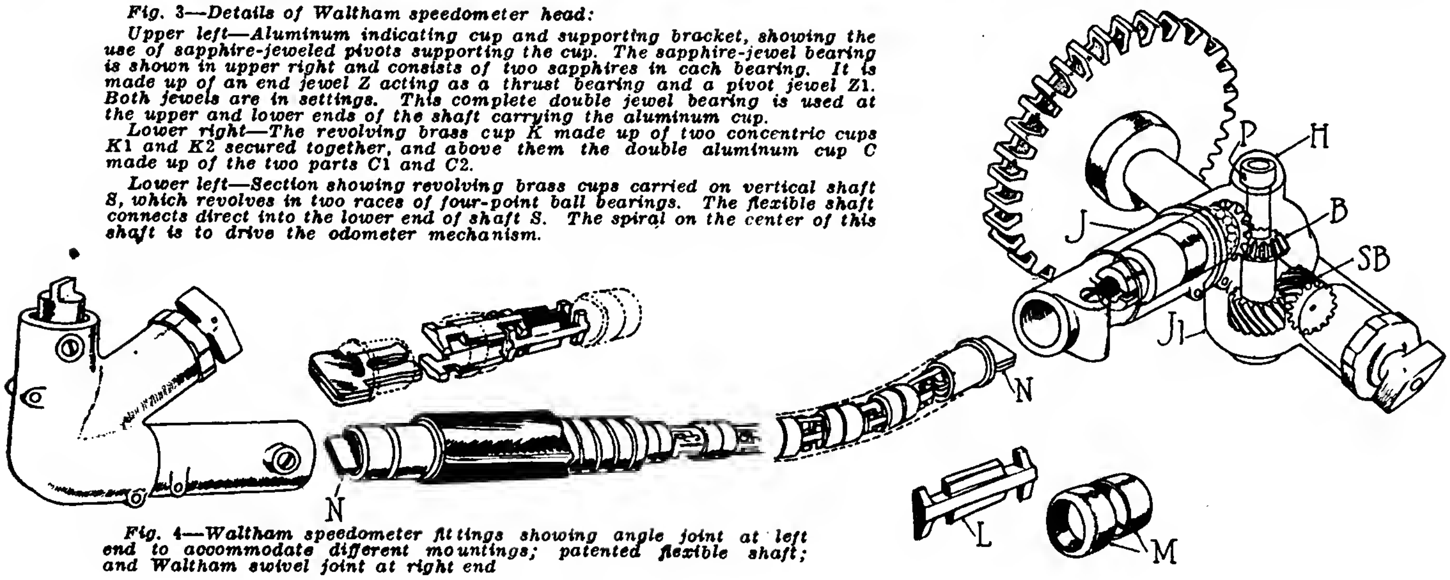


Fig. 4—Waltham speedometer fittings showing angle joint at left end to accommodate different mountings; patented flexible shaft; and Waltham swivel joint at right end

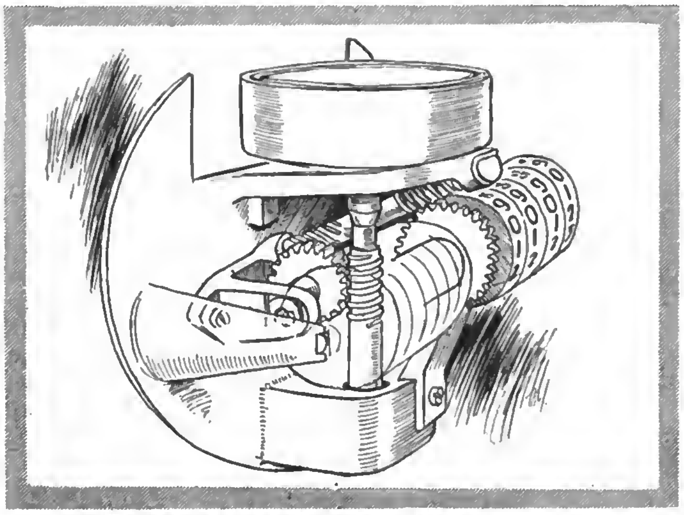


Fig. 5—Section showing oblique drive for odometer

snapped in position and when removed permits of removing the pin *P* from the retaining collar on the top of the shaft. This done the entire housing *J* is removed, leaving the vertical shaft carried on the lower part of the housing *J*1. A large capacity grease cup is an integral portion of the swivel joint.

In designing the driving mechanism the Waltham company has endeavored to have the swivel joint, shaft, and shaft casing, interchangeable with other standard instruments. The revolving brass cups *K*, Fig. 3, must revolve 1008 times to the mile. With the aid of gear ratios in the angle joint or swivel joint, Fig. 4, the flexible shaft may revolve at either 680 or 1008.

The assembly of the head of the Waltham speedometer is such that the complete group illustrated in Fig. 5 is placed within the case or shell as a unit. With this unit goes a guard for the indicating aluminum cup shown in another illustration. The dial showing car speed as well as trip and season odometer is commendably plain, making it correspondingly easy to see the large indicating figures.

Shorter Races Feature 1916 Schedule

Speedway-Owned Racing Cars and Selection of Master Driver and Car—Other High Lights

ALTHOUGH plans for 1916 racing are as yet far from complete, a survey of the events already carded and of those looming up as possibilities indicates that the coming season will far surpass previous years not only in the number of contests held, but also in importance and national interest. It is a foregone conclusion that higher speeds will be made in a number of races than ever before, for track surfaces will be more conducive to record-breaking speed, races will be shorter and cars will be faster.

The most interesting development of the 1916 season is that practically all of the speedway events, at least, will be shorter than previously, only one race of importance, the Montamarathon at Tacoma, being longer than last year. This tendency toward shorter races was manifested during the latter part of the 1915 contest season and the idea received such unmistakable approval from the public and racing fraternity alike that its general adoption seems inevitable. Short, snappy races with plenty of dash and higher speed than the drivers would dare to attempt in a long race should draw large crowds and go a long way toward permeating the general public with a wider interest in and enthusiasm for the automobile industry.

Indianapolis may be said to have inaugurated this movement for shorter races by its announcement last fall that the Hoosier Memorial Day classic, famous throughout racing history as the 500-mile race, would appear on the 1916 schedule as a 300-mile contest, the purse being correspondingly reduced from $50,000 to $30,000. Seat prices for spectators and entrance fees for racers are also lower, while the speed requirements are higher, 80 m.p.h. now being necessary to qualify instead of 75. Only thirty-three cars will be permitted to start this year in the brick-track speed battle.

Chicago has also gone in for shorter contests, a 300-mile event replacing the 500-mile race of 1915.

Sheepshead Bay is to open its season with four short races, the longest being the Metropolitan trophy event which calls for 90 m.p.h. to qualify, the 150-mile race to be called in ninety minutes. The other races are for 50, 20 and 10 miles, respectively.

Sioux City's 300-mile contest of 1915 is to be replaced this year by 50 and 100-mile events.

These examples will suffice to demonstrate that the speedway managements have realized that the public loses interest in races that are too long drawn out and in the monotony of a 500-mile grind fails to appreciate the bursts of speed and bits of skilful driving which flash forth now and then. What the public likes is a series of brisk, short, speedy events where all the finer points are more forcibly brought out instead of being lost in an endless succession of uneventful laps. The strong hold of horse-racing on the general public is a simple and conclusive proof of this psychological principle.

Speedway Racing Teams

Another important development which will first become apparent during the coming racing season is the début of speedway-owned racing teams. The formation of the Indianapolis Racing Team Co. and the Prest-O-Lite Racing Team Co. last September and the announcement that the first-named organization had bought two Peugeot racing cars and that Premier racers were to be built, while the second intended to use the four Maxwells, were followed by several similar purchases of racing cars by speedway interests. Harry S. Harkness, president of the Sheepshead Bay speedway, sent Carl Limberg to Paris this winter where he bought the three Delage racing cars which appeared in the 1914 French Grand Prix and brought them with all spare parts, etc., to New York, where he already had the Delage driven by Limberg in the Astor Cup race last fall. After being overhauled and fitted with new bodies, these cars will race as a team on the speedway circuit during the coming season under the management of Limberg, who will also drive one of them. It was also recently anounced that the Sioux City speedway was negotiating for the purchase of two of the Duesenberg racers. This deal, if successfully consummated, will bring the number of speedway-owned racing cars up to fourteen. There are also a number of special racing machines now being constructed which will probably figure in the 1916 races, Ray Harroun's 250-hp. free-for-all twelve being one of the projected speed demons. Harroun has also bought the Maxwell racing team's equipment and the three 450-in. cars so he may be a factor in the unrestricted events.

The Chevrolet brothers plan to race three Frontenac cars this season and hope to have one of them in shape in time for the Sheepshead Bay opening May 13 and two for Indianapolis on May 30. These cars will have aluminum motors, among other unusual features, are expected to develop 125 hp. and to weigh under 1750 lb. The three Crawford specials to be managed by Wm. Chandler will also bear watching. There are several well-known car manufacturing concerns rumored to be preparing racing cars for the coming season, although they are keeping things dark.

To Select Master Driver and Car

This year for the first time the contest board of the American Automobile Association will select the master driver and the master car in the 1916 speedway and road-racing circuit. While the system of determining the standing of the various contestants and their cars has not yet been definitely decided upon, it has been suggested that a gold medal carrying the profile of the winning driver and a cash prize as well be hung up.

Last summer and fall witnessed a regular avalanche of speedway plans all over the country and while most of these plans seem to have been abandoned, several speedways have been added to the list and others are still possibilities. The big centers of interest, however, continue to be Sheepshead Bay, Chicago, Twin City, Tacoma, Omaha, Des Moines, Indianapolis and Sioux City, all eight of which have important races scheduled for the 1916 season. Ascot, the new speedway developed in Los Angeles, has already held successful races this spring and Philadelphia begins to loom up as a a speedway town, its track being nearly completed.

Cincinnati's projected speedway also seems to be progressing, while there are several others which may also be classed as possible developments during the year. Last summer and fall speedway promotion movements were undertaken in Cleveland, St. Louis, Pittsburgh, New Orleans, Louisville, Kansas City, St. Joseph, Dallas, Birmingham and Detroit. Some of these proposed tracks have apparently faded into dreams which will probably never be realized and others promise only a small measure of attainment.

Of the established speedways, four have board surfaces, Sheepshead Bay, Chicago, Des Moines and Omaha, the board track proving lively and very fast with plenty of elasticity and also having the advantage that it is not so susceptible to heat on hot summer days as some of the other surfaces. Tacoma has a combination surface, the foundation being board with an asphalt covering. The Narragansett and Ascot speedways also have asphalt surfaces, that of the Twin City track is concrete, the Indianapolis speedway is brick and Sioux City races are run over a dirt surface.

Twenty-one Speedway Dates

There are twenty-one dates scheduled for speedway races of all sorts at the present time and the addition of a number of other events may be expected as the season advances and the plans of speedway managers round into more mature form. The longest races are for 500 miles, there being five of these on the card at present. A glance at the calendar in the right column will bring out emphatically the great number of short-distance events announced by the speedways this year. Of course, several of the important races like the Astor cup, to be held at Sheepshead Bay, Sept. 30, have not yet assumed final form and this race will be at least 300 miles.

Several invitation races will be held this year and the non-professional race to be held at Chicago on May 20 bids fair to be tremendously popular, many of the amateur drivers having already taken their cars out for practice on the course and some good time being recorded.

Corona enjoys the distinction of opening a new class of speed contest, its 300-mile Grand Prix on April 8 being designated as a boulevard race, as distinct from a speedway, road or track event.

The only road races on the card so far are the Elgin classics to be run off Aug. 18 and 19 and the Vanderbilt cup and Grand Prize which will be held sometime in November at Santa Monica, Cal. There was some talk of having a whole week's racing at Elgin when it was thought possible that the Vanderbilt and Grand Prix might be secured for the Watch City, but now it looks as though the regular two-day Elgin program will be sufficient, the regular Elgin classics, the Elgin national trophy race and the Chicago Automobile Club cup contest, being held during the two days.

Six cities already have track race dates arranged, the Galesburg race on June 20 being for 100 miles. Details of the other programs are not yet available, but most of them will probably be made up of several short events.

Only one hillclimb is scheduled for the coming season at present though it is hoped that more will be announced later. The one now on the card is the 13-mile event to be held Aug. 11 and 12 at Pike's Peak, which should present a sufficiently difficult grade for the most ardent devotees of the art of ascension. To still further stimulate the interest in the affair, the management offers a generous purse—$5,400—to successful contestants.

One French driver, at least, is assured for the Indianapolis race, René Thomas, who won the 500-mile Hoosier classic in 1914. He will drive a Peugeot, as reported by special cable to THE AUTOMOBILE Feb. 17. Resta, DePalma, Pullen, Limberg, Cooper, O'Donnell, Alley, Anderson, Oldfield, Burman, Rickenbacher, Mulford, Rooney and many other first-class drivers are available, so that there should be an abundance of record-breaking speeds registered if the cars can stand the pace these daring pilots are capable of exacting from them.

Contests Scheduled to Date for the 1916 Season

SPEEDWAY RACES

Date	Speedway	Event	Distance, Miles	Purse
May 6	Sioux City	....	......	......
May 13	Sheepshead Bay	Metropolitan Trophy	150	$15,000
		Queens Cup	50	2,500
		Coney Island Cup	20	1,500
		Brooklyn Handicap	10	1,000
May 20	Chicago	Non-Professional	30*	......
May 30	Indianapolis	Sixth Annual Sweepstakes	300	30,000
May 30	Tacoma	....	......	......
May 30	Twin City	126-160 cu. in.	10	300
		161-230	20	300
		Daily News Trophy	10	......
		450 cu. in.	50	2,000
		Twin City Trophy	10	......
		Free-for-all Handicap	10	300
May 30	Des Moines	Iowa Derby	20	......
		Des Moines Special	10	......
June 10	Chicago	International	300	30,000
June 28	Des Moines	Free-for-all	300	10,000
July 4	Tacoma	....	......	......
July 4	Twin City	....	300	......
July 4	Sioux City	....	......	......
July 15	Omaha	....	......	......
Aug. 5	Tacoma	Montamarathon	300	10,000
Sept. 4	Des Moines	Invitation	......	......
Sept. 4	Indianapolis	....	......	......
Sept. 16	Narragansett	....	......	......
Sept. 30	Sheepshead Bay	Astor Cup	......	......
Oct. 7	Omaha	....	......	......
Oct. 14	Chicago	....	......	......
Oct. 19	Indianapolis	....	......	......

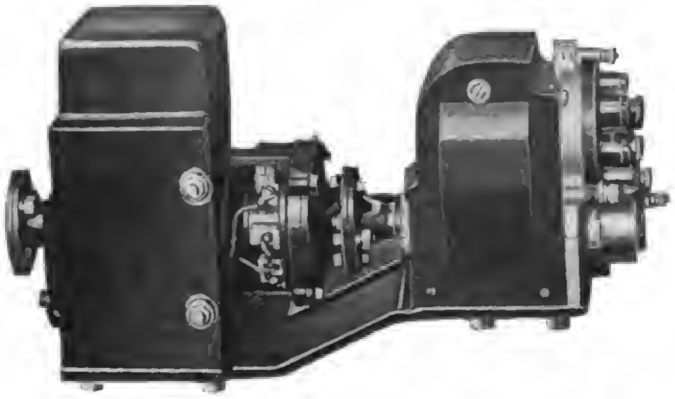
BOULEVARD RACE

Date	City		Distance, Miles	Purse
April 8	Corona, Cal.		300	$12,000
ROAD RACES				
April 29	Fresno, Cal.		12	......
Aug. 18-19	Elgin, Ill.	Elgin Trophy	......	......
		C. A. C. Cup	......	......
Nov. ..	Santa Monica, Cal.	Vanderbilt Cup	......	......
		Grand Prize	......	......
TRACK RACES				
June 20	Galesburg, Ill.		100	$2,000
July 4	Coeur d'Alene, Idaho		......	......
July 15	North Yakima, Wash.		......	......
Aug. 12	Portland, Ore.		......	......
Sept. 4-5	Spokane, Wash.		......	......
Sept. 29	Trenton, N. J.		......	......
HILLCLIMB				
Aug. 11-12	Pike's Peak, Col.		13	$5,400

*Preliminary heats, 20 miles.

Splitdorf Starting Switch Conserves Current

New Splitdorf-Apelco Two-Unit Starting and Lighting System Incorporates Engine-Speed Generator and Starting Motor with Integral Switch—Uses Constant Voltage Regulation



New Splitdorf-Apelco generator which operates at engine speed, direct-connected to Dixie magneto

A NEW two-unit 6-volt, starting and lighting system has been added to the Splitdorf-Apelco line which incorporates two features of novelty. These are both incorporated in the starting switch and are intended to respectively reduce battery drain and eliminate starting switch troubles.

With the complete Splitdorf system for lighting, starting and ignition there are three units, the generator being intended solely as a means of charging the battery and not incorporating the distributer unit. A separate battery system can, of course, also be used. The installation, as shown in the illustrations, includes a Splitdorf-Dixie magneto for ignition. The layout of a typical system is shown in the wiring diagram electrically, and mechanically the generator and magneto can be operated off the magneto shaft, because it is an engine-speed type of machine.

The important features of the new system are wrapped up in the starting switch design which incorporates a very clever scheme for the purpose of taking the control of the starting motor away from the operator as soon as it has cranked the engine. This is shown diagrammatically in the accompanying illustrations.

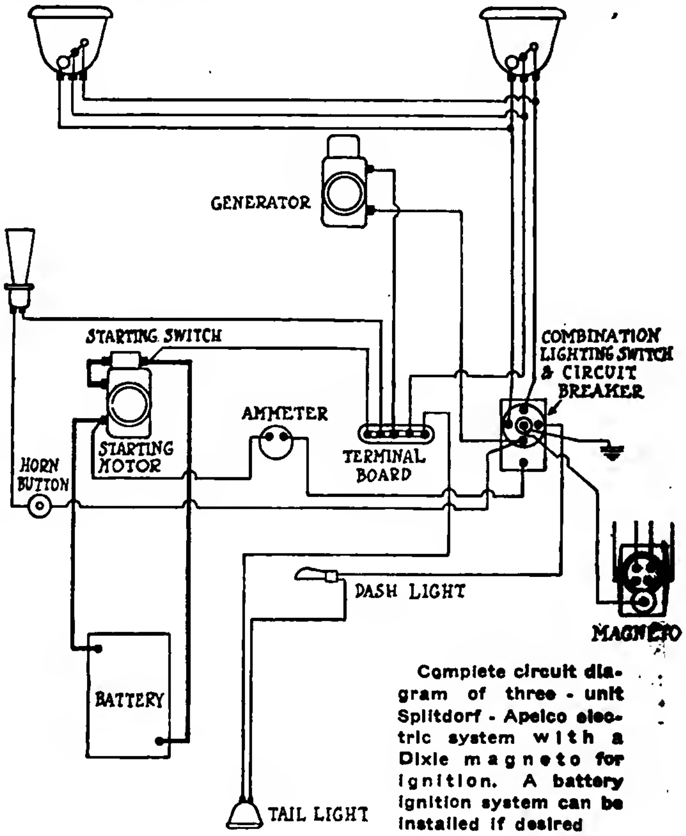
Pinion on Spiral Guide

When the operator presses the starting pedal or button, the mechanical act of pushing on the pedal meshes the starting pinion which slides up into position on a spiral guide. A slight mesh is made mechanically, therefore, in advance of any electrical action. A further movement of the foot closes the contact across the starting switch, which is made up of two independent rods, each carrying a U-shaped contact piece. Contact is made across the rectangular switch box through the two U-shaped pieces which are illustrated in diagram.

As soon as the starting motor has cranked the engine, the motion of the latter throws the pinion back along the spiral sleeve guides. The pinion shaft travels back with the pinion and carries with it one of the two switch plungers, thus breaking the contact, although the foot still remains on the starting pedal. In other words the action of the driver in holding his foot on the starting motor pedal has no effect on the battery, and the starting motor is independent of the driver as soon as the motor has cranked the engine.

The action of the driver in pushing the pedal or pulling the starting lever causes the pinion to be carried into mesh with the flywheel ring gear and when the engagement is made, current flows through the motor as described. As the gear is held movably on the armature shaft, being carried by the spiral guides in a sleeve, these spiral guides tend to hold the pinion in mesh while the engine is being cranked. As soon as the engine picks up, it turns faster than the motor pinion which is engaged with the flywheel, and on account of the spiral splines, the gear is forced out of mesh with the flywheel ring.

The pinion is mechanically connected to a rod which in turn is joined to one of the switch rods in the starting switch. When the motor is first engaged with the flywheel, the switch rod is pulled into engagement by means of the connecting rod and is held in an engaged position under spring tension. As soon as the gasoline engine begins to operate, the gear on the splined sleeve is thrown out of mesh and the connecting rod is forced to its original position. As this rod moves back the engaging latch mechanism is moved to an inoperative position. By this arrangement, since contact is broken as soon as the engine starts to rotate under its own power, the minimum amount of current is used in



Complete circuit diagram of three-unit Splitdorf-Apelco electric system with a Dixie magneto for ignition. A battery ignition system can be installed if desired starting, thus conserving the supply in the battery. The switch contacts are always disengaged with a quick snap to prevent the formation of an arc, thus giving long life to the switch contacts.

Series-Wound Cranking Motor

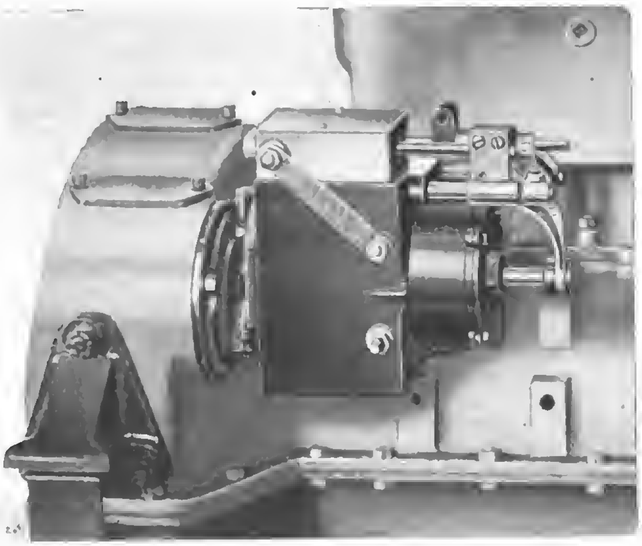
In working out the installation of this system the motor is designed to have a twelve-tooth pinion wherever possible. It is a straight, series-wound machine and, like other parts of the system, can be installed either in connection with a two-wire or grounded return layout.

The generator is shunt-wound and is driven at engine speed. It is arranged to cut in at from 6 to 8 m.p.h. The regulation is a new system of voltage control worked out by the Splitdorf company, so arranged that the current output will not exceed a certain maximum, even though the engine is speeded to its limit. This is accomplished by means of a keeper operated across pole extension. The keeper goes in and out of contact with the voltage fluctuations, responding to the voltage delivered by the generator in proportion to its speed.

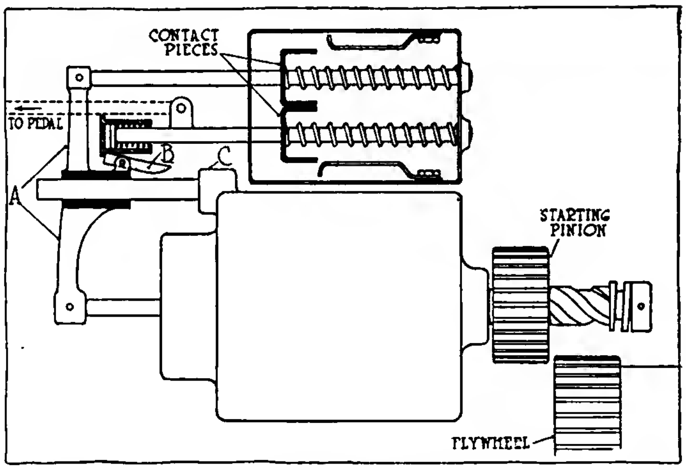
In the construction of the generator attention has been paid to making the job accessible. A movable lid, for instance, is placed over the commutator brushes, so that when the lid is removed the brushes are exposed to view and are readily accessible.

Taking the entire assembly as a whole, this should make a good installation for a car which is started and stopped frequently. The generator cuts in early and also due to its inherent characteristics gives a tapering charge to the battery. If the battery is nearly discharged the generator will put in a larger amount of current than when it is nearly charged; speed conditions being assumed equal in both cases. When the lights are used but little the current is held to a low value, thus preventing boiling of the battery electrolyte.

The regulator is mounted directly on top of the body of the generator and incorporates with it the automatic cutout. On the electric motor the starting switch is carried on the top of the machine, so that the car manufacturer does not need to make any starting switch installation on the car. All that has to be done is to install connecting linkages to give the proper transmission of motion from the starting pedal to the switch.



Splitdorf-Apelco-starting motor showing new switch mounted on top



Diagrammatic view showing the functions of the new switch which is automatically disengaged when the engine starts. Starting pinion flies back and carries with it one of the switch rods through connecting rod A

Six-Cylinder Columbia Well Designed

New Five-Passenger Car to Sell for About $900

HEREWITH appears the first illustration of the new Columbia car produced by the Columbia Motors Co., Detroit, Mich., recently organized and headed by J. G. Bayerline, former president of the King Motor Co.; A. T. O'Connor, W. L. Daly and Wm. E. Metzger. This car is constructed of standard units throughout.

The six-cylinder Columbia touring car which is to sell at about $900

The six-cylinder motor is rated at 21.6 hp., having a bore of 3 in. and a stroke of 4¾ in. The unit power plant includes dry-plate, multiple-disk clutch and a standard two-unit lighting and starting system.

In addition to the above details this car will have Timken axles, front and rear; cantilever rear springs; semi-elliptic springs in front; three-quarter floating rear axle; chrome-nickel steel frame of extra wide section; full-crowned fenders; Stewart vacuum fuel feed; tires, 32 by 3½, non-skids in the rear and the wheelbase is 115 in.

The body is roomy, being of five-passenger capacity. Particular attention is given by the company to the smooth lines of the body and its roominess. The rear seat is 46 in. wide, clear of the upholstery.

Deliveries to Begin June 15

The approximate weight of the car, according to the manufacturer, is 2150 lb. While the price is not definitely announced, it is stated on good authority that it will be around $900. Deliveries of the cars are expected to begin about June 15.

Analyzing Engine Cooling

An Accurate Determination of the Factors Affecting Cylinder Cooling and a Quantitative Examination of Air- and Water-Cooling Comparatively

Results of F. W. Lanchester's Researches Reviewed by A. Ludlow Clayden

IN the last issue that part of F. W. Lanchester's paper was given which deals with the main features of successful air-cooling; and toward the end, the similar major points in water-cooling were touched upon. The paper now continues to discuss this latter subject and goes into considerable detail regarding radiator construction and water circulation. The main thought in this part of the paper is that whether water is used or not we come back eventually to the air, since the water acts merely as a carrier to take the heat from the cylinders and spread it over the radiator where the air can take it up finally. Introducing this subject the paper proceeds as follows:

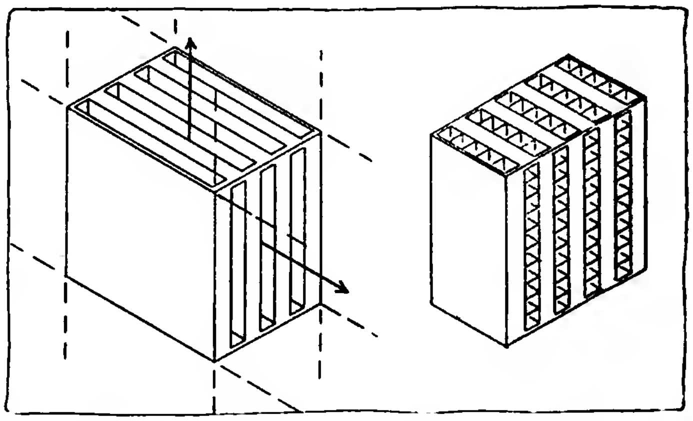
Weight of Water Needed

The conception of a "unit cell" has been put forward as forming the basis of design for the gills forming the cylinder jacket where direct air-cooling is employed; the same conception is equally applicable when discussing the design and proportion of the radiator when water (circulation) cooling is employed; in the honeycomb type the individual tube forms the unit cell. There is, however, one important difference. Whereas in the radiator the individual cell is almost constant as to surface temperature over its whole area, in the air jacket the individual cell has a variable temperature at different points in its surface; the heat per unit area discarded by the different portions of the cylinder wall, and combustion space wall, is by no means constant, the maximum being probably at least twice the mean. But the complication of the problem in the air jacket does not end here; thus if it were required to bring the cylinder and combustion space walls down to some stated temperature it is clear that for a given air velocity the surface would have to be proportionally greater in those regions where the reject heat is greater, and so the value of h (the height of the gill) in terms of s (the pitch of the gills) would need to vary from point to point.

In broad theory it is possible to regard the motor car radiator as a particular case of an appliance for heat transference. It has already been remarked that the various types of radiator may be regarded as analogous to corresponding known types of steam boiler. It would be equally correct to point out that, in some respects and in certain types, the analogy also holds good with the steam condenser; in fact some of the condensers used on steam cars have been almost identical in construction with certain of the coolers or radiators used on petrol vehicles. There are many other industrial uses also where heat transference is required—either a fluid has to be warmed or cooled, or some other purpose fulfilled in which the general principles of cooling are similarly employed.

It is not every type of cooler or condenser, however, or heat transference appliance, that can be said to act on just the same plan as the motor car radiator, since in many cases the flow on opposite sides of the conducting partition is in the same direction and sense or in a sense diametrically opposed. It is a characteristic feature of the motor car radiator that the directions of motion of the two fluids, air and water, are *at right angles one to the other;* there may be other movements in addition to the main motion, but the above salient fact remains.

In its most general form, then, we may regard the type as one in which we have a number of parallel walls in close proximity to one another, with the interspaces alternately coupled to a vertical and to a horizontal conduit, Fig. 13. If the problem were entirely symmetrical as in the interchange of temperature between two different gases at atmospheric pressure, the block of cells or flat tubes would form a square body as drawn in the figure, and owing to the considerations of symmetry the flow of the one gas could be dealt with by exactly the same method as the flow of the other. In the cooling of the internal combustion engine, however, as exemplified by the motor car radiator, the problem is by no means symmetrical; we have on the one hand a liquid—water, 800 times the density and approximately 3200 times the volumetric heat capacity of the air by which it is cooled, and this fact alone has two immediate consequences of importance. Firstly, the thermal continuity between the water and the metallic partition is so perfect that the heat flow from the water into the metal may be taken as free and uninterrupted, whereas the air takes up the heat from the adjacent surface comparatively speaking sluggishly, and so the whole resistance of the heat flux is virtually determined by the air temperature and velocity. Secondly, the *work done* in promoting the necessary circulation of air and water is much greater for the fluid of a lower density, at least this is so in any practical design of radiator so far produced. Thus it is evident that the quantities of air and water per second circulated or passed must be in some degree related to their respective heat capacities, and so the volume of air will be of the order of 3200 times that of the volume of water. But the mass of the air on this basis is four times that of the water (that is, in inverse relation to their specific heats), so that for an actual energy, the respective air and water areas would need to be related roughly in the relation of 6000 to 1. This relation is far, far beyond anything that is possible or expedient, the water channel in practice is commonly some hundreds of times bigger than the above stated, and so it



Figs. 13 and 14—Unit cell conception as applied to water cooling arises that the horsepower absorbed by creating the air blast, that is to say, the fan horsepower (where a fan is used), counts for everything, and the water circulation, so far as power is concerned, for nothing. It will be clearly understood from the above why it is that the area of the circulation pipes, even where convection or "thermo-syphon" is used, is incomparably less than the effective water area of the radiator itself. Thus it comes about that the things which count in radiator design are exclusively those which pertain to the air ducts, namely, the air surface area and the aggregate air duct cross section. We can have higher water velocity, and so a bigger water flux through the radiator for the asking, it costs virtually nothing. We can have the extent of the water surface minimized and the air surface extended by the use of gills, and, within the reasonable limits of conductivity, we lose nothing.

We will consider the radiator for the purpose of the investigations which follow as if it consists of two sets of square tubes laid faggotwise, Fig. 14, that is to say, we will think of the radiator as of the honeycomb type, but in which the water as well as the air is confined to definite rectilinear channels.

Quantitative Analysis of Details

Mr. Lanchester then proceeds to make a mathematical analysis of the air and water flows required to dissipate the required amount of heat, and this being a simple calculation may be omitted from this review. The following are the conclusions reached for the weight of a water-cooling system per horsepower supposing the type of radiator is the most efficient honeycomb form commercially obtainable.

The Condition of Least Weight

The author has calculated the weight of solder in the standard assemblage, and has carefully weighed the tubes concerned. These calculations have been verified by comparison with the makers' weighings of assemblages of 4500 tubes and 3700 tubes respectively, and in both cases the calculated figure and the weighing were found to be within 2 or 3 per cent. In brief, the weight of the solder in these assemblages amounts to 25 per cent of the tubes themselves, and it is actually this proportion of weight which determines, so far as the tube assemblage is concerned, the *length/diameter* ratio of greatest cooling efficiency per unit weight. The fact must not be overlooked that we have an added weight of water which is slightly in excess of two-thirds of the tube weight. Taking this into account, we diminish the relative weight value of the solder in the relation of 5 to 3, and on applying the construction once more we find that the minimum weight proportion comes almost within (but slightly over) the range of lengths used by the makers. We must also take into account the fact that the problem of least weight in the radiator design includes not only the tube block and water content, but also the containing walls including the well and header, and that these are relatively heavier when the tube is longer. It is clear, therefore, that the results reached are in nowise out of harmony with experience as exemplified in present-day practice.

From a quantitative standpoint the actual weight *per square foot surface* of the tube assemblage, analyzed above, is 0.35 lb., and the water weight (per square foot surface) is 0.184 lb. Total, 0.534 lb.

In practice the other portions of the radiator add at least 50 per cent to the tube assemblage or "block" weight, and it is certainly not possible to work with less than 50 per cent addition to the calculated water as contained in the tube block. Thus the total weight *per square foot* surface of this standard type of radiator with its complement of water may be taken as 0.8 lb. For motor car work it is necessary to supply about 3 sq. ft. per horsepower, and thus the weight per horsepower comes out at approximately 2½ lb. This is the present-day tax which the automobile engineer has to pay for his water-cooling apart from the weight of jackets, pipes, pump and their water content.

When we come to the minimum possible for aeronautical work as based on existing practice, we find that the weight per square foot of the tube block is 0.25 lb., and the water content is but little less than in the previous example, approximately 0.15 lb., totalling 0.4 lb. per square foot. This, for a complete radiator with proportionate water charge, becomes 0.6 lb., which is also the radiator weight per horsepower in this case in view of the fact that one square foot per horsepower is approximately the minimum allowance permissible.

It is clear from the above that when the cylinder jackets, jacket water, pump, etc., are included, it is with difficulty that less than 3 lb. per horsepower can be reached in the road automobile, or 1 lb. per horsepower in the flying machine. It is the author's view that in the latter service it will not be found possible, even with the most careful future design and experience, to get below 0.75 lb. per square foot (approximately per horsepower) without the construction becoming too flimsy to stand up to its work.

We pass now to the more complex problem of cooling by gills. We have seen that the distribution of heat over the gill surface is not uniform, and thus in addition to the variation of temperature difference as due to the increase in temperature of the air in its passage through the cell, we have to take into account the variation of the temperature difference as due to the temperature gradient in the gill itself at right angles to the air flow. Now this temperature gradient, as we have already seen, depends upon the conductivity and the sectional form of the gill; thus in Fig. 5 (in which the gill tapers uniformly from maximum at the root to zero at the tip) the temperature gradient is more nearly uniform than in the parallel gill (made from sheet metal of uniform thickness); here the temperature gradient is maximum at the root and approaches to zero at the periphery.

The conditions governing the loss of temperature difference in the line of air flow are (on the assumption of uniform heat emission per square inch of cylinder wall area) virtually the same in the unit cell of air jacket as in the unit tube of the honeycomb radiator already considered. The proximity of the gills, however, in the one problem corresponds to the *radius* of the tube in the other.

Least Weight Proportion

It is evident that in applying a system of unit cells to the cooling of an area of stated measurements, such as a cylinder development Figs. 11 and 12, we may only vary the sectional size of the cells employed; the length is determined by the size of the cylinder and gill distribution adopted, and is therefore constant. Evidently there is some particular proportion that results in a minimum expenditure of copper, in other words a *proportion of least weight.* The investigation which follows is an attempt to determine approximately what this best proportion is under the conditions chosen. For the sake of simplicity we treat the problem as if the cylinder wall were a plane, with the gills normal to the plane and parallel to one another.

Problem Quite Complex

The complexity of the problem of least weight even in its simplest form is great; we must at the outset adopt some convention or make some assumptions as the basis of investigation; without this the number of variables are such that even were a complete mathematical solution possible it would be so ambiguous as to be of but little practical value.

(1) The sectional form of the gill is a matter which must be specified or defined. From the practical engineering standpoint preference might be given to a uniform thickness of material, as, for example, when sheet copper is used. From

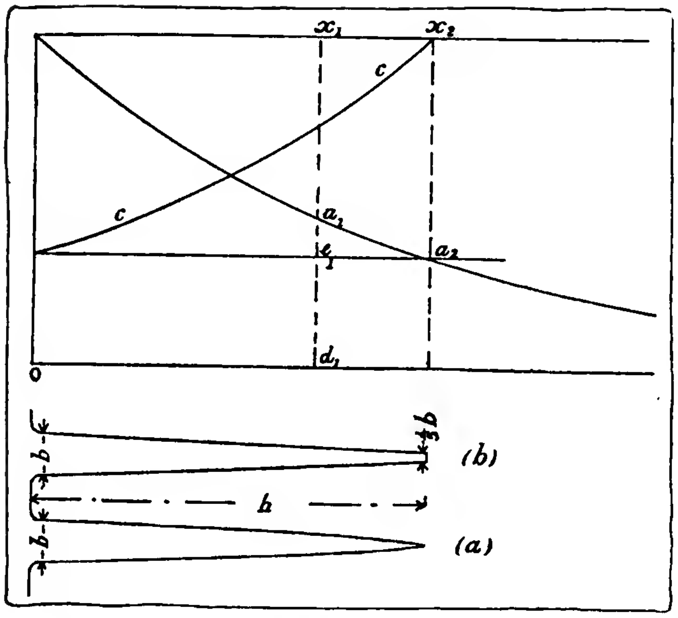


Fig. 15—Curves of temperature difference, and Fig. 16—Ideal and practical gill shapes

a scientific and technical point of view, however, it is better to assume a section giving a logarithmic temperature gradient; a constant value of $\frac{d\theta}{\theta dl}$ in fact. This assumption brings the problem into line with that of the radiator, so far as this particular feature is concerned.

(2) A further assumption which will be made is that the gills are thin compared to the pitch, so that the interspace may be taken as equal to the pitch without serious error. The final result will have to be watched in any case to ascertain that this condition is complied with to a reasonable degree of approximation: an allowance or correction may be needed in the final design if the departure from the assumption be deemed too serious.

(3) Further, it will be assumed that the air flow is based on the condition of some definite available pressure. This is commonly the ultimate fact with which the engineer has to deal. In the case of the flying machine this pressure is the Torricellian pressure corresponding to the velocity of flight, or in *pounds per square foot* is given by expression.

$$\frac{0.5\rho V^2}{32.2}$$

in which ρ is the density and V is the velocity of flight When a fan is employed, the pressure is that in the delivery chest or *wind chest* under running conditions.

Thermal Similarity of Gills

We shall *define* gills as *thermally similar* when the temperatures at different similarly situated points of their height *h* are equal one to the other. The condition above defined when spoken of generally will be termed the condition of *thermal similarity*. Thus under given conditions gills of totally different materials may be *thermally similar* if their thickness is proportioned inversely to their conductivity *k*.

The above definition disposes of any need for the question of conductivity to be taken initially into account. When it comes to a question of design, the gills may be of iron just as well as of copper, provided the assumption (2) above be sufficiently complied with; it is in fact the need for compliance with this condition which will force the designer ultimately to the adoption of the material of highest *k* value available, namely, copper. There is, of course, the additional question of weight saving.

As a preliminary to the investigation, let us examine the exact meaning of the first of the foregoing assumptions, which as it stands might be considered open to criticism.

(1) In Fig. 15, we have a logarithmic curve $a\ a_1\ a_2$ representing the temperature difference, and consequently also the rate of heat loss; abscissae *h* give the height of the gill, and the complementary ordinate $x_1\ a_1$ the area cut off by the ordinate of the curve $a\ a$ at the point a_1. Now the area in question represents the quantity of heat dispersed by the surface up to the point a_1 and if a_2 be the extremity of the gill the whole of the heat will have been given up at that point, hence to the scale of the diagram the ordinate $x_2\ a_2$ will be the measure of the whole of the heat dispersed by the gill in question. Hence the short ordinate, as $a_1\ e_1$ cut off by the abscissa drawn through a_2 will represent quantitatively the heat flux through the gill at every point. Now the heat flux at every point divided by the temperature gradient at that point is the measure of the conductivity, which in the present case is determined by the thickness, so that the appropriate thickness of copper will be at every point proportional to the short ordinate in terms of the full ordinate; at the point a_1, for example, this will be expressed as $a_1\ e_1/a_1\ d_1$. For the particular length of gill chosen this graph is given in Fig. 15, *c c*; this may be taken as defining the gill section, the ordinate scale being many times magnified. In Fig. 16 (a) the gill section is shown drawn to a more reasonable ordinate scale. An approximate equivalent is given (b) of a section more suitable for actual production. The "V" section in practice would never have a knife edge, and the ordinary cast gill complies very fairly with the definition given above.

Weight of Gills

In the following part of the paper full proofs are given for each step in the reasoning. In these pages the proofs will be omitted and the paper abridged very greatly. It will be attempted to retain just sufficient of the reasoning to make clear the steps by which the author reaches his conclusions, and readers who are interested in the detail of the determination are referred to the original paper. It is well worthy of careful study by any engineer desiring to experiment with air-cooling. The consideration begins with the following statement:

Under the conditions of thermal similarity, the aggregate weight of copper for a given wall area is proportional to the square of the height h.

Under the condition of thermal similarity a number of assemblages such as illustrated in Fig. 17 will involve different weights of copper varying directly as h^2 no matter what the degree of sub-division; it remains for us to investigate in what manner the degree of sub-division is independently controlled or determined, and the particular measure of conductivity as a function of h^2 which may be most usefully employed.

Our next investigation will be to determine the best temperature distribution over the gill to satisfy the condition of least weight. That is to say, the best distribution of surface temperature as a standard to which all gills should be thermally similar.

Let us consider a gill of definite weight serving a strip of wall area of definite width, and therefore employed to con-

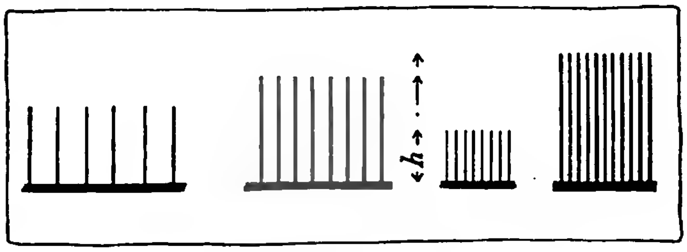


Fig. 17—Possible variations in gill proportions

duct away a certain definite quantity of heat. Let us imagine a number of gills thus all of the same weight but of varying height and varying thickness; our object will be to determine which of these presents a surface to the air current whose combination of area and temperature is such as will dispose of its heat most readily.

We have thus prescribed a gill of constant weight, that is to say, whose section has a constant area; the variations of thickness and height must comply with this condition: we desire to find the particular relation of these quantities when the cooling value of the fin is greatest. Now this condition is that at which simultaneous small infinitesimal variations can be made in the *thickness* and *height*, with no corresponding infinitesimal variation in the cooling value of the fin. Thus we shall suppose the height of the fin increased by a small increment, and we shall find graphically an expression for the corresponding increase of cooling efficiency, ignoring the fact that an increased passage of heat through the root portion of the gill would require a greater temperature gradient. In other words, we may suppose that the increased efficiency is neutralized by lowering the velocity of the air to an appropriate extent.

Next let us suppose the thickness of the gill diminished by all appropriate (negative) increment; to comply with the condition, *weight = constant*. Then the temperature gradient of the gill will be increased and the temperature of the outer portions of the gill will be less than previously, so that in order to carry away the necessary quantity of heat we must imagine the velocity of the air increased.

Condition of Maximum Cooling

*When the increase of velocity required as due to the diminished thickness of gill is equal to the decrease of velocity as due to added height, then we have the condition of maximum cooling effect for a given weight of copper, in other words, we have the condition representing the design of least weight.**

Having ascertained the correct proportion of height to gradient, this proportion settles the thermal pattern to which all gills should conform. We have now to deal with the question of the *sub-division* of the copper distribution; we have already formed the mental picture of an air jacket of thickness equal to the height of the gills and having a definite quantity of copper distributed over each unit area of the cylinder (and head) walls whose weight for any given heat flux density is proportional to h^2. Further investigation is required to determine the extent of the sub-division of the said copper, *i. e.*, the pitch, and thickness, of the individual gills. Our position is as though in specifying the charge for a sporting gun we had settled the weight of lead but had not yet decided the number of pellets.

Cooling and Air Friction

It is evident that if we consider a certain area of wind conduit and think of it first as being quite unobstructed, then we shall have a velocity of air through the said area in accordance with the theorem of Torricelli, but there will be no cooling because there is no frictional surface. If, in the other extreme, we consider the gill assemblage sub-divided to an indefinite extent, i. e., an enormous number of unit cells of minute cross-section, the skin-frictional resistance will become indefinitely great, and there will be again virtually no cooling because the velocity will be negligibly small. Our object is to determine the condition lying between these extremes at which the degree of sub-division is such that the cooling is greatest; with due consideration to any other matters, such as uniformity of distribution, which may be deemed of practical importance.

It is not necessary for us to specify exactly in what manner the frictional surface is introduced into the sectional area of wind conduit under consideration; thus, taking the latter to be 1 sq. ft. and the surface 96 sq. ft., it will make no difference to our present investigation whether the *assemblage* comprises 48 laminæ of 1 sq. ft. area (surface and area 2 sq. ft. each) pitched $s=\frac{1}{4}$ in., or whether 24 laminæ pitched ½ in., with half the individual area, *i. e.*, $l=6$ in. in place of $l=1$ ft. The essential is the l/s ratio, and we may think of either l or s as variable as suits our convenience.

Air Energy Wasted

It may at the outset be remarked that we are not theoretically bound to lose the efflux energy of the air on its leaving the jacket; it is possible by fitting an expanding efflux nozzle to avoid throwing away more than a moderate proportion of the total energy. As a matter of fact, however, the actual conditions are rarely such as will permit of an effective évasé nozzle, and therefore we must be prepared to look upon the ordinary efflux energy as lost.

Now the best way to think of the resistance proper to the Torricellian head is to represent it as so much inevitable and useless friction surface. Thus, in Fig. 18 abscissæ represent the values of l/s ratio, and ordinates represent in the upper diagram percentages of wind velocity, and in the lower diagram percentages of temperature difference. It is clear that for the purpose of this investigation we may take s as constant, so that abscissæ are in effect values of l and therefore represent by their magnitude the resistance of skin friction per square foot conduit area. The abscissa line is shown as carried to the left or negative side of the origin to a secondary origin O_1, and the distance $O\,O_1$ is the length of gill surface to which the resistance of the flux velocity is regarded as equivalent. In cases where it is found practicable to fit an expanding nozzle and so diminish the efflux loss, the distance $O\,O_1$ is made proportionately less. Evidently, also, this distance depends upon the magnitude of ξ selected.* The question of the appropriate skin friction coefficient is one of considerable difficulty. The skin friction double surface coefficient is for the purpose of the present paper taken as = 0.007, this being based on experiment in the open. The author believes this applies also to the gill surface so long as the l/s ratio is low, but there is no doubt that the coefficient is considerably greater for long passages; for example, in pneumatic transmission the basis on which the pipe resistance is calculated corresponds to the value $\xi = 0.016$. In Fig. 18 curves for both these values have been given, the corresponding coefficient being indicated.

Now referring to Fig. 18 the cooling effect will be greatest when the products of the ordinates of the velocity curve and the complementary ordinate of the logarithmic curve has a maximum value. The graph representing this product is plotted for the two values of ξ given in the upper diagram, and the maximum points approximately determined. Now these maxima correspond to an l/s ratio of about 370 and 250 respectively, that is to say, they indicate that the sub-division of the cooling fins should be very fine indeed; and we are at once able to see that in focussing our attention on the maximum we are on the wrong track. If we were to attempt to employ these maximum values we should have a ratio of temperature variation from one end of the cell to the other of 15/100 in the one case and 25/100 in the other; clearly, this is a most undesirable state of things. Our decision in this matter of l/s ratio evidently cannot be allowed to rest exclusively on considerations of maximum efficiency or minimum weight; we have to strike a compromise by selecting a value in which, without sacrificing too far the question of weight or efficiency, we maintain a fairly reasonable uniform temperature difference and arrive at a degree of sub-division which is commercially possible to carry into practice. The matter thus is one of individual judgment, and the author feels that a value in the neighborhood of $l/s=50$

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*Calculation for gill form follows; omitted here.

* In accordance with the author's practice ξ is the symbol denoting the double surface co-efficient of skin friction.

is one best suited to general purposes, and is the standard, therefore, adopted in the present paper.

Put in another form, and apart from practical or constructional considerations, the argument for rejecting the maximum total cooling value is that, for the sake of a high total value, the cooling valve of the *leeward* portion of the gill is too greatly sacrificed.

The designer may always, however, vary this if he thinks fit, especially if the individual conditions are such as to lead him, in view of all the facts, to suppose that some other proportion is better. Fig. 18, however, stands as his reference diagram whatever conditions he may have to meet.

Degree of Subdivision

It has already been explained that although the variations have been considered as variations of l with s=*constant*, it is equally applicable for variations of s with l=constant, for the factor on which the velocity curves are based is the relation of skin friction surface to conduit area—in radiator terminology, the relation of surface area to frontage area. It clearly is immaterial to the problem what the *scale* of the outfit happens to be except so far as concerning departures from the ordinary laws of fluid resistance commonly used by engineers, that is to say, the resistance varies as the *area* and as V^2 square. Thus, if we have a certain length of jacket and a certain height of gill h and a certain weight of copper per unit wall area, Fig. 18 is definitely the criterion of the degree of *sub-division* desirable.

It is worthy of note that $l/s=50$ gives a loss of temperature difference between the air entering and the air leaving of only 20 per cent with an average or total cooling value approximately half the maximum possible. If $l/s=100$, the loss of temperature difference amounts to 40 per cent and the cooling value obtained is about 75 per cent of the maximum. Under no circumstances does the author consider it would pay to go beyond this.

Drawing the whole of the above facts together we are able to frame a few simple rules for the design of an air jacket.

(1) l is determined from the design. s is related to l in accordance with Fig. 18; ordinarily $l/s=50$ or thereabouts.

(2) The heat flux density for the walls of the cylinder and combustion space is known or is to be computed from the general design and from established test results.

Its mean value is commonly about 13 hp. per square foot; or 2.5 gram calories per square centimeter per second.

The value on the cylinder walls proper is commonly about two-thirds mean value.

The value on the walls of the combustion space is commonly double mean value.

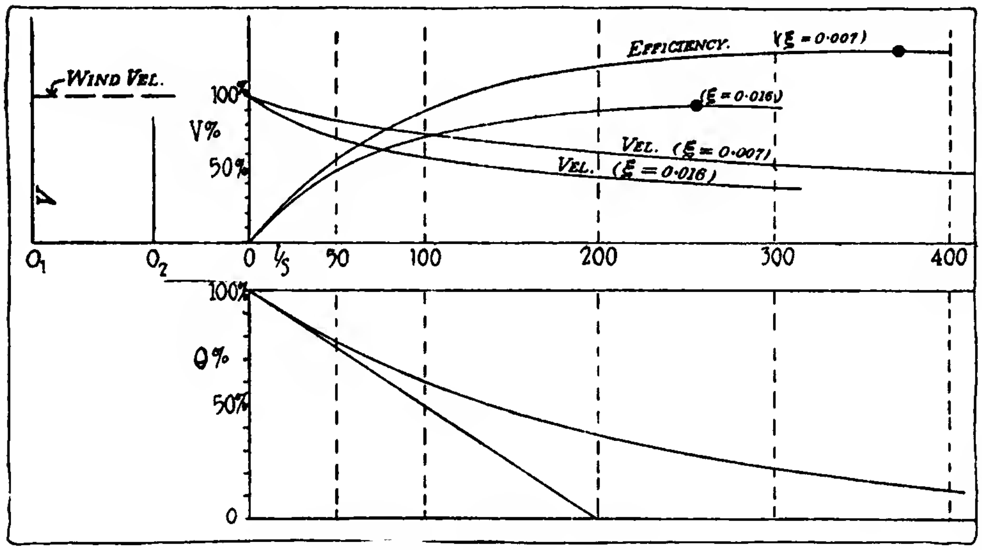

Fig. 18—Cooling efficiency curves

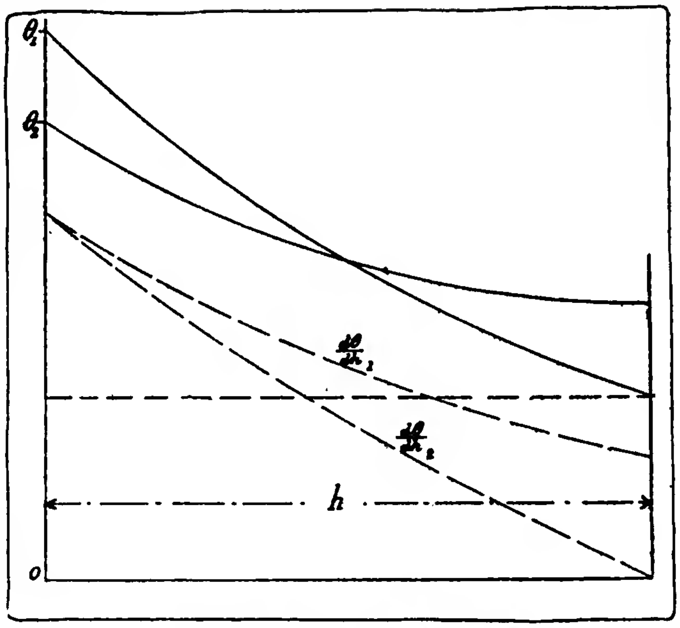

Fig. 19—Curves for gill of rectangular section

(3) The gill surface required per unit area of wall is given by an expression founded on the formula for rate of dispersion

$$\text{hp. (dispersed)} = \frac{\theta V}{15{,}000}$$

Thus,

$$\frac{15{,}000\kappa}{E_1\,E_2\theta V} = \frac{2h+s}{s}$$

In which κ is the heat flux density through the wall, E_1 the efficiency as due to temperature gradient, and E_2 is the cooling efficiency in accordance with Fig. 30. Thus when $l/s = 50$, $E_2 = 0.5$ or thereabouts. Since s is commonly small compared to $2h$ it is ordinarily sufficient to write $\frac{2h}{s}$ in place of $\frac{2h+s}{s}$. This ignores the cooling value of the exterior surface of the walls.

(4) We have thus determined s and h in terms of l. We next have to calculate the root thickness of the gill. From the known heat flux density we calculate the amount of heat discarded by a strip of wall of unit length and width $= s$. The thickness b must be calculated so that the heat gradient

$$\frac{d\theta}{dh} = \theta \times \frac{1.1.}{h}$$

account being taken of the conductivity of the gill material employed.*

Let us take a few examples, basing our cell length l on the considerations discussed, with reference to Figs. 11 and 12. Thus if D be the cylinder diameter $l = 1.6D$. Then,

$$h = 0.14 \times 1.6D = 0.224D$$

$$s = \frac{h}{7} = 0.032D$$

$$b = \frac{h^2}{400} = \frac{D^2}{8{,}000}$$

as exemplified in the following table.

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*Section omitted.

TABLE I.

D m.m.	h m.m.	s m.m.	b m.m.
60	13.4	1.92	0.045
70	15.6	2.24	0.06
80	18.0	2.56	0.08
90	20.0	2.88	0.10
100	22.4	3.20	0.12
110	24.6	3.51	0.15
120	26.9	3.84	0.18
130	29.1	4.15	0.21
140	31.4	4.48	0.24
150	33.6	4.80	0.28

A comparison of columns 3 and 4 shows at once the importance of high conductivity, especially for cylinders of large diameter. Thus where cast iron is employed in place of copper, b will require to be increased in the inverse ratio of the conductivities, approximately as 1 is to 8; in the case of a cylinder 80 mm. diameter the thickness of the gill would thus absorb about one-quarter of the air interspace, and for a cylinder 150 mm. diameter almost half the space will be taken up. In both cases condition (2) as laid down in Section 55 is infringed; it becomes clear that the successful application of direct air cooling to cylinders of large diameter depends definitely upon the employment of metal of high conductivity.

Turning to the question of weight, we have it from the equation:

$$\text{weight in lb. per hp.} = 0.015\, h^2 \ (h \text{ in c.m.})$$

We may express this in terms of diameter as

$$\text{weight per hp.} = 0.00075\, D^2$$

which give the following values for the series of diameters stated—

TABLE II.

D m.m.	Weight lb. per hp.	D m.m.	Weight lb. per hp.
60	0.028	140	0.15
70	0.037	150	0.17
80	0.047	160	0.19
90	0.061	170	0.22
100	0.075	180	0.24
110	0.090	190	0.27
120	0.110	200	0.30
130	0.125	300	0.67

It is quite clear that with gills as thin as specified in Table I., even in the case of the largest diameter of cylinder, it will be virtually impossible to grade or taper the copper in the manner suggested. Sheet copper, for example, 0.1 mm. thick is already as thin as paper and very liable to be crumpled or injured; any attempt to fine it off, whether by polishing or beating out to a knife edge, is out of the question. It is therefore incumbent upon us to extend the study to include gills of uniform thickness as in Fig. 5. The author has attacked this problem with a certain amount of success, but at present the solution cannot be said to be altogether complete, the mathematical work involved is not easy.

The results so far achieved are given in Fig. 19. Instead of a single form of curve for both *temperature* and *temperature gradient* as when the basis is logarithmic, we have two conjugate curves as in Fig. 19, the curve θ_2 and the lower of the dotted curves $(d\theta/dh)_2$. The curve θ_1 and the upper of the dotted curves are respectively the temperature and temperature gradient curves for a gill of logarithmic properties of equivalent value. It will be noted that the mean of the two curves θ_1 and θ_2 is the same. The uniform gill has been taken of a thickness equal to the maximum thickness of the logarithmic gill; thus the increase of weight of copper is in the proportion of 6 to 10, and the cooling value is the same, but it is to be noted that the gill of uniform gage is doing its work on a far lower cylinder wall temperature than the logarithmic gill, the actual result is that the temperature difference with the gill of uniform gage is 5/6 of that of the logarithmic gill.

It would appear from the above to be sufficient when using gills of uniform gage to design initially for a cylinder wall temperature 20 per cent higher than that intended, and then when substituting the one type of gill for the other the required temperature will be obtained.

Subject Full of Pitfalls

The author says above "*it would appear,*" in view of the fact that the subject is full of pitfalls and the investigation is not yet finished. It is probable that alternatively the cutting down of the gill of uniform thickness to 5/6 of its height as calculated on a logarithmic basis will be good enough for all practical purposes. In this case the parallel gill will involve a weight of copper for giving cooling efficiency about 40 per cent greater than the logarithmic type. Table III gives the results for a gill of uniform thickness on this basis.

TABLE III.

D m.m.	Weight lb. per hp.	D m.m.	Weight lb. per hp.
60	0.039	140	0.21
70	0.052	150	0.24
80	0.068	160	0.27
90	0.085	170	0.31
100	0.105	180	0.34
110	0.125	190	0.38
120	0.150	200	0.42
130	0.190	300	0.95

From tables II and III it is quite clear that the general belief in the greater applicability of air cooling to small engines has ample foundation. Where, as is customary, cast iron is used in place of copper for the gills, the above weights will have to be multiplied by 8 or thereabouts as representing the relation between the conductivities. It is, however, customary to sacrifice cooling efficiency and put up with higher cylinder temperatures to save weight, which would otherwise be excessive, and thus it is that in air-cooled cylinders of about 90 mm. diameter the weight of gills per horsepower in cast iron is commonly only about four times that given in table III for copper.

It is clear that when we run into cylinder diameters of 300 mm. upward direct air cooling offers little or no advantage on the score of weight, but for lesser diameters a substantial saving can be effected. Thus, if we take such diameters as are currently used for aeronautical work—$d =$ 100 or 110—we see that the weight per horsepower is about 2 oz. as against very little less than 1 lb. if water cooling be adopted. There appears to be a clear saving of ¾ lb. per horsepower.

It is the author's opinion that a saving of weight of this magnitude in aeronautical engineering will prove in the future to be quite decisive as settling the cooling system to be adopted; the advantages of direct air cooling are overwhelming. In the case of the automobile the conditions are somewhat different; to obtain an air velocity of 40 meters per second, which is about 130 ft. per second or 90 m.p.h., a fan of considerable power will be needed, and the only fan which would effectively serve the purpose would be one of centrifugal type. It will probably be found advantageous to work with a considerably lower air velocity and a greater weight of copper. The objections are mainly those of noise and horsepower consumed, but with an appropriate increase of copper and a lower fan pressure the saving in weight is still great—probably more than 0.5 lb. per horsepower developed. In the author's opinion, also, there is a possibility of saving cost as well as weight. The main difficulty in the

(*Continued on page* 598)

The History of the American Automobile Industry—23

Two Great Strides of Progress—Compression and the Four-Cycle Principle—Birth of Practical Explosion Type Motor in 1876—Otto's Patent Stimulates Development

By David Beecroft

THIS week brings us to the most important epoch in the development of the gasoline engine. It is the year 1876. To the development of the gasoline engine the year 1876 was as important as the year 1776 to the United States of America. In 1876 the two great steps finally settled in the development of the gasoline engine were compression and the four-cycle system of operation. Compressing the charge before exploding it, which is one of the secrets of the gasoline engine, was made practical. It was patented. For twelve years it had been under consideration. It took this length of time to crystallize how it could best be accomplished. It took several minds to evolve it.

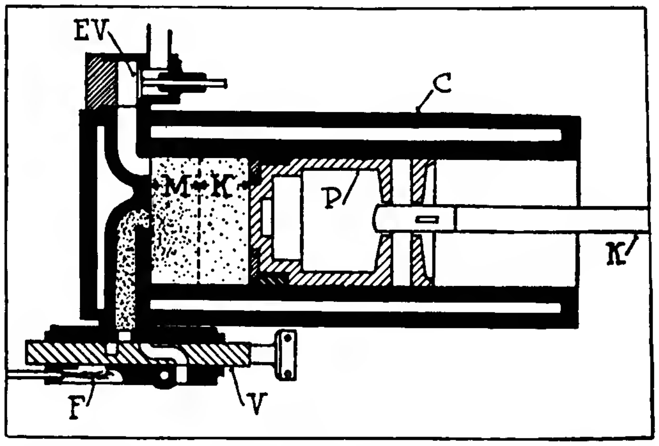
The Four-Cycle Engine

The other great step was the development of the four-cycle engine, operating as our four-cycle engines of to-day, namely: drawing in the charge of explosive gas on the first stroke of the piston, compressing it on the second stroke, exploding it on the third stroke and exhausting the burnt gases on the fourth stroke. All of these cycles were clearly outlined, patented and engines operating on this principle manufactured in 1876.

The year 1876 can best be described as the birthday of the practical explosion type of motor as we have it to-day. The two great basic principles were formulated. It is true that many facts in connection with the engine were not understood; in fact, the inventors had not drifted entirely away from steam. They did not want a sudden explosion as we use to-day, but preferred to have a slow combustion of the mixture so that the expansive force driving the piston was due to the expansion of an air charge rather than to the sudden instantaneous explosion of the charge of gas.

Otto's Early Patent

The name most associated with the development of the explosion engine operating on the four-cycle principle and compressing the mixture before exploding it is Nicolaus August Otto, Deutz, Germany, who on Aug. 14, 1877, was granted patents covering the four-cycle engine and compressing the mixture. His application was made a year earlier. Otto's patent had a very far-reaching effect: in fact, it entirely altered the gas-engine situation and started it on the direct road along which development it is still traveling. It displaced the Brayton two-cycle engine that was then the leader.



1876—Section through Otto four-cycle motor, the father of the present explosion motor. The use of the connecting-rod is noted, also a slide intake valve V, and a poppet exhaust valve EV. The flame ignition is shown at F, and was uncovered by the slide valve at the correct instant for ignition

Although Otto receives to-day practically all of the credit and naturally profited very materially because of his patent, the conception of compression and four cycles of operation was not original with him. He was the person who combined these ideas into a practical engine. The general development of the four-cycle engine as well as the use of compression was twelve years in the making, and three countries participated in evolving the thought. The conception started in 1862, when a Frenchman, Alphonse Beau de Rochas, obtained a patent and wrote a pamphlet in which he laid down the principles of the four-cycle engine. He wrote on the theoretical advantages of the four cycles of operation and of the necessity of compression in order to get thermal efficiency.

Development In England

Six years later the scene of development of the four-cycle compression engine shifted to England, where Boulton, a prolific inventor of explosion engines, secured a patent in 1868 covering the use of compression in an engine. Unfortunately, Boulton failed to work out the necessary means for compression in a practical way, and the net value of his patent was to set more practical inventors thinking along the same line.

In 1874 still another step was taken which unquestionably played its part in the final evolution of the four-cycle engine of Otto in 1877. In 1874 Gilles, an English inventor, introduced the use of the connecting-rod between the piston and the crankshaft as known to-day. Previous to this time the piston rod as used in steam practice had been followed. Gilles' development was essential to the practical working out of the explosion engine.

Coming to Otto's engine, the father of the gasoline engine of to-day, we must understand, before going into a description of the engine, that Otto did not intend to operate his engine exactly as we do. He planned—and his patents show it—first to draw in a charge of pure air during the first half of the intake stroke. During the second half of the intake stroke a charge of explosive mixture was taken in. This drawing of one-half charge of pure air first and mixture later was accomplished by a slide-valve arrangement. Otto's object was to get an expansion from explosion similar to steam. The air charge drawn in first was supposed to fill that half of the cylinder against the piston head. When the explosive mixture filling the outer end of the cylinder was exploded it was expected that the explosion would become slower as it approached the piston head, and that the final part of the power on the piston would be due to the expansion of the air because of the heat of the explosion. Otto, like previous inventors, aimed to get away from the sudden explosion and hoped to get the progressive expansion of steam.

A Single-Cylinder Design

Turn next to a description of Otto's engine taken from his patent papers of 1877.

It was a single-cylinder, horizontal design, with a separate cylinder head and the intake valve arrangement at one side and the exhaust valve at the other side. The cylinder C was open at its inner end, and the piston P is shown with a conventional design of connecting-rod K as invented by Gilles. The intake valve V was a slide one operated by a gearing from the crankshaft. At the opposite side was the exhaust valve EV, a poppet design as used to-day. Ignition was from a constantly burning flame F, and which was uncovered by the valve V at the time when the explosion was desired.

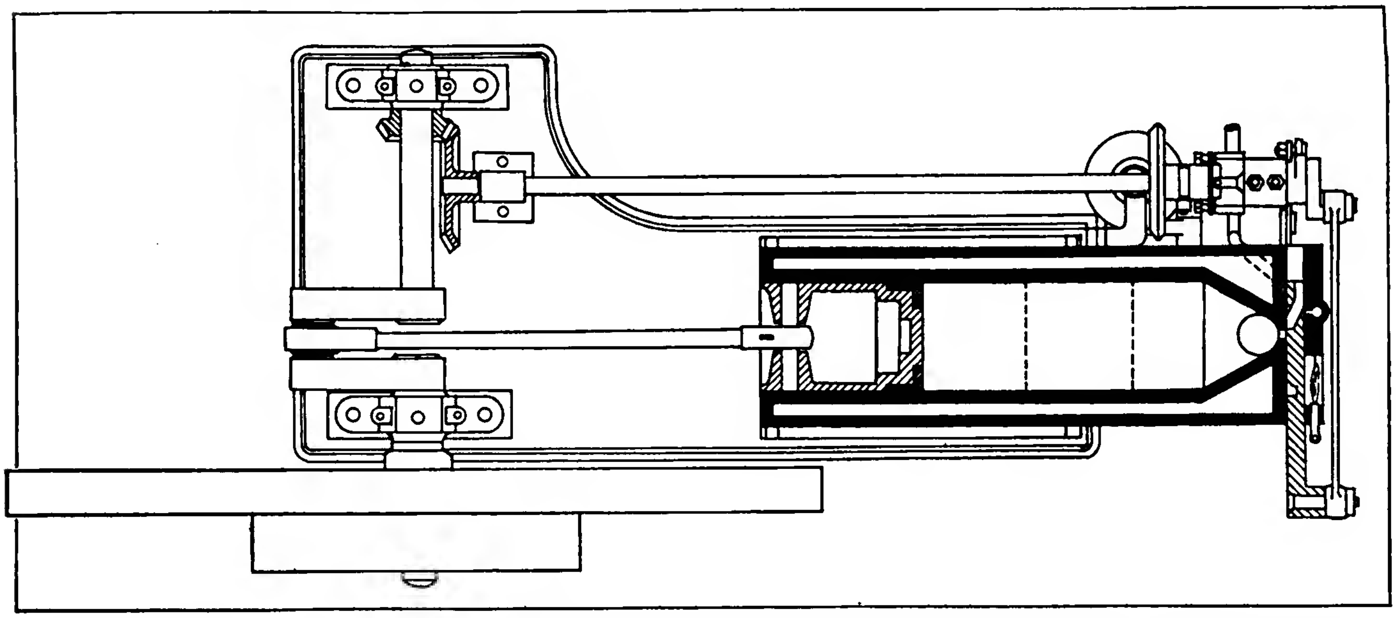
Securing An Air Mixture

In operation Otto had the slide valve V with a passage so arranged as to draw air from the atmosphere during the first half of the stroke, so that that part of the combustion chamber K was filled with air, whereas the outer half M was filled with explosive mixture. Otto realized that during compression there would be a co-mingling of the pure air with the explosive mixture, but notwithstanding this he realized that there would be a quicker burning of the mixture adjacent to the cylinder head because of the greater number of particles of hydrocarbon in that part of it. His conception of how the explosion would take place is shown by the following extract from his patent:

"It will be seen that in this improved mode of operating there is no sudden explosion of the gaseous charge, but a gradual development of heat and expansion of the gases; there will be no such losses of effect as result in gas engines of present construction through shocks produced by sudden development of motor power and by the absorption of heat consequent upon the inability of the gases to expand with sufficient rapidity. This beneficial effect will be further increased by the fact that the charge of air interposed between the combustible mixture and the piston will operate as a cushion or buffer in still further reducing the suddenness of the expansive force generated as it transmits it to the piston."

Otto had a very clear conception of all the requirements of valve timing as necessary for the

(*Continued on page* 615)



1876—Part section through Otto's four-cycle engine, the first one made to operate on the four-cycle principle. The slide valve is placed transversely on the cylinder head. Thus the first four-cycle motor was a valve-in-the-head design. The use of a connecting-rod was new, having been patented but two years earlier

The FORVM

ADVOCATES AIR COOLING—SIZES OF TRUCK ENGINES AND FORMULAS INVOLVED—A CAST BRONZE CYLINDER FOR AIR COOLING

Air-Cooling Most Satisfactory

By H. A. Grant
(Chase Specialty Co.)

THE article on engine cooling in the March issue, and your editorial in the same issue, are very much to the point, and I have been surprised that this matter has not been taken up by automobile engineers in this country long ago. Having been associated with the automobile business since 1905, and having owned some nine different makes of automobiles in that period, I appreciate both the article and the editorial.

I have yet to learn of a single objection to air-cooling, and I can put my finger on several very distinct advantages. It has sometimes been stated, as an objection against air-cooling, that practically every concern that used to employ it has either failed, or abandoned it in favor of water-cooling. This argument is no argument, for several of the concerns that first tried air cooling, and then water cooling, made an equal failure of both. Then again, I think everyone will admit that in the early days at least, we patterned as closely as possible after the foreign cars.

Reasons for Water Cooling

There are many reasons that have led to the almost universal adoption of water-cooling, probably the chief reason being that new manufacturers entering the field choose to follow the course of least resistance. Consequently, there was much available data on water-cooling which enabled new manufacturers to build what they had every reason to believe would work satisfactorily, since it followed common practice.

The problem of air-cooling was one which no one, with the exception of the Franklin Automobile Co., knew anything about. Yet, to-day I believe that the Franklin cars have the most perfect system of cooling, either air or water, that we have.

The various cars that I have owned, both low-priced and high-priced, have given me a pretty clear idea of what I want, and what I do not want, and when I began to canvass the market last spring with another engineer, it was with the idea of selecting as nearly perfect an all-around machine as possible.

Air Cooling Tested

With practically a year's experience with the Franklin, I have no hesitancy in saying that it is by far the best all-around machine I have ever owned. Its cooling system leaves nothing to be desired. I have purposely subjected its air-cooling system to the most extreme tests, and yet never have I been able to find the least trace of overheating. On the other hand, being designed to work at a temperature of 350 deg., it has shown the greatest economy in gasoline, averaging for the season slightly over 19 m.p.g., and frequently averaging, under favorable conditions, as high as 25 m.p.g.; this with a six cylinder touring car carrying five people. I feel that such results speak for themselves, and show the possibilities of direct air-cooling when worked out the way the Franklin people have solved the problem.

Truck Engine Sizes and Formulas

By John Younger

THE paper read by W. D. Williamson before the I. A. E. brings up again the question which time and progress are now settling. There seems to be an idea prevalent that truck engine sizes need be bigger in this country than in Europe, and Mr. Williamson throws no additional light on the subject.

In 1913 C. T. Myers gave a paper before the S. A. E. to establish a formula for engine capacity:

$$TF = \frac{28.22 \times d^2 s R}{D W}$$

Where TF is a tractive factor

$$\left.\begin{array}{l} d \text{ is diameter of cylinder in inches} \\ s \text{ is stroke of cylinder in inches} \end{array}\right\} \text{the usual 4-cyl., 4-cycle engine is assumed.}$$

R is total gear reduction
D is diameter of driving tires in inches
W is gross weight of vehicle in pounds

For reasons stated in his paper, he gave the value of TF as being 0.04 for good practice, European trucks being slightly less, and American trucks being then somewhat more.

In another form he stated that $\frac{d^2 s R}{D W}$ should equal 0.0014. (a)

Williamson's Formula

Take now Williamson's formula:

$$Q = \frac{V}{W} \qquad \text{(b)}$$

Where V is volume of one cylinder in cubic inches
W is weight of vehicle in *long* tons.

All his trucks are assumed to go 15 m.p.h. with an engine speed of 1300 r.p.m., so that approximately, $R = \frac{12}{\pi D}$

Substituting this in (a)
we have

$$\frac{\frac{\pi}{12} d^2 s}{W} = 0.0014$$

or

$$\frac{\frac{\pi}{4} d^2 s}{3 \times 2240\, W} = 0.0014$$

or

$$\frac{V}{W} = 9.4 \qquad \text{(c)}$$

This is in exceeding close agreement with Williamson's

9.3, and is rather wonderful, considering the premises and method of attacking the problem are quite different.

Thomas' Formula

Williamson's formula is somewhat involved and to my mind a simpler formula can be devised.

H. K. Thomas uses this formula for the capacity of a truck:

$$\frac{63{,}000\,PRe}{n\times\frac{D}{2}\times W\frac{[20g+r]}{2000}}=1. \qquad \text{(d)}$$

Where P is horsepower at engine and "w" r.p.m.
R is as before
e is mechanical efficiency of transmitting mechanism
W is weight of vehicle in pounds.
g is percentage grade.
r is road resistance in pounds per 2000 lb.

By stating what you definitely expect a truck to do you can find the value of P, and hence V. My practice, and I find it acceptable, is that a truck should climb a 3-per cent grade on high gear with a road resistance of 50 lb. per ton, with practically no falling off in a speed of about 15 m.p.h.

Its e should be 0.85.

Personally, for many reasons concerning not only the engine, but the whole vehicle, I think a governed speed of 1000 r.p.m. preferable, and I do not limit the speed of 15 m.p.h. to light trucks, but carry it up to 5 tons capacity.

The gear ratio R then becomes $\frac{\frac{\pi}{12}D}{1320}$

So that we have

$$\frac{63{,}000\,P\times 0.85\times\frac{1000}{\frac{\frac{\pi}{12}D}{1320}}}{1000\times\frac{D}{2}\times W\left[\frac{60+50}{2000}\right]}=1.$$

or

$$\frac{38.6\,P}{W}=1.$$

Now P at 1000 r.p.m. with an $n\,p$ of 80 lb. per square inch is 4.85 V
and $W=2240\,W$,
so that

$$\frac{38.6\times 4.85\,V}{2240\,W.}=1.$$

or

$$\frac{V}{W}=12.$$

This is obtained with an engine speed of 1000 r.p.m. Correcting this to Williamson's 1300, 12 would reduce in inverse proportion to $\frac{1000}{1300}\times 12$, giving us again the figure $\frac{V}{W}=9.3$, also in remarkable accordance with the others.
cordance with the others.

In its simplest form we may take it that a motor truck for use in any country should be just capable of climbing a grade of 3 per cent on high gear at full motor speed, against a road resistance of 50 lb. per ton of 2000 lb.

The motor capacity should be such that

$$\frac{\frac{V}{W}}{2240}=12\times\frac{1000}{n}$$

or

$$\frac{Vn}{W}=5.36. \qquad \text{(e)}$$

Where V is volume of one cylinder in cubic inches
(a four-cylinder four-cycle engine being assumed)
n is normal number of revolutions of engine
W is gross weight of vehicle in pounds.

In connection with the above, it is somewhat interesting to note that H. K. Thomas introduced a coefficient Q in 1913, as a standard of comparison between different vehicles, trucks and pleasure cars.

This Q is really a measure of piston displacement per foot traveled per 1000 lb. gross weight, as will be seen from the formula:

$$Q=\frac{\frac{\pi}{4}d^2 s\,n\,R}{\pi\,\frac{D}{12}\times W.}$$

n is number of cylinders
W is gross weight per 1000 lb.

This reduces to the simpler form.

$$Q=\frac{3\,d^2 s\,n\,R}{DW} \qquad \text{(f)}$$

This coefficient is of great value and has been adopted as a standard of comparison by the combined engineering departments of the Pierce-Arrow Motor Car Company.

It gives an indication also of the relative gasoline consumption of the different vehicles.

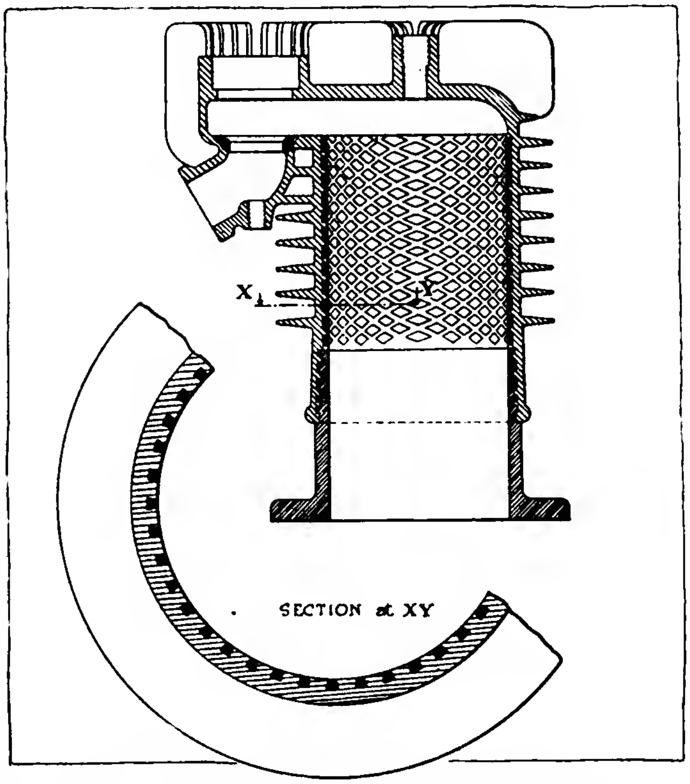
A Bronze Alloy Cylinder

By L. G. Nilson

(Nilson-Miller Co.)

YOUR article and editorial on air-cooling in THE AUTOMOBILE for March 16 indicate interest in this subject. In 1911 I obtained a patent, No. 1,010,787, covering a cylinder construction designed to combine light weight and efficient air-cooling by the use of a manganese bronze or similar alloy cast around spirally-arranged wearing pieces of cast iron having undercut grooves so that the bronze will flow into these and tightly fasten the wearing surfaces. In one sense the cast iron cylinder is a lining for the bronze cylinder. One operation suffices to unite the two cylinders since the iron cylinder is grooved on the outside so as to present diamond shaped lugs to the bronze coating, which, if applied before the bronze is cast, prevents the cylinder from rusting. As shown in the illustration, integral radiating flanges are cast around the top and sides of the cylinder.

The base of the cylinder may be a cast iron if desired as it is not subjected to heat, but where light weight is desired the entire cylinder may be of bronze or other alloy.



Nilson patent cylinder construction using bronze or other copper alloy for light weight and air cooling

The Rostrum

Petromortis Experiences

EDITOR THE AUTOMOBILE:—Reading so many discussions and noting queries regarding carbon monoxide poisoning, think perhaps the following personal experience will enlighten some of your readers.

In 1903 I owned a one-cylinder Packard with 6-in. bore. I overhauled same during the winter and was tuning the car up in a fairly light garage, 16 by 22, 9-ft. headroom. It was on a very cold winter night and a coal fire was burning in this room. The motor had been running about 15 minutes, when, without any previous warning or the slightest discomfiture, I remember reeling and falling. I do not recall striking the floor. As I was falling I saw my brother, who was with me, falling also. The motor was still running when we became unconscious. We both owe our lives to the fact that I happened to be passing by the door and I believe that in falling struck the latch, opening the door, for when I regained consciousness, I was lying partly out of the door in the snow. I managed to drag my brother out and he shortly regained consciousness.

We both suffered intensely from headaches and violent heart action. Arteries in the neck distended at each heart beat until it seemed they would burst. I remember my brother's temples pulsating with at least ¼-in. movement. My wife, alarmed at our non-return, found us as we were becoming able to stand, and procured some aromatic spirits of ammonia which helped us. The ill effects lasted nearly a week.

This all occurred in the early days of the gasoline automobile and before the automobiling public had been acquainted with this insidious gas. Too much care cannot be exercised. I know of one case at least where the victim worked on his car expecting to be warned by some indications or discomfiture in time to stop, but his experience was similar to mine. No warning was given.

Brighton, Mass. C. F. SMITH.

Using Mixed Fuels

Editor THE AUTOMOBILE:—Where can I secure information regarding any recent tests on the use of alcohol, benzol and keresone as motor fuels and also a fifty-fifty mixture of alcohol and benzol and kerosene and gasoline?

2—What is the amount of heat it is necessary to supply for the various fuels; what changes are necessary in float mechanism and jet sizes; also whether special fuel is required for starting or whether an electric heating device could be used to be operated from starting battery?

Detroit, Mich. L. E. F.

—It is impossible to answer these questions in definite terms, as everything depends upon the particular motor under consideration, and even at that there is no readily available collection of data. A fifty-fifty mixture of alcohol and benzol almost invariably acts exactly like good gasoline, requiring no alterations of any kind. Kerosene and gasoline when mixed will act well in a motor which has a carbureter giving a very fine spray and with an extremely short intake manifold or else a manifold jacketed with hot water or exhaust gas. The addition of kerosene will call for slightly more air.

2—It is possible to start on mixtures of kerosene and gasoline in warm weather without special heating, provided the carbureter atomization is sufficiently fine. An electric heating device operated from the starting battery has been applied for the purpose of warming the nozzle and this greatly assists starting. As a rule, with an ordinary carbureter it is not possible to get satisfactory running with a mixture so rich in kerosene that starting requires a special supply of lighter fuel.

Spectroscope for Carbureter Testing

Editor THE AUTOMOBILE:—Could you give me some information concerning a spectrescope such as aeroplane manufacturers use in testing their motors to tell whether they have the best explosive mixture for their motors?

2—Where could I purchase one?

Greenwich, Conn. L. H. M.

—A spectrescope can be purchased from any dealer in scientific instruments, but it is a rather elaborate and costly piece of apparatus for determining carburetion.

Timing Six-Cylinder

Editor THE AUTOMOBILE:—Please explain how to time a six-cylinder motor. The magneto was taken off some time ago and the motor has been turned over. How must I set the motor and magneto so that they will fire right?

Ames, Iowa. N. D. B.

—To time a 6-cylinder motor remove the distributer cover so that you can see the carbon brush of the high tension distributing arm. Set the piston in No. 1 cylinder until it is exactly at the top of the compression stroke. Turn the armature of the magneto until the distributer brush touches the segment corresponding to No. 1 terminal on the magneto. Then move the armature more gently while examining the low tension end until it is seen that the break is just about to take place. If you then attach the magneto while in this condition you will note that the break will occur and the spark take place just as the piston is coming over dead center, which is correct for full retard. With a fixed spark magneto the setting would have to be made with a piston about ½ in. or even more below the dead center and on the rising side. You will probably find it advisable to get an approximate setting to run the engine and then try advancing setting one tooth. If the motor lacks power it means the magneto is too much retarded. To make quite sure you have the distributer set correctly follow the firing order of the cylinder so as to check this, and then see that the high tension wires are in proper sequence on the cylinder.

Simple Hydrometer

Editor THE AUTOMOBILE:—Replying to the letter of H. M. B. in your issue of Feb. 7, relative to testing a mixture of denatured alcohol and water to ascertain its freezing point, I beg to state that there is a simple hydrometer on the market which is graduated so as to indicate the freezing point of a mixture of denatured alcohol and water. To make the test it is only necessary to draw off a small portion of the water from the radiator into the containing vessel, float the hydrometer in this and read off the freezing point. I have used an instrument of this nature several years and have found it entirely satisfactory. The hydrometer is made by the Alcohol Utilities Co. of New York.

South Bethlehem, Pa. BARRY MACNUTT,
Lehigh University.

Putting Ammeter on Buick C 25

Editor THE AUTOMOBILE:—Kindly give sketch and directions for installing an ammeter reading scales 15 to 0 to 15 on a 1915 Buick model C 25.

2—What size wire should be used?

Schleisingerville, Wis. J. K.

—The accompanying illustration, Fig. 1, shows the method for installing an ammeter.

2—H-10 wire should be used.

Limiting Engine Speed

Editor THE AUTOMOBILE:—There seems to be some misunderstanding regarding the maximum r.p.m. of high speed automobile engines, but more particularly the eights and twelves. I, and no doubt many others, should like to have correct information concerning the highest speed yet obtained, and the theoretical top speed of an engine of the ordinary reciprocating type.

This letter is occasioned by an argument I had with a salesman at the Haynes stand in last week's Boston Automobile Show. On questioning him about the maximum speed of his twelve-cylinder engine, he informed me that it was 4340 r.p.m. I argued that the motor would not operate at that speed because there would not be time to draw in gas, fire it and exhaust it; and that the valve would not have time to close at so high a speed. He claimed that the valves had to operate regardless of the engine speed. Then I asked what limited his engine speed. He replied that there was no limit and that the r.p.m. would go to 5000 or even 6000 if the designing engineers had wished it so.

Furthermore, when recently talking with a very intelligent mechanic who works in the local Cadillac agency, I was informed that the Cadillac, when it recently averaged 70 odd m.p.h., on a speedway, had an engine speed of over 8000 r.p.m. He had not stopped to figure out the speed, but was simply taking someone's word for it. Consequently, I figured out the engine speed and convinced him that the r.p.m. were somewhat below 4000.

I have understood that Prof. David L. Gallup, who is head of the gas engineering at Worcester Polytechnic Institute and a prominent member of the S. A. E., got the highest speed thus far obtained from an automobile engine. That is, he speeded up a Flanders 20 engine to over 4000 r.p.m. before it ran dead.

Nashua, N. H. G. C. H.

—Internal combustion engines of small size have been made to run and deliver power at speeds up to 6000 r.p.m. A good modern automobile motor of the highest speed type will run at 4000 r.p.m., delivering maximum horsepower at about 3000. It used to be thought that it would be impossible to get gas into a cylinder and to fire it for speeds as high as this, but experience has proven the theory to be wrong, which is another way of saying that an engine will run on a very small charge.

Value of Oversize Tires

Editor THE AUTOMOBILE:—I have a Dodge touring car, which I practically always run loaded with five people. Under these conditions would it be advisable to use oversize tires, 33 by 4 regular 32 by 3½?

2—Is the actual air cushion in 33 by 4 larger than in 32 by 3½?

I understand that 32 by 4 is actually larger than 33 by 4.

3—In the *Forum*, March 3, article by Charles E. Manierre, working table is given to inflate 4-in. tire to 60 lb. for 750 lb. load per wheel. Would this hold good for 33 by 4? Somehow I have the impression that 33 by 4 has not the air capacity it is supposed to have.

Wonalancet, N. H. E. L. F.

—It is almost always best to use oversize tires.

2—Yes.

3—Yes.

Adjusting Buick Valves

Editor THE AUTOMOBILE:—Kindly give me a description of a Buick 1912 model 29, telling how to adjust the pushrods on this car. I have trouble starting this car and have been told that the carbureter is not adjusted properly, and when it is adjusted to suit starting the engine it misses. Kindly give me necessary instructions.

Baltimore, Md. E. McI.

—The pushrods can be adjusted by loosening the lock nuts and yokes which fasten them to the rocker arms. These rods should be adjusted with a clearance of 0.010 in. between ends of valve stems and rocker arms, when both valves are fully closed.

It is quite probable your trouble in starting is due to too much clearance on the pushrods. If the valves are not operat-

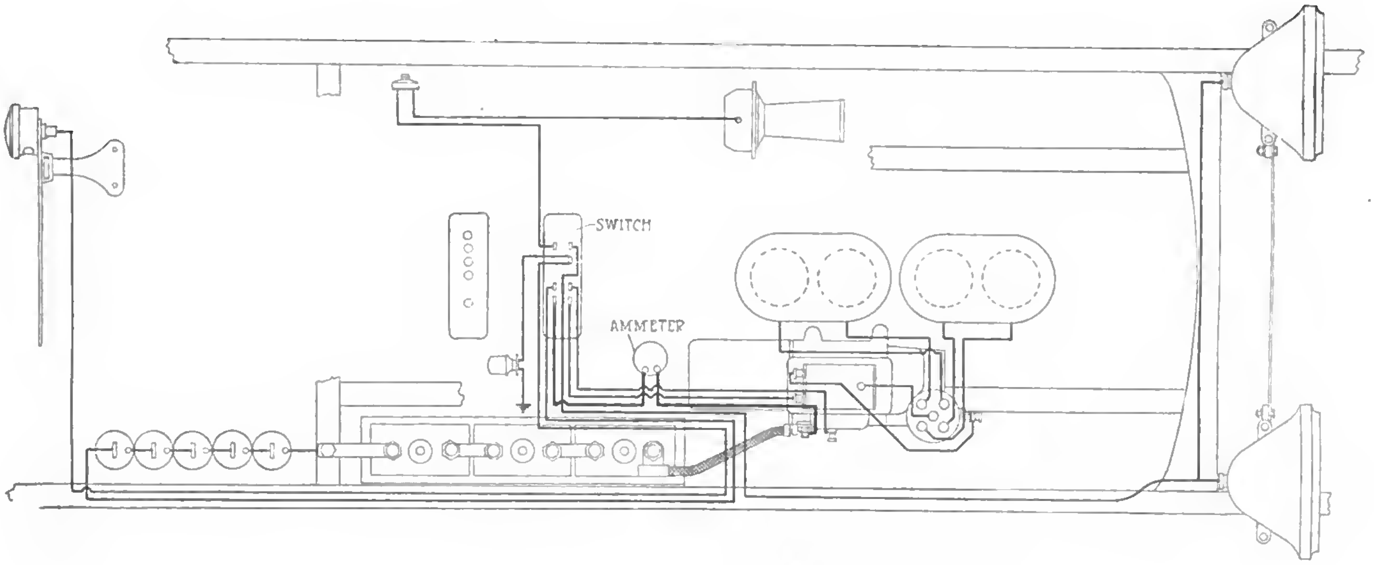


Fig. 1—Position of and connections for fitting ammeter to Buick 25

ing correctly you will need an excessively rich mixture for starting.

Series Plugs Cannot Hurt Engine

Editor **The Automobile**:—I have a Scout 1914 model American underslung with a four-cylinder 4 by 5 motor, T-head type, which I have recently equipped with double ignition by using two spark plugs in series for each cylinder. Since making this alteration it has occurred to me that possibly I have been unwise as the much more rapid combustion due to the two-point ignition might subject the engine to greater strains than it was designed for, especially at low speeds.

Equipped with series plugs there is no way to cut out one set while running at low speeds and then to cut them in when the faster speeds are attained.

Will you please inform me whether you deem it advisable to discontinue their use?

San Antonio, Tex. C. M. B.

—It is highly improbable that you would injure your motor by using two-point ignition. As long as the engine does not knock when running slowly no harm can possibly accrue. It certainly would be possible to design a cutout switch for the second plug but it would not be very simple as it would have to be a high tension switch.

Wiring of Saxon

Editor **The Automobile**:—Through the columns of the Rostrum would you give me the complete wiring diagram on the Saxon S-2 touring car, also how would you go about to take the Atwater Kent timer off so as to get the cylinder head off to clean the pistons and get the timer back in its place so it will be in time?

Marshall, Ill. E. F. C.

Wiring diagram of the model S-2 is given in Fig. 2. To remove the Atwater Kent distributer, it is only necessary to loosen the set screw which holds it into the bracket. You will notice after having removed the distributer that the driving slot in the shaft is off center. The distributer cannot be put back into place and be out of time.

Two-Point Ignition for Power

Editor **The Automobile**:—I have a Chalmers car model 26-B in which the engine is too small for the weight of the car for satisfactory use over our rough and trying roads. I have read several times of the increased power secured by the use of the two-point sparking system as obtained by the use of the Su-Dig plugs. Will you kindly advise me if I could obtain increased power by drilling and tapping the caps over the exhaust valves in this car and using the two-point plugs, and if it would be liable to injure the balance of the ignition system, which is of Atwater Kent make with current taken from a nine-cell battery?

Dowagiac, Mich. A. B. G.

—You would probably obtain slightly increased power with a two-point sparking system and need not have the least fear in applying it, as it could not injure the ignition system.

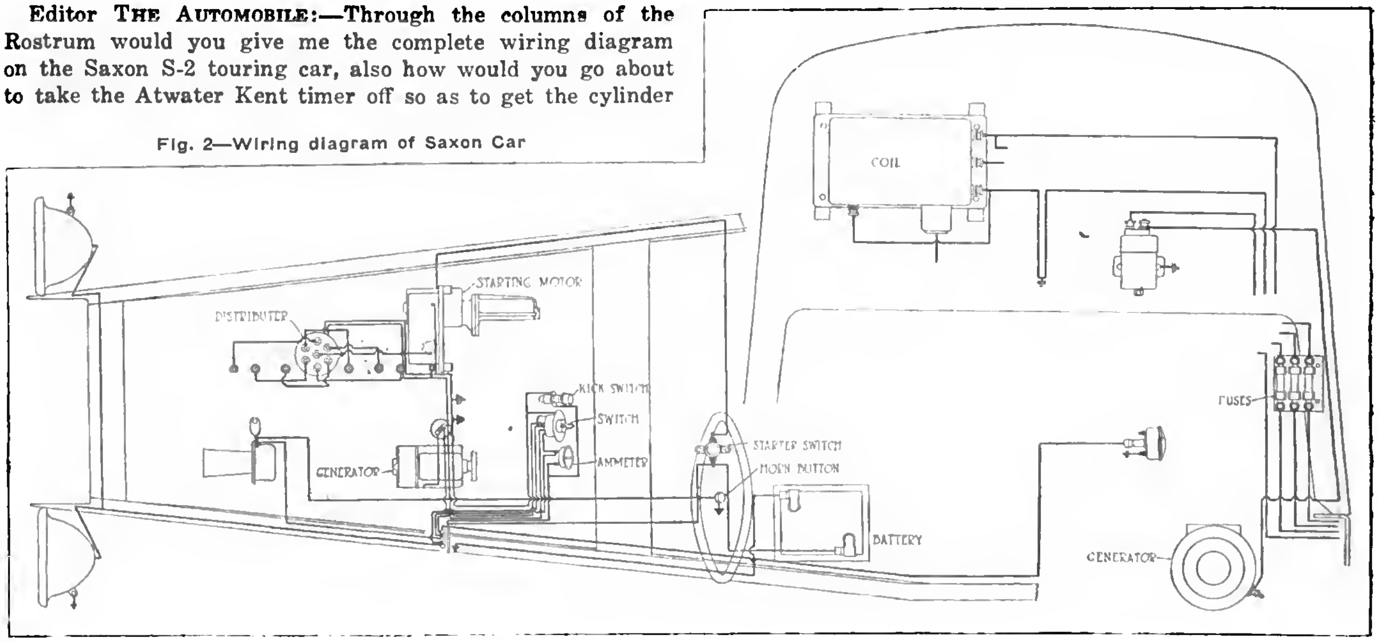


Fig. 2—Wiring diagram of Saxon Car

Analyzing Air Cooling

(*Continued from page* 591)

case of the ordinary motor car is that of properly accommodating the fan and air conduit arrangements; in this respect the ordinary motor car does not lend itself so well to air cooling as does the flying machine.

Sooner or later a limiting diameter must be reached at which the weight of copper becomes prohibitive in face of the possibility of cooling by water circulation, but the reservation must always be made that the foregoing figures are based on assumed distribution of air jacket gills. In special cases it may be found possible to sub-divide the jacket in the manner, for example, illustrated in Fig. 9.

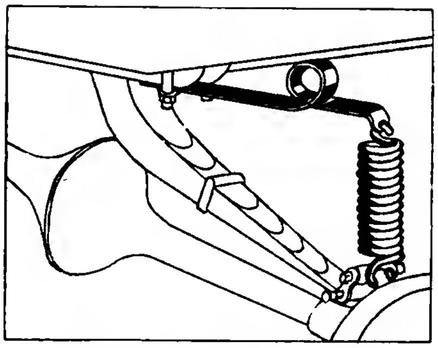
It will probably be found that the weight per horsepower is independently limited by considerations of an entirely practical nature. Thus, copper of less than 0.01 in. (0.25 mm.) is so structurally weak and flimsy that the limit of what is actually available is evidently in that region. The thinnest the author has employed has been nearly double that figure. If we accept a limit of thinness in this region, the weights per horsepower given in table III for cylinders of less than 140 mm. cannot be realized to the full; it would seem, in fact, that the weight per horsepower will automatically remain the same for all cylinders from 140 mm. downward. The simplest course when dealing with cylinders of less than 140 mm. (which, after all, includes the majority of cases) is to adopt the gill standard proper to that diameter uniformly on all sizes; if this be done the design of the air jacket may be finally specified (for copper) in the following form:

b (copper) 33s.w.g. = 0.01 in.
s 4.5 mm. (= 5.5 per inch)
h 26 mm. (for uniform thickness) say = 1 in.

ACCESSORIES

Burrows-Overton Shock Annihilators

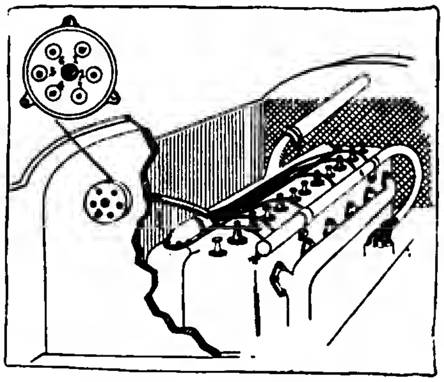
CONSTRUCTED on the spring-lever principle, the Burrows-Overton device for the rear of Ford cars is claimed to control to the fullest extent all side-sway and rebound. The top bar is made of 1 by 3/16-in. flat spring steel and has a coil of 2-in. diameter in it which renders it exceedingly flexible. This is attached to the frame cross member and is secured in place by a U-clip and yoke and also by a right-angle upturn of ½ in. at the inner end. A rectangular wooden block prevents the bar from slipping up into the spring channel. The expansion spiral spring hooks to the brake drum bracket with a specially-designed hook, slipping easily into place. The whole device can be mounted on the car in five minutes, according to the manufacturer, without disconnecting any part of the car. The shock annihilators sell for $3.50 per set of two.—Burrows-Overton Co., New York City.



Burrows-Overton Shock Annihilator

Lazco Trouble Detector

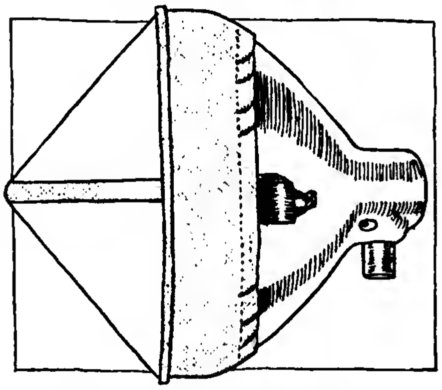
A series of spark gaps is arranged in a round casing mounted on the dashboard. There is a point for each spark plug of the motor and a central point connected with the other side of the circuit. Opposite each point there is a window. An arm, which may be turned in a circle by an exterior knob, may be brought opposite any of the points; if the engine is being properly ignited, it will be indicated by the spark at the gap. Price for fours and sixes, $5; eights, $7.50, and twelves, $10.—Lazarus Mfg. Co., Cleveland, Ohio.



Lazco ignition trouble detector

Clark Headlight Dimmer

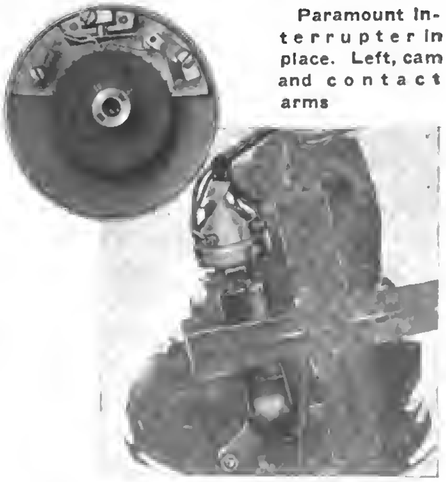
In this device a cone of pyralin is attached to the front of the lamp by means of a flexible band which fits tightly over the rim. The light is diffused and scattered in all directions. When not in use, the dimmer is folded flat and can be put in the pocket or under a seat cushion. No. 1 is for lamps up to and including 9½ in. outside diameter, including Ford lamps; No. 2 is for all lamps larger than 9½ in. No. 1 sells for $2.50 per pair and No. 2 for $2.75 per pair.—Cherry-Clark Guard & Dimmer Co., Chicago, Ill.



Clark flexible folding dimmer

Paramount Interrupter

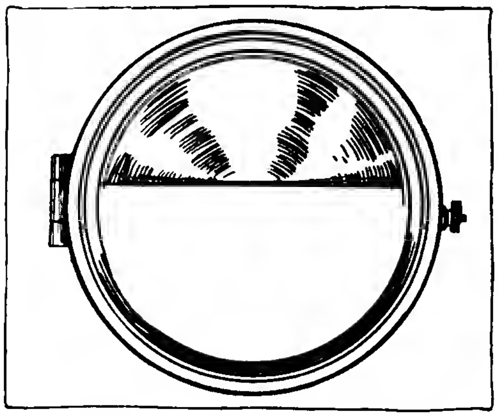
This interrupter is designed to eliminate the necessity for the vibrator on the Ford coils and at the same time to improve the ignition. It consists of a special interrupter which is wired into the ignition circuit between the magneto and the coils; the vibrators are short-circuited and so rendered inoperative. The interrupter is driven by a vertical shaft mounted in a special bracket which is attached to the crankcase at the front of the motor by bolts passing through existing holes, drive being taken from the end of the camshaft, which ordinarily drives the Ford timer; the latter is removed from its normal place and is attached at the top of the Paramount interrupter and is driven by the same vertical shaft. Advance and retard of ignition are not interfered with in any way. The shaft runs at camshaft speed. The interrupter cam has thirty-two teeth. The interrupter and the timer, working together, are so arranged that the current is always interrupted at the proper instant. No additional current is required, the regular Ford flywheel magneto current being used.—Detroit Engineering Products Co., Detroit.



Paramount Interrupter in place. Left, cam and contact arms

H-M Ray Controller

The H-M ray controller is of glass with the upper part frosted inside to a point a little below the center; the light of the upper part of the lamp is diffused, but the lower part of the beam is thrown out undimmed. The side rays illuminate the roadsides just as without the device attached. The glasses are installed in the same way as the original headlight glasses, it being only necessary to take out the old glasses and insert the new ones. Price, per pair, 7 to 9½-in. flat glasses, $1.25; 9⅝ to 11⅝ flat, $1.50.—H-M Mfg. Co., Providence, R. I.



H-M ray controller for headlights

Pamco Products

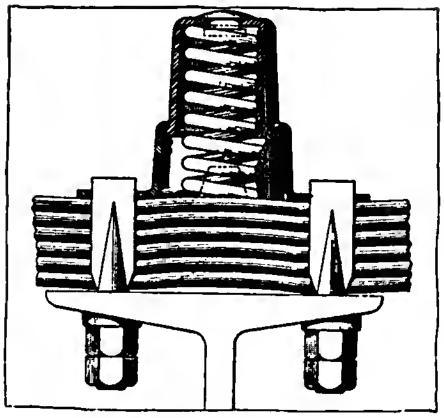
The Pamco Tire Saver jack comes in three models. No. 1 and No. 2 are toggle and lever operated and are non-adjustable. No. 1 is for Fords, and No. 2 for larger cars. No. 3 is also toggle operated, but it has a dog and rack for giving different adjustments. This jack can be operated in less than 6-in. clearance, having an offset head. No. 1 lists at $4; No. 2, $5, and No. 3, $5.

The Pamco spring bumper is a coil spring in a telescopic case and is used to

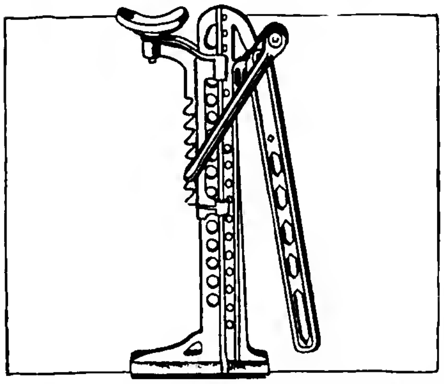
Kim torsion springs in position

replace rubber bumpers between springs and frame. The bumpers are attached by loosening the spring clips and then putting the bumper flanges underneath. They are made in two sizes, for case under and over 2500 lb. Price, per pair, $1.

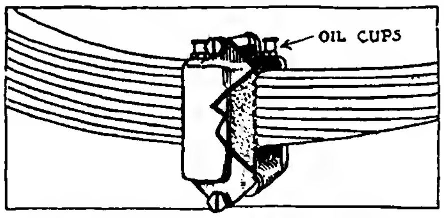
Pamco oil boxes clip to the sides of the springs and contain felt pads from which oil is fed between the leaves. The motion of the springs produces a pumping action on oil wells at the bottom, keeping the pads saturated. The boxes sell for 75 cents each. Ford size, $3 per set of four.—Auto Devices Co., St. Louis, Mo.



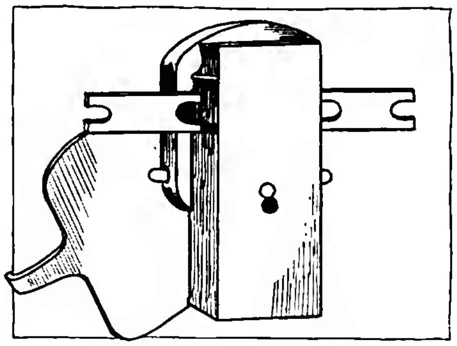
Pamco auxiliary spring bumper



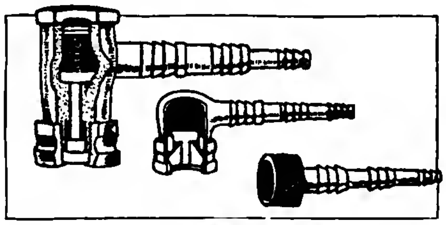
One of the three Pameo tire-saver jacks



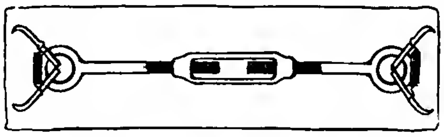
Pamco spring lubricator mounted



Sure-Cure steam vulcanizer



Two Romort air valves and a coupling



Grier closing tool for non-skid chains

Kim Torsion Springs

In the Kim device a pair of torsion springs connected by a yoke is placed between the ends of the leaf springs, or between the leaf spring and its support in the case of a semi-elliptic. There are no wearing parts. The springs can be attached to any car in a few minutes, without drilling or machine work. Price, rear set, $15; Ford set of four, $25. —Kim Mfg. Co., Inc., Merrimac, Mass.

Romort Air Valves

Romort valves are for use on tire-inflating hose and are automatic, shutting off the air when the hose is removed from the tire valve. Style A is a heavy valve for severe service and is made from a solid bronze casting. Style B also is made of bronze, but is a smaller and lighter valve and designed for ordinary service. Both valves are equipped with universal step-up stem, so that any size hose will fit, from ¼-in. to ⅝-in. Style A sells for $3 and style B for $1.

A new specialty is the Romort tank connection, for connecting the hose at the tank. Hose is disconnected by merely unscrewing the heavy knurled nut; this also has the universal step-up stem.—Romort Mfg. Co., Seattle, Wash.

Sure-Cure Steam Vulcanizer

This little portable vulcanizer has a one-piece body which is filled with water at the factory and does not require refilling, as steam is not allowed to escape and when cooled returns to liquid form. The fuel used is gasoline, which is measured into the fire-box and allowed to burn out; the makers state that the heat is automatically controlled. A complete outfit of repair material, clamp hooks, chain, etc., accompanies each vulcanizer. The finish is nickel. Price, $2.25.

Another product is the National air jack, a pneumatic jack operated by either a hand or power tire pump, a brief application sufficing to lift the largest car. To lower the car, the air is released. For storage purposes a mechanical lock is provided. The air, however, will retain its pressure for several hours, and sometimes days, at a time. The jack has a large base, being 5 in. in diameter and weighing only 7 lb. A 3-ft. hose is furnished, making attachment easy. The jack sells for $6.—National Motor Supply Co., Cleveland, Ohio.

Mecco Garages

All Mecco garages are of pressed steel, and they are made in great variety. The metal is pressed into ornamental designs or into plain shapes, and various arrangements can be had to harmonize with the surroundings; roofs may be metal shingled or tiled with Spanish type metal tiles. Covering may be built on structural steel or wood framing. Both portable and non-portable types are built; the former range in size from 10 by 12 to 20 by 20, there being fifteen sizes. Prices are from $50 up.—Moeschl-Edwards Corrugating Co., Covington, Ky.

Grier Chain Closer

The common turnbuckle is the basis of this tool for bringing together the end links of tire chains. At each end of the turnbuckle is a ring and each ring carries a pair of hooks which engage the chain links. Turning the yoke pulls up the chain. It sells for 75 cents.—P. A. Grier Co., Cleveland, Ohio.

P. & H. Robe and Poncho

This is a fleece-lined robe of lightweight waterproof material, and can be carried under the seat or on the robe rail. It can be thrown over the shoulders and fastened at the neck for use as an emergency rain-coat or weather-proof. The makers also recommend it as an engine hood cover. Price, $2.25.—Peters & Herron Dash Co., Columbus, Ohio.

Mecco sheet steel garage

The Automobile

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Racing Advancing

SCHEDULING shorter-distance speedway races for the coming season will have a desirable effect on the speedway meets, because shorter races can only be interpreted as insuring fewer cars being eliminated due to serious breakages, which often eliminate a machine for several weeks, or, in some cases, months. Last year the long 500-mile contests proved particularly serious, due to higher average speeds than previously possible, and to the consequent strains imposed on the machines because of such. This year the machines are better able to withstand such severe tests, but added to this is the fact of shorter races, which will mean fewer cars seriously eliminated.

Still a further step that should insure better contests and more cars is the program of short events—four races rather than one long race of 500 miles. In addition to such short events conserving car stamina they will also be potential interest stimulators. Instead of one finish in a day there will be three, or perhaps four. The spectator in his own mind will get three or four times as much excitement out of the day as formerly. These short-race programs are going to be very general, and will lead back to the days of five or six years ago, when some of the best racing events were made up of short-distance contests.

The old handicap event is bound to return—that is, a handicap based on previous performances. A handicapping committee is essential. The handicap event was looked upon with more or less disfavor because of the danger connected with it. The fast cars had to go through the entire field to win. This was sometimes attended with accidents. To-day this situation has been altered, and with the circuit of board speedways it is now possible for the fast cars to do this without the danger element. There is much attraction to a good handicap race. It can crowd into a few minutes as many memories of a terrific speed duel as several hours of a 500-mile race, which lapses into a mere spectacle for a percentage of the time.

Increasing Efficiency

THE proverb "Necessity is the mother of invention" is simply another way of expressing the inertia of the human mind. We do not start to improve until some circumstance compels us to get up and hustle.

Now that there is an agitation to increase the economy of the gasoline engine, there is an immediate response, and scores of inventors are working on methods to improve our present engines or to introduce new and better types.

The possibilities of altering the present Otto cycle motor to secure more work from a given quantity of fuel are received with interest by engineers. Anything which will increase the work area in the diagrams, and which will at the same time allow the car to perform in accordance with the demands of the public, would be hailed as a valuable discovery.

Naturally the first thing to be suggested is the carrying out of the expansion line until the pressure falls almost to atmospheric, thus cutting out the high exhaust pressures which now allow about a third of the fuel energy to be ejected through the muffler. The big point to consider, however, is not whether an engine can be made to work on the extended expansion stroke method, but can it be made to do so and give the quick, snappy action demanded by the super-educated automobilist.

Let Us Conserve

THE law of progress is to eliminate waste. Many generations will not have passed before the man who makes it possible to conserve our precious mineral fuel, either by increasing the visible supply through greatly improved distillation or by the invention of an engine which can use now wasted products, will be recognized as one of those who has rendered a service of the greatest importance. His practical reward would be immediate.

Billions of barrels of kerosene for which there is practically no market to-day are being stored or lost. To find some means of using this either by converting it into a more volatile product or by finding an engine or device that will use it, would make the automobile a possibility to thousands who do not use it now, and would immeasurably increase the mileage of those cars now on the road.

S. A. E. Standards Work Progresses

Five Divisions Meet This Week —Nomenclature Committee Completes Task

DETROIT, MICH., March 29—*Special telegram*—At this morning's session of the nomenclature division of the Standards Committee, Society of Automobile Engineers, the names of all the parts of the frame, spring and steering gear assemblies were decided upon. Rapid progress is being made and the committee expects that by to-night its work will be nearly completed.

The meeting of the electrical equipment division of the standards committee was held in New York Tuesday morning, the principal work done being the revision of certain old recommendations in the data book which have lately fallen out of use. These are concerned with details of wiring and recommendations as modified are much wider. A large part of the time was spent in discussing the design of lamps and lamp bulbs, particularly from the viewpoint of glare. A sub-committee has been appointed to carry the investigations already made very much further and to confer with makers of lamps and bulbs. It is hoped that standards of a large number of the parts which go to make up a lamp will enable glare to be eliminated without the need for elaborate focusing or other devices. The subject is a large one and bristles with difficulties, but the electrical equipment division is very hopeful of ultimate success. This matter will be one of the principal subjects for discussion at a general meeting of the Standards Committee which takes place in Cleveland on April 21.

A Busy Week

Activities of the standards committee this week include meetings on Wednesday, Thursday, Friday and Saturday of the nomenclature, engine and transmission, miscellaneous and research divisions.

The activities of these divisions are in general continuations of previous work. The nomenclature division has drawn up a list of names of parts which it is getting ready to submit at an early meeting of the national organization. These names of parts are for use in standard parts price lists in which it has been found that under present conditions there are several names for the same part used by different concerns in the automobile business. This results in confusion to the stock managers and also to the general public.

The engine and transmission division is collecting data necessary to the plotting of average curves of engines of different classes. These curves will furnish what may be called expectancy charts as a check on design. Sub-committees of this division are gathering information in order to develop proposed standard designs relating to V belts and pulleys, poppet valves and hand-starting cranks.

The miscellaneous division has a large number of small details. Some of the topics for which they are discussing standard dimensions are license plates and brackets, tire pump bases, standard weight of car, location of identification number, location of engine number, hose clamps and fittings for hose diameters from 3/16 to 3 in.

The research division is taking up the matter of more elaborate forms for the gasoline consumption test and is also working out a standard method for acceleration tests. This division has another matter under consideration dealing with standard tap and drill sizes.

Midgley Is Now Lancaster Tire & Rubber Co.—Capital, $850,000

LANCASTER, OHIO, March 25—The name of the Midgley Tire & Rubber Co., this city, was changed, at a recent special meeting of the stockholders, to the Lancaster Tire & Rubber Co. At the same time the capital stock of the company was increased from $550,000 to $850,000. The $300,000 increase is 7 per cent cumulative stock. Certain stockholders have already underwritten $100,000 worth of this preferred stock, so it means the putting in of an additional $150,000, as $50,000 worth of common stock was purchased a short time ago. It is also known that as rapidly as additional funds are needed the other preferred stock will be purchased.

The new directors are: F. A. Miller, Columbus, Ohio, general manager of the H. C. Godman Shoe Co.; H. B. Peters, Lancaster, Ohio, president Fairfield National Bank; C. S. Hutchinson, Lancaster, Ohio, assistant secretary H. C. Godman Shoe Co. and vice-president Lancaster National Bank; Harry Davis, Pittsburgh, Pa., president Harry Davis Enterprises Co.; E. E. Lerch, Columbus, Ohio, secretary of the H. C. Godman Shoe Co.; H. V. Blaxter, Pittsburgh, Pa., of Lazier & Blaxter, attorneys-at-law; J. T. Rose, Lancaster, Ohio, president of The Lancaster Tire & Rubber Co.

The officers of the company are: J. T. Rose, president; C. S. Hutchinson, vice-president, and G. A. Stephenson, secretary and treasurer. Walter H. Hermann is factory manager and T. B. Davies is manager of sales.

VANCOUVER, B. C., March 25—Up to November, 1915, there were 9100 automobiles registered in British Columbia, as compared with 6387 in 1914.

Briscoe Disposes of Argo Plant

Former Disco Manager Secures Control of Jackson Plant—To Continue Cars

DETROIT, MICH., March 28—Announcement was made to-day by the Briscoe Motor Corp., Jackson, Mich., that a contract has been made with Mansell Hackett, former manager of the Disco Starter Co., this city, for the sale of the Briscoe interest in the Argo Motor Co., Jackson, Mich.

To Widen Scope

Mr. Hackett will take immediate charge of the Argo Motor Co., to which he will bring an entirely new organization, and it is anticipated that he will extend its business activities in a large measure within a very short time. Mr. Hackett is well known in automobile circles and has made an enviable position for himself by putting on its feet the Disco Starter Co., which he purchased from a receiver.

The Briscoe Motor Corp. will hereafter devote its entire time, organization and the new plants which it recently acquired and has under construction to the manufacture and sale of Briscoe motor cars exclusively.

Mr. Hackett states that it is the intention to continue the present Argo models for the time being, adding a light delivery car on the same chassis. However, larger cars to sell between $600 and $700 will be brought out later, the plans being for a production of 5000 the first year.

Stover Tractor Makes Appearance

FREEPORT, ILL., March 27—The first model of the new Stover tractor was turned out this week by the Stover Engine Works, which is to manufacture the machines. The wheelbase is 90 in.; the front wheels are 36 in. in diameter and the rear drive wheels 56 in. The latter are equipped with cross cleats. When used in sod or stubble plowing, extra spurs are furnished, twenty-four to each wheel, which contributes to the footing of each wheel. The motor has four cylinders, and is rated at 40 hp. The tractor is to be sold for a three-plow machine, but has a maximum capacity of four. A 20-in. steering wheel enables the operator to handle the machine as easily as an automobile. A Bennett carbureter and air cleaner is part of the equipment. The Stover company plans to turn out 100 or more of these machines during the coming season, and work will commence as soon as the tests of the first model have been completed.

To Compile Industrial Data

Federal Trade Commission Plans Closer Co-operation with All Manufacturers

Boston, Mass., March 28—In an address before the Boston Commercial Club here last night Edward N. Hurley, vice-president of the Federal Trade Commission, gave a summary of the industrial research done by the commission during the year in which it has existed and outlined the plan for securing better co-operation between the commission and manufacturers in all industries in the United States. This plan comprises the compilation of data on production, sales, investment, depreciation, etc., so that each member of an industry, when furnished with the resulting summary, will have a clear conception of the general condition of the industry and what remedies may be applied to existing difficulties. Brief extracts from Mr. Hurley's address follow:

"The Federal Trade Commission has been in existence one year, and after surveying the field, we found from a preliminary investigation that 200,000 corporations out of a total of 260,000 engaged in the manufacturing and mercantile business of the United States were eking out an existence; 100,000 of them did not earn a penny. Out of 60,000 successful corporations doing a business of $100,000 a year over 30,000 charged off no depreciation whatever. Only 10 per cent of our manufacturers and merchants know the actual cost to manufacture and sell their products; 40 per cent estimate what their costs are, and 50 per cent have no method but price their goods arbitrarily. Most of the manufacturers and merchants who do not know what their goods cost are basing their selling price on what their competitors sell for and with only this knowledge for a basis they are frequently cutting prices and demoralizing the industry in which they are engaged.

"There were over 22,000 business failures in the United States last year; more than 20,000 of them were small concerns. We all know that a large percentage of business is run at loose ends, haphazard and without the proprietors really knowing at any time how they stand or whether they are making a profit or a loss.

"In order to co-operate intelligently with the manufacturers and merchants of the country the Federal Trade Commission must have these facts. With this thought in mind we recently mailed to every corporation in the United States a form containing a few simple questions pertaining to their industries. This information embraces the products which they manufacture, their annual sales, the capital invested, and other principal items, such as depreciation, etc. These data will be compiled by industries and a summary of results sent to each company engaged in that particular line. This will give each man in the business an opportunity to know whether or not the industry he is engaged in is in a healthy condition."

Stearns-Knight Advances Car Prices $50 March 20

Cleveland, Ohio, March 23—The F. B. Stearns Co., this city, announces an increase in price of $50 per car on all models, beginning March 20. The Apperson Bros. Automobile Co. has announced that there will not be any increase in list prices on current models. The prices placed on the 1916 models will remain unchanged until the 1917 models are announced.

The following list gives the price increases and decreases made during 1916:

INCREASE

Company	New Price	Old Price
Chalmers	$1,450	$1,350
Dort	665	650
Studebaker—		
Roadster Four	850	825
Seven-Passenger Four	875	845
Landau Roadster Four	1,150	1,145
Three-Passenger Six	1,060	1,025
Seven-Passenger Six	1,085	1,050
Saxon Six	815	785
Marmon—		
Five-Passenger	2,900	2,700
Seven-Passenger	2,950	2,750
Three & Four Passenger	2,950	2,750
Buick Six—		
Roadster	985	950
Touring	1,020	985
Empire Four	935	895
Scripps-Booth Four—		
Roadster	825	775

DECREASE

Company	New Price	Old Price
Maxwell of Canada—		
Touring Car	$850	$925
Roadster	830	900
Cole	1,595	1,785
Overland	695	750

Napoleon Car on Market

Napoleon, Ohio, March 24—Beginning April 1, a light four-cylinder 25-hp. chassis will be produced by the Napoleon Auto Mfg. Co., this city. A plant has been secured and all the necessary machinery and tools and equipment have been placed and are ready for operation.

The company will capitalize for $50,000 to $75,000.

The following are a few of the features of the car: selective transmission; disk clutch; double system, starting and lighting; I-beam front axle; semi-floating axle, rear; irreversible steering gear; demountable rims; vacuum gasoline feed; gasoline tank in rear; cellular type radiator; semi-elliptic front springs, and cantilever rear springs.

The officers of the company are: President, A. O. George; vice-president, F. P. Diemer; vice-president, G. M. Donnelly, and general manager, F. M. McGrew.

Sunbeam Racers for America

Two 300-In. Sixes Built—Christiaens to Drive One—Two New Fiats

Paris, March 11—Around Brooklands track it is an open secret that the Sunbeam company has built a couple of six-cylinder 300-cu.-in. racing cars specially designed for American track conditions. The military authorities of England have given permission for one of these cars to be exported, and arrangements are well in hand for Joseph Christiaens to handle it in some of the leading American races. The new Sunbeam is a four-valve motor in which has been incorporated all the experience gained during recent months in the building of aviation engines. In trial work the car has shown a speed of 120 m.p.h. The acceleration is remarkably rapid, it being possible to get the motor to its most efficient speed of 3000 r.p.m. on one of the straightaways of Brooklands, standing start. Joseph Christiaens, who has been selected as driver of this car, is the Belgian who drove the six-cylinder Excelsior into sixth place at Indianapolis two years ago.

Two Fiat Racers

Fiat is showing interest in racing, and although no decision has yet been arrived at regarding an American campaign, two cars are in preparation at the Turin factory. These are the 1914 Grand Prix models with engines redesigned with four valves, and increased in bore so as to bring the cubical capacity to the maximum of 300 in. The engines have undergone thorough bench tests and are declared to be very satisfactory. Drivers selected for these cars are Jack Scales and Antonio Fagnano. Scales is an Englishman on the testing staff of the Fiat company at Turin, and was driver of one of these cars in the last French Grand Prix at Lyons. Fagnano is one of the old school of drivers who acted as mechanician to Felice Nazzaro during the period when the Italian crack got away with all the leading prizes in Europe.

Ort Goes to Willys-Overland

Detroit, Mich., March 27—John A. Ort, export manager of the Hudson Motor Car Co., resigned recently to join the Willys-Overland organization. Mr. Ort was formerly connected with the National Cash Register Co., Dayton, Ohio, and with the Burroughs Adding Machine Co., Detroit. He was also the chairman of the Detroit Board of Commerce export committee.

Peace No Remedy for High Prices

Purchasers Do Not Expect War's Close Will Relieve Materials Market

DETROIT, MICH., March 27.—There is no longer any tendency for the purchasing departments of car and parts manufacturing concerns to discount the present materials market conditions. Several weeks ago there were a few who held the view that conditions would improve as the spring advanced, but evidently their method of figuring was wrong, for each week sees increasingly high prices for everything that goes into a car.

Nor is there any hope that with the cessation of hostilities abroad there would be any betterment of price. On the contrary, all now believe that with a great foreign demand opening up when industries of Europe again take up peaceful pursuits, the exportation of iron and steel and other materials will be enormous for the next two or three years, at least, and that any hopes for lessening of prices on the declaration of peace is indeed a forlorn affair.

Some telling arguments are advanced by F. E. Watts, chief engineer of the Hupp Motor Car Co., who believes with most others that we are in for high prices for some time to come. He says in part:

"At the present time the steel companies are contracting for the third and fourth quarters of this year at the present market prices, which are high. In order to protect themselves on the raw material, the steel companies are now contracting for their pig iron, coke, steel scrap and alloying elements, the prices of which are extremely high. Practically all of the ferro-manganese used in the manufacture of steel is imported from England. The latest quotation made on this product was $225 per ton, in comparison with $40 per ton before the war started. The last week the British government declared an embargo on the exportation of ferro-manganese, and it will have to be obtained from some source, as yet undeveloped.

Railroads Buy Heavily

"The railroad companies are ordering very heavily to keep their rolling stock and rails in condition. In the first two months of this year 641 locomotives were ordered, approximately 10,000 freight cars of various types, and the rail tonnage will be over 150,000 tons.

"The Russian government, last week contracted for 60,000 tons of rails. The locomotives will have the tendency to keep the price of tubing up, as there is approximately 10,000 ft. of this material used in every locomotive.

"The shipbuilding companies are busier than at any previous time, and the contracts held by the American shipyards will keep them busy throughout 1916, part of 1917, and some boats are being contracted for with delivery specified in 1918. The engines in these boats will also require an immense amount of tubing, and the decks and plates for the hulls will require a large tonnage of cheap steel.

"At the present time there is very little steel being produced in Europe, and with the destruction of railroads and railroad equipment, and bridges, there is going to be an immense demand for steel after peace is declared. Steel men estimate that the exportation of steel will be very large for at least two or three years after the war is over.

"We cannot possibly escape the effects of this general increase. What we gain in one place by purchasing, manufacturing, or designing skill, or by getting parts from companies which have raw materials in stock, we lose elsewhere."

Ford Excluded from California Interstate Business

SACRAMENTO, CAL., March 28—Failure to pay the State franchise tax of last year has caused a proclamation to be issued by Governor H. W. Johnson, excluding from interstate business in California about 5500 corporations, including the Ford Motor Co. In the case of the Ford company, the tax amounted to $24,000, which the company refused to pay on the ground that it was excessive. A penalty of $100 a day is fixed for violation of the proclamation which declares the franchise forfeited. The company, however, can pay up and revive itself at an expense of $51,000 besides the tax. It was stated that the courts would probably be asked to enjoin the enforcement of the Governor's proclamation.

Belmont Electric Announced

WYANDOTTE, MICH., March 28—The Belmont Electric Auto Co. will shortly start the production of an electric delivery car selling at $985, a four-passenger car at $1,400, and a six-passenger limousine for $1,600. The concern will occupy the Murphy Machine Shop on Biddle Avenue, this city. The company plans to produce 250 cars the first year.

The car, it is stated, is capable of 75 miles on one charge of the battery. The company is also planning to provide a charging plant, patents applied for, for $150, which will make the electric car owner entirely independent of charging stations. J. H. Bishop of Wyandotte is president of the company. Temporary offices are at 410 Scherer Building, Detroit, Mich.

Car Production Breaks Records

Ford Sure to Build 500,000—Other Concerns Surpass Previous Outputs

DETROIT, MICH., March 28—Although prices of materials continue to advance and factory officials see no hope of relief in the near future, production of cars continues to make record-breaking strides here and in the surrounding automobile manufacturing centers. With the freight car situation also adding to the troubles of the factories, it is surprising that shipments continue to increase as the days go by. Many prominent manufacturers have increased the prices on their cars to take care of the added cost of materials, but all reports seem to indicate that even the increased amounts which the customers have to pay for their cars are not in any way affecting the enormous demand, which continues to be much greater than the most optimistic would have cared to predict some months ago.

Information received from the Ford company indicates that there is no longer any doubt of 500,000 Fords being built for the present fiscal year. Plans have already been laid for 1,000,000 Fords for 1917.

So far as the 1916 outputs are concerned, it may be said that not one of the factories now has any doubt of its ability to market as many, or even more cars than were called for in the original monthly production schedules.

As an instance of present manufacturing conditions, Studebaker reports that the daily production will soon be raised from 300 to 400 cars. Reo is turning out about 125 cars per day, Chevrolet is increasing its production as predicted some months ago, so as to be producing over 300 cars per day next month, with the ultimate idea of turning out 460 per day in August. Cadillac will ship more eights this year than ever before and Dodge's production is now running about 300 per day. Maxwell will soon have its second assembly conveyer system in operation, which will allow of a possible production of about 500 cars per day. At its present pace Saxon will easily turn out the 30,000 cars which are planned for the present year. Similar stories emanate from practically every factory in the big production area.

Tracy Is Premier Purchasing Agent

DETROIT, MICH., March 29—P. W. Tracy, purchasing agent of the Paige Motor Car Co., has signed to go with the Premier Motor Corp., Indianapolis, Ind., in a similar capacity.

To Show Cars in Paris

Automobiles and Trucks Will Play Important Part in Reconstruction

PARIS, March 27—Motor vehicles will play an important part in the great work of reconstruction which must follow the declaration of peace in Europe. Preparations for undertaking this tremendous task are already well under way and include expositions such as the Reconstruction Exposition, to be held during the latter part of May and through June and July, and the fair and market now being held in Agricultural Hall, London.

The Reconstruction Exposition, which will be held on the terraces of the Tuileries Gardens and the Halls of the "Jeu de Paume," will be very broad in scope and will be open to exhibits of automobiles, motor trucks, parts, accessories, etc., in fact anything which is admitted to an automobile show in the United States. The exposition is semi-official in character and all goods destined for the display have preference over all others on the French lines to Bordeaux and on the railroad to Paris. Fifteen days notice to the general agent in New York is necessary, however, to secure this preference. The same applies to New Orleans, where the same preference is given. The secretary of the exposition suggests that it would be advantageous for automobile concerns desirous of sending exhibits to co-operate with the chambers of commerce in their respective cities and group their shipments in order to have them arrive at New York or New Orleans at about the same time.

Big Sales Expected

The secretary also declares that those exhibiting will do a larger business than at most of the American shows, for not France alone but many other European countries, such as Spain, Portugal, Egypt, Italy, Greece, etc., will be represented by people anxious to buy cars and to secure agencies. He points out that reconstruction in Europe will bring American manufacturers many times more business than the war orders, but that buyers here will not purchase unless they can see a sample. Hence the reason for the exposition.

The demand for American automobiles selling under $1,000 is entirely beyond the belief of Americans. They are wanted all over Europe by the thousands. Many people are endeavoring to secure parts to assemble them here to meet the demand for cheap cars.

Farm Possibilities

Europeans do not realize the wide use American farmers make of their cars as farm implements, for sawing wood, pumping water, using them as tractors, etc., and if they could be shown some of these possibilities the market would be correspondingly widened. Farm tractors will be in immense demand in Europe after the war, and American manufacturers will have enormous opportunities in introducing their machines if they make the direct effort necessary to bring them before the European farmers.

40-Cent Gasoline Not Expected

NEW YORK CITY, March 27—The price of gasoline in the East remains unchanged. All four of the principal companies—Standard Oil, Crew-Levick, Gulf Refining and Texas—are quoting 24 cents to garages in New York and 23 cents in New Jersey. Prices in Connecticut are at the same level as for New York. Of the Western cities Minneapolis alone has a higher price, Independents advancing low grade gasoline, tank wagon basis, to 20½ cents, medium 24½ cents and high 26 cents. The Standard Oil prices in Minneapolis are one cent lower for the lower and medium grades.

In view of the fact that the higher prices now prevailing have served to stimulate production, conservative oil men are beginning to question the probability of further increase. It is generally conceeded that the present supply and demand situation justifies current prices. Oil men, therefore, are inclined to look askance at predictions of 40-cent fuel.

The following table gives prices of fuel at present obtaining and those for August, 1915. Prices for March, 1915, were at their lowest, which was 2 to 3 cents below the August price.

	Current Price, Cents	August Price, Cents	Advance, Cents
Boston, Mass.	25.0	15.0	10.0
Buffalo, N. Y.	23.0	12.0	11.0
Chicago, Ill.	18.5	10.5	8.0
Cincinnati, O.	23.0	12.0	11.0
Denver, Col.	22.0	12.0	10.0
Detroit, Mich.	19.0	11.0	8.0
Hartford, Conn.	24.0	14.0	10.0
Houston, Tex.	20.0	12.0	8.0
Kansas City, Mo.	16.8	9.8	7.0
Louisville, Ky.	21.0	12.0	9.0
Minneapolis, Minn.	19.5	11.5	8.0
New York City	24.0	14.0	10.0
Newark, N. J.	22.0	11.0	11.0
Philadelphia, Pa	25.0	13.0	12.0
Pittsburgh, Pa.	25.0	14.0	11.0
Portland, Me.	25.0	16.0	10.0
Raleigh, N. C.	24.0	15.0	9.0
St. Louis, Mo.	17.9	10.9	7.0
San Francisco, Cal	18.0	11.5	6.5
Seattle, Wash.	18.5	12.0	6.5

Wallman Co. Is Now Inglis

MILWAUKEE, WIS., March 27—The Wallman Mfg. Co., maker of gasoline and oil storage systems, tanks and pumps, has been succeeded by the Inglis Mfg. Co., newly organized, of which C. W. Inglis, of the Milwaukee Steel Foundry Co., is president and treasurer. Charles Inglis, for twenty-eight years past with the International Harvester Co.'s Milwaukee branch, is secretary and manager. It is the intention of the new concern to improve and increase the production of garage systems.

Another Gasoline Resolution

Massachusetts Congressman Calls on Attorney General To Cite Prosecutions

WASHINGTON, D. C., March 27—Another legislative attempt to find out why the price of gasoline is now so high has just been made by Congressman Treadway of Massachusetts, who has introduced a resolution in the House calling on the attorney general to furnish data to Congress showing what prosecutions have been inaugurated.

The resolution provides, in effect, that the attorney general transmit to the House of Representatives full information relative to prosecutions, if any, that have been inaugurated by the Department of Justice against any person, firm or corporation for violation of the Sherman anti-trust act and amendments thereto in relation to the production, transportation and sale of gasoline, and especially with relation to the increase in price in certain localities of the United States and the variation in price between certain sections of the United States. It is further provided that in case the attorney general has not instituted prosecutions on this subject he is directed to transmit to the House his reasons for failure to bring such prosecution.

House Names Sub-committee to Decide on Relief Plan

WASHINGTON, D. C., March 28—The various resolutions proposing an inquiry into the rising price of gasoline were placed in the hands of a sub-committee to-day by the House Committee on Mines and Mining. Representatives James of Michigan, Van Dyke of Minnesota and Garland of Pennsylvania were appointed to decide what course should be pursued.

There are two resolutions before the sub-committee. One, by Representative Randall of California, proposes that the Federal Government take over the oil output of the country and operate wells and refineries. Another, offered by Representative Carter of California, calls for an investigation by the Bureau of Mines.

The sub-committee will examine documentary evidence and also consider a report soon to be made by the Federal Trade Commission on the subject.

Wondertone Opens Chicago Office

NEW YORK CITY, March 28—The Motor Appurtenances Corp. of this city has opened a branch in Chicago at 1469 South Michigan Avenue. The company manufactures the Wondertone horn and other motor car equipment.

N. G. E. A. Adopts Standards

Approves Magneto and Carbureter Flange Standards —Tractor Suggestions

CHICAGO, ILL., March 25—The Society of Automobile Engineers standard magneto practice was adopted by the National Gas Engine Assn. Standards Committee at a meeting held at the Sherman Hotel here to-day. Another S. A. E. standard to be adopted was that for carbureter flanges. The ⅞-in. eighteen-thread spark plug was recommended for adoption.

A large number of tractor men attended the meeting and a section of the Standards Committee was formed to take up this work. This section will consider the subject of wheel sections, plow hitches, engine mountings, etc. They will hold several meetings between now and the time of the annual convention in Chicago June 27, 28 and 29, at which time they will report.

Among the points discussed for standardization were magneto mounting dimensions and couplings, spark plugs, screw threads, cap and die limits, carbureter fittings, fan belt speed, clutch pulley spiders and horsepower rating. The only special tractor feature taken up was that of draw bars for wagons and other trailers.

More Study Required

As this was the first regular meeting of the Tractor Section no definite recommendations were made of standards in most instances, as it was felt that in the majority of cases further study was required before a recommendation could be made.

Export Trade Problems

The export trade in tractor engines which is anticipated necessitated the consideration of whether or not the spark plug adopted should be of metric thread instead of U. S. standard, and a very lively discussion arose on this score. One suggestion was that arrangements be made by which spark plugs of any pitch thread and of any diameter from any predetermined maximum could be used. This, it was suggested, could be accomplished by making the spark plug hole considerably larger than the ⅞-in., and put in a bushing which in America could take a ⅞ or ½-in. U. S. standard thread plug, and for foreign use it will be necessary only to change the bushing for one which would take a metric plug. The discussion of this subject brought up a number of interesting points. George A. Schwer, of the Dauch Mfg. Co., insisted that a bushing of liberal diameter be used, as the original suggestion of a shell which replaced the ⅞-in. plug, and that the ½-in. plug would not be safe, as it would not stand up. Chairman Charles Kratch of the Sumpter Electric Co. suggested that all holes be tapped for bushings so that any plugs to answer the foreign or domestic be used. S. M. Walker, head of the gas engine department of Montgomery Ward & Co., suggested that inasmuch as the trade would be called upon to supply large quantities of engines for foreign shipment, the trade should be prepared to meet this demand as well, and that the bushing should have a metric thread, which he believed was the U. S. Government as well as the foreign standard. Mr. Walker felt that it was the best policy in catering to the foreign trade, as well as the domestic, not to try to make the market buy what manufacturers were selling so much as it is to sell them what they want to buy.

Putting in Bushings

Fred Glover of the Emerson-Brantingham Co., Rockford, Ill., voiced an opinion which was generally diffused that the method of putting in a bushing in every engine made in order to take care of the comparatively small proportion of the output for foreign trade would be uneconomical. Further, that the use of a bushing would put the plugs too far away from the water space. H. T. Buffington, of the Minneapolis Steel Machinery Co., concurred in this, and stated that where metric threads were needed it would not be difficult to tap out the holes for them. The bushing idea finally was dropped, and the S. A. E. standard plug recommended.

For standard magneto dimensions the S. A. E. standards were recommended for adoption. However, it was felt that there was one feature in tractor practice which was not cared for by the S. A. E. standards, and this was the case of impulse starting, which has been developed for use in tractor engines. There are four or five magneto concerns offering these impulse starters and all of them differ from ⅛ to ¾ in. in the dimension from the first holes in the base to the face of the coupling, and it also was brought out that the length of magneto shaft end to the first holes in the base varied among the magneto makers.

Magneto Couplings Discussed

This brought up the point of magneto couplings, which was discussed by Mr. Williams, who developed the conditions necessary for flexible couplings for tractor magneto drive, and illustrated his points with samples of a number of different types. The question of the standardization of couplings was referred back to a sub-committee for a later report.

The standards of the Society of Automobile Engineers were used as a basis to a great extent in the discussion of the standards for tractors, and this section of the standards committee of the N. G. E. A. realized the value of working in harmony with the S. A. E. By special request the standards committee of the Society of Automobile Engineers was represented by Mr. Herman, of the Chicago Screw Co. There were in all twenty-five representatives of the tractor and allied interests present, and it is to be expected that the next meeting of this section will see even closer co-operation with the S. A. E.

To Build Lane Worm-Driven Light Truck In Kalamazoo

KALAMAZOO, MICH., March 25—The Lane Motor Truck Co. of Kalamazoo, Mich., has been recently organized with a cash capital of $25,000, M. H. Lane being president and general manager, and G. E. Bardeen, secretary and treasurer. The directors are M. H. Lane, G. E. Bardeen and F. G. Gilsky. The company will build a factory at once and expects to begin manufacturing about May 1.

The company will bring out a light worm-driven truck with a wheelbase of 120 in. and pneumatic, solid and cushion tires. The unit power plant will be 3¼ by 5 in., with a three-speed transmission and multiple-disk clutch. The radiator will be a fin and tube type. Semi-elliptic springs 2½ in. front and rear will be used with Hotchkiss drive. Both service and emergency brakes will be internal expanding on the rear wheels. Front axle will be an I-beam with roller bearing, rear axle Sheldon worm drive with a gear ratio of 6.2 to 1. Wheels will be artillery types with square spokes. Tires will be 34 by 4 pneumatic front and rear. There will be four body styles.

Suggests Headlight Ordinance

ST. PAUL, MINN., March 25—Secretary T. M. Johnson of the automobile club has drawn an ordinance for approval by the club and city council covering dimming of headlights of automobiles. The present ordinance leaves it to the discretion of each policeman to decide whether the particular lights are too bright. The proposed law requires a lamp shedding a ray of light 75 ft. to be adjusted so the beam will not be higher than 3 ft. above the ground.

Turney Radiator a M. A. M. Member

NEW YORK CITY, March 25—At a meeting of the executive committee of the Motor and Accessory Manufacturers held in the association's offices, New York City, recently the following concern was admitted to membership:

Turney Radiator Co., manufacturer of radiators for passenger cars, trucks, tractors, and aeroplanes, Canal Street, Rome, N. Y.

Car Shortage Still Serious

Situation Is Practically Unchanged—Railroads Are Doing Their Best

DETROIT, MICH., March 28—The freight car shortage situation remains practically unchanged. It has not become worse during the past week. Traffic managers of automobile manufacturing concerns agree that the railroads are doing all they can do to remedy the situation, but there is no question that with the congestion in the East persisting, with the bad weather continuing, little headway is possible.

There are also a number of things which happen, and which according to railroad men show that manufacturers are also to be educated along lines about which little is said. A railroad freight manager said that he had received a report from the freight agent in one of the cities along his road, advising him that a certain dealer in that city will not take delivery of two carloads of automobiles now there until April 5. The reason given is that these cars were ordered shipped to arrive on a certain day, but not before April 5. The manufacturer thought it just as well to ship a week earlier, but the dealer has made his financial arrangements to take delivery of the shipment April 5, and not March 25. Consequently in this case the dealer is not to blame, it is all the fault of the manufacturer if the cars are not taken out promptly. This happens quite frequently among manufacturers of automobiles, said the railroad man, more so than among any other manufacturers.

Railroads Losing Thousands

Another railroad man said that the railroads are losing thousands of dollars because of the freight car shortage and that they are doing their utmost to have as few idle cars as possible. However many roads keep cars from other roads on their tracks too long instead of reshipping them promptly from where they came from. Thus, it is claimed that there are a large number of Coast cars in the Detroit territory which should have been on the way to the Coast a long time ago.

At Dodge Bros. plant it was stated that no matter what is being done, not enough railroad cars can be had. The concern lacks 35 to 40 per cent, and this means all kinds of freight cars fit to be used for shipping automobiles. As far as regular automobile equipment is concerned the roads furnish only one-fifth or one-sixth of what Dodge needs. However it is felt that the railroads are doing what they can.

Fully 50 per cent of all outgoing carloads from Detroit contain automobiles or automobile parts, according to the manager of the freight division of one railroad. Whether the freight cars contain complete cars or only parts, makes no difference in the billing, and thus this road cannot tell, it is claimed, how many carloads of automobiles and how many carloads of parts, it is handling. This information could only be obtained from the shipper.

Standard Truck Plant Plans

DETROIT, MICH., March 25—The plans for the new three-story plant of the Standard Motor Truck Co., show that the structure will be 130 by 160 ft., between Lafayette and St. Paul Avenues, adjoining the Michigan Central belt line. The ground floor will be occupied by the assembling, blacksmith, shipping and receiving departments besides a day and night service department. The front part of the second floor will be occupied by the general offices and its sub-offices, while the rear part will have the machine shop, stock room and the woodworking department. On the third floor, the fore part will be used as display rooms and the rear portions will be occupied by the painting, varnishing and trimming departments.

It is estimated that the cost of this building will be in the vicinity of $100,000, and the new machinery which will be installed after the building is completed will cost approximately $100,000.

10 per Cent Increase in Pierce-Arrow Wages

BUFFALO, N. Y., March 23—An increase of 10 per cent in wages for its employees has been made by the Pierce-Arrow Motor Car Co., this city. The increase dates back to March 3 and includes daily, weekly, monthly and piece-work rates in all departments.

Walz Resigns from Johns-Manville

NEW YORK CITY, March 28—C. H. Walz has resigned his position as manager of H. W. Johns-Manville Co.'s local automobile accessory department to take effect March 31. He will return to Philadelphia to engage in the automobile accessory specialty line. He has taken quarters at 1335 Mount Vernon Street, where he will handle the Genemotor system for Ford cars.

Overland Will Employ 18,000

TOLEDO, OHIO, March 27—As soon as the office building in this city of the Willys-Overland Co. is completed, the office force will be increased to 2000, making the total number of employees 18,000.

Test Cotton Tire Fabric

Bureau of Standards Aims To Aid Mill Operators in Uniform Testing

WASHINGTON, D. C., March 27.—The Bureau of Standards, Department of Commerce, has just completed a paper entitled "Standardization of Automobile Tire Fabric Testing." The paper is the result of a study of the causes of variation and confusion in the interpretation of results of commercial tests on tire fabrics by various mills. The work was carried out particularly with a view toward getting some standard method as regards test piece and machine for testing 17¼-oz. cotton tire fabric.

The chief causes of variation in test results were found to be due to different varieties of testing machines, sizes of test specimens, difference in quantity of moisture of the fabric at time of test and in methods of selecting samples and differences in the fabric.

Machines Differ Widely

The difference in strength of the same fabric found between results obtained upon two testing machines was often large. In one case the difference was 40 lb. on tensile tests where the strength of the fabric was about 225 lb. Variations caused by different sorts of test pieces led to the belief that a test specimen 1 in. wide and 3 in. long is as satisfactory as any other. The reason for the difference in results from two testing machines, the bureau states, is probably due to two causes; first lack of calibration of the instruments and second, some inherent defect in the mechanism. It is strongly recommended, therefore, that testing machines be calibrated at frequent and regular intervals. In general, tests on bone dry samples give more uniform results and for this reason this method has been tentatively accepted for tire fabric testing.

The report touches on the hygroscopic quality of cotton fiber. It states that automobile tire fabrics are generally sold in rolls of from 100 to 500 yd. each and in some instances moisture is added to the cloth when it is rolled for shipment. Cotton tire fabric under such conditions may contain from 3.5 to 10.5 per cent of moisture, or 100 parts of dry material. Preliminary tests show that for each 1 per cent increase moisture upon the basis of 100 parts dry material there is an increase in tensile strength of approximately 7 per cent.

Knapp Completes Plant Additions

DETROIT, MICH., March 27—The A. C. Knapp Co., which makes tops and does a general car trimming, finishing and painting business, recently completed additions to its plant which give it a total of 100,000 sq. ft. of floorspace, not including the factory buildings of the former Benham Mfg. Co., and of the former Eby Auto Parts Co. Production will be doubled and it is probable that several novelties in the top line will be brought out soon. The company has a large number of orders on the books and expects this to be its banner year. A. F. Smith has been made general superintendent of the top department. He was formerly superintendent of the body department of the Studebaker Corp.

Hoover Ball Doubles Plant

ANN ARBOR, MICH., March 27—The Hoover Steel Ball Co. will double its plant this year, adding 42,000 ft. of floor. The entire new addition will be in operation by Oct. 1.

The company will increase its issued capital stock from $300,000 to $450,000, leaving $100,000 still unissued. Stockholders have been notified that 15,000 shares of a par value of $10 each will be offered for sale and that each stockholder will be permitted to purchase up to 50 per cent of his present holdings. The stock is said to have been selling at $125 and it stated that $75 a share has been offered for the rights.

R. C. H. Corp. to Furnish Parts

DETROIT, MICH., March 25—Having temporarily discontinued the manufacturing of automobiles, the R. C. H. Corp. will devote its attention to the continuation of the repair parts business for R. C. H. cars. Quarters have been secured at 31-33 Woodbridge Street, East Detroit, Mich., and the entire stock of parts, jigs, tools, dyes, patterns, etc., has been moved to this location.

The personnel and management of the company remain the same, Charles P. Sieder being president and general manager and Ted F. Drews assistant general manager.

Work Starts on Buick Foundry

FLINT, MICH., March 25—Work on the new foundry plant of the Buick Motor Co., is progressing, but not as fast as desirable. This is due partly to the lack of laborers, carpenters and other workers. The structural work has been started.

Alloy Steel Plant in Hartford

HARTFORD, CONN., March 25—Peter A. Frasse & Co., Inc., will shortly erect a factory in Hartford, having purchased a site 320 ft. facing on the Boulevard. The building will be a saw-tooth type 320 by 100 ft. It will be used for rolling and heat treating high grade alloy steels.

Bad Truck Bill in Maryland

Would Tax Commercial Vehicles on Ton-Mile Basis and Restrict Load

BALTIMORE, MD., March 24—Perhaps the most drastic and unreasonable motor truck taxation bill ever read has just been introduced into the Maryland Legislature by Senator Bennett of Wicomico County. The bill would tax motor trucks which are operated over State or State-aid roads for the carrying of freight on regularly-constituted time schedules, in Maryland according to the ton-mileage they make and also by the mile and would restrict the load per inch width of tire to 500 lb.

A $4,000 Yearly Tax

The real meaning of the proposed legislation is apparent when by computation it is ascertained that a 5-ton truck making 50 miles a day and delivering 25 tons would be charged $4,124.99½ per year for the privilege of operating over the roads for which privilege the truck owner already pays in his general taxes.

The moneys so raised are to be applied to the roads, according to the plan of the genius from Wicomico County.

The fees called for are as follows:

> "Trucks weighing less than 3 tons, carrying capacity included, 1/10 cent per ton-mile, multiplied by the total number of miles which the application for the license shows will be traveled by the truck during the year for which the license is issued.
>
> "Trucks weighing over 3 tons and not more than 6 tons, 1/8 cent per ton-mile, multiplied by the total number of miles to be traveled by the truck during the year for which the license is issued.
>
> "Trucks weighing over 6 tons and not more than 12 tons, 1/6 cent per ton-mile, multiplied by the total number of miles to be traveled during the year for which the license is issued."

A 5-ton truck, with its load, would certainly weigh more than 6 tons. Five trips, with 5 tons each, 5 load miles each, would equal 125 ton-miles per day. At the rate given, 1/6 cent per ton-mile, the tax would be $0.208333 multiplied by the yearly mileage. Assuming 300 days of operation at 50 miles each, this would be 15,000 miles per year, and $0.208333 × 15,000 = $4,124.99½.

Bill Is Discriminatory

Needless to state, the passage of this law would be tantamount to prohibiting the operation of trucks in the State of Maryland, in such service, which includes not only inter-city express trucks, but also trucks and delivery vehicles making interurban or suburban deliveries. Furthermore the income which would otherwise be derived from taxation of these vehicles would be forfeited. Besides this the bill is obviously discriminatory against a class of vehicle, inasmuch as a tire width of 1 in. per 500 lb. of weight is unreasonable. Other states have laws prescribing 750 lb. per inch of width; others 800 lb.; still others 1000 lb. The ordinary wagon tire, besides greatly exceeding these figures, is composed of steel and is therefore still more injurious to the road.

Hydraulic Steel Cuts Melon

CLEVELAND, OHIO, March 25—The directors of the Hydraulic Pressed Steel Co., this city, recently decided to issue the remaining $155,000 capital of its total authorized issue of $1,000,000 to present holders of the common stock at $150 per share.

Action was also taken to increase the capital stock of the company, from which a 50-per cent dividend will be declared.

The present outstanding common stock amounts to $845,000. Shareholders of record as of the close of business March 7 will have the right to subscribe pro rata to the 15,500 shares now in the treasury. This will represent an allotment of 18.34 per cent at $150 a share. Subscriptions are made payable March 20.

The company will realize $232,500 from the paid-in stock, which will partly reimburse the treasury for an outlay of $600,000 which has been made in the way of extensions of plants during the past six months.

The gross business for the year 1916, exclusive of the output of munitions, will amount to between $3,000,000 and $4,000,000.

Hupp Declares Regular Dividend

DETROIT, March 25—The Hupp Motor Car Corp. has declared its regular quarterly dividend of 1¾ per cent on the $1,500,000 of 7 per cent preferred stock, issued last Fall. The dividend is payable April 1 to stockholders of record March 20.

$200,000 for Old Lozier Co. Creditors

DETROIT, MICH., March 25—A dividend of 7½ per cent, representing about $200,000, has been mailed from the offices of referee in bankruptcy, Lee E. Joslyn, to creditors of the former Lozier Motor Co., which has no connection whatever with the present new Lozier organization in this city.

Thus far four dividends have been declared, two of 5 per cent each, one of 2½ per cent and the present one of 7½ per cent, and the total paid to creditors is about $700,000.

Saxon Ships 179 in 1 Day

DETROIT, MICH., March 27—The Saxon Motor Car Co., broke its former record for one-day shipments on March 16, when 179 Saxons were shipped.

Manitoba Car Market Booming

Dealers Report Unprecedented Sales—Consignments May Total $1,000,000

WINNIPEG, MAN., March 27—A big trade is being done among the car dealers in Manitoba this spring, especially in medium-priced cars. All the dealers report unprecedented sales, one shipment from the East the other day representing over $200,000. The cars were sold in the provinces of Manitoba and Saskatchewan. This was only about one-third of the consignment which is to follow later.

There are at present 9206 cars in use in Manitoba. Placing an average price on these of $1,000 it represents a capital of nearly $10,000,000 in the single province of Manitoba. There is, in addition to this, probably two-thirds as many in Saskatchewan and about the same number in Alberta. The prairie provinces, therefore, represent probably the biggest market for motor cars in Canada, if not in America.

There are 4201 cars owned in the city of Winnipeg, the balance being distributed in various points in Manitoba as follows: Brandon, 371; Portage La Prairie, 149; Neepawa, 81; Carberry, 65; Deloraine, 53; Minnedosa, 60; Virden, 47; Melita, 45; Stonewall, 33; Morris, 20; Emerson, 29; Carman, 65; Cartwright, 22; Gladstone, 32; Glenboro, 26; various municipalities, 3487; by dealers, numbers set apart, 400; by Manitoba Government telephones, 20. Total, 9206.

Hartford Auto Parts Doubles Capital

HARTFORD, CONN., March 25—The Hartford Auto Parts Company, Hartford, Conn., has decided to remain in Hartford and will make use of the New Britain location as a branch. The company is now quartered in the old Cheney silk mill, where the Kelsey motorette was formerly made. The stockholders of the company have decided to double the capital, increasing the stock from $300,000 to $600,000. This concern has come along well within the past year and is now operating 24 hours a day. It is expected that the New Britain branch will be in operation by the first of July.

New Plant for Laporte

SOUTH BEND, IND., March 25—The Portable Power Mfg. Co., Chicago, has decided to move its plant to Laporte, Ind., it will occupy a part of the building of the Laporte Carriage Co. The concern makes a specialty of light and low-priced gasoline engines, such as a motor adapted for use on a grain binder or mounted on a light base and used for any sort of work the gasoline engine is adapted to on the farm.

The contractor is putting the concrete roof on the building just east of the main office at the plant of S. F. Bowser & Company, Fort Wayne, Ind., and it is expected to complete the building and have it ready for occupancy by April 1. This building which is absolutely fireproof is 40 by 60 ft. in dimensions and five stories high. The lower floor will be used for a dead storage vault and the upper floors will be used for offices.

Better Business Dept. for Chalmers

DETROIT, MICH., March 27—For the betterment of its dealers the Chalmers Motor Co. has instituted a Better Business Department and has promulgated an accounting and business system for dealers. The operation of the system is backed up by the Chalmers company, which proposes to stand behind it and assure its satisfactory operation in the places of business of those dealers and distributors who install it.

The system comprises a complete set of forms, including such details as inventory cards, shop work order tickets, material requisitions and providing also ledger forms, a check register and everything required for an extensive system.

With the system goes a book in which are described all the different accounts and operations. It cites the operations in daily routine, weekly routine and monthly routine. There are forms for balances and profit and loss accounts.

Chalmers Factory Men Dine

DETROIT, MICH., March 25—The Chalmers Motor Co. entertained at a banquet to-night a number of superintendents, foremen, inspectors and other factory employees connected with the motor assembly, block test, tuning and repair departments. As in the case of similar banquets where the men higher up from other Chalmers departments are invited, the object is to bring about closer fellowship and discuss matters of general interest relative to the particular departments. Vice-president and general works manager S. H. Humphrey presided at the banquet.

Receiver for Toledo-Findlay Tire

FINDLAY, OHIO, March 25—The Toledo-Findlay Tire & Rubber Co., a concern having a capital of $300,000, has been placed in the hands of a receiver upon the application of A. O. Hamilton, Charles Reick, V. T. Spitler and Henry Hard, directors. The concern was previously known as the Toledo Ford Tire Co., and makes tires especially for Ford cars.

50 Per Cent Gain In Southwest

Cadillac Representatives in That Section Meet at Dallas—Predict Boom

DALLAS, TEX., March 27—The sale of motor cars in the Southwest during the 1916 season will be 50 per cent greater than last year, according to the sentiment expressed at the first annual conference of Cadillac southwestern representatives in this city, March 20 and 21. The dealers came from Missouri, Kansas, Oklahoma, Texas, and parts of Louisiana and Arkansas. They were guests of R. L. Munger, the company's representative in this city.

The increasing prosperity in the South and the optimistic reports from the various commercial centers in Texas, Missouri, Kansas, Oklahoma and parts of Arkansas and Louisiana were among the topics discussed during Tuesday afternoon. Wednesday the discussion of these conditions continued and the salesmen and dealers concluded their meeting more optimistic than when they came.

Those attending the meeting were: E. C. Howard, sales manager, and L. M. McNaughton, assistant sales manager, both of Detroit; George H. Gaston, Detroit; R. C. Greenlease and H. H. Pierce, Kansas City; F. B. Callender, Wichita, Kan.; M. E. Swinney and W. W. Tillman, Springfield, Mo.; H. Perry, Detroit; D. D. Wetzberger, Tulsa, Okla.; J. D. Burrows and C. C. Jones, Oklahoma City, Okla.; Joseph H. Roberts, Enid, Okla.; P. P. Kearney, Ardmore, Okla.; Miles G. Bivens and W. Crossett, Amarillo, Tex.; J. G. Spaulding, Abilene, Tex.; Ed G. Hall, Brownwood, Tex.; H. G. Staacke, San Antonio, Tex.; C. F. Gydeson, Houston, Tex., and J. W. Sanders, Shreveport, La.

Union Tire and Rubber Co. Incorporated for $500,000

ST. LOUIS, MO., March 25—The Union Tire and Rubber Co., recently incorporated in Delaware with a capital of $500,000 to manufacture automobile tires, has acquired the former plant of the Banner Rubber Co., at Kenrick and Bittner Streets, this city. The plant has a frontage of 252 ft. on Kenrick Street.

Fried Joins Premier

INDIANAPOLIS, IND., March 28.—E. R. Fried, at one time connected with the engineering department of the General Motors Co. and the Ferro Foundry and Machine Co., having more recently acted as assistant chief engineer of the F. I. A. T. Co., has been appointed assistant to C. S. Crawford in the engineering department of the Premier Motor Mfg. Co., this city.

Kemco Electrical Co. Reorganized

Entirely New Ownership and Personnel—Officers and Board of Directors Elected

CLEVELAND, OHIO, March 27—The Kemco Electrical Mfg. Co. has been reorganized with an entirely new ownership and personnel. C. A. Burrell, for a number of years credit and advertising manager of the Willard Storage Battery Co., has been made secretary and general manager. The other officers are: President, Frank W. Glass; vice-president, E. M. Silver; treasurer, A. O. Silver. The three latter are from Salem, Ohio. The Silver brothers practically own the Silver Mfg.. Co. of Salem. The directors will be the four officers and H. E. Silver, also of Salem. Under the reorganization none of the old Kemco officers or directors remain. The company will specialize in the manufacture of starting and lighting equipment for Ford cars, which it has been making for some time.

Splitdorf Co. Pays Back Dividend of 7 per Cent

NEWARK, N. J., March 27—The Splitdorf Electrical Co. has declared a dividend of 7 per cent, which represents dividends in arrears. This leaves 19 per cent in back dividends remaining to be paid off. It is expected that the remaining back dividends will be paid off within the next four months.

Market Prices Steady

NEW YORK CITY, March 28—With the exception of a large rise in lead, market prices last week were on the whole very steady. Bessemer and open-hearth steel remained constant at $45 per 100 lb. Lead, however, continued on its record-breaking rise, reaching $8.18 yesterday, recording a jump of 30½ cents per 100 lb. for the week. This metal rose 12½ cents the previous week. Copper is holding firm with fair buying at 28½ cents a pound. Aluminum and antimony were slightly firmer yesterday with a large demand. Aluminum is now selling at 65 cents a pound, while antimony is quoting at 44½ cents.

A somewhat firmer tone developed in the market for crude rubber yesterday, although prices did not show much change. Business in the local market was more active. Mail advices from London state that the market for crude rubber has fluctuated moderately, but that its undertone has been on the whole good. The quantities actually available or left unsold are rather light, and there is a nervous feeling among those who have to secure deliveries against outstanding contracts, while importers maintain a reserved attitude, being apparently inclined to hold back a little stock pending developments. The price of hard Para is at present comparatively low, and therefore should tend to attract a better demand. Up-river Para is now quoting at 75 cents, while Ceylon first latex is steady at 91 cents.

The oils and lubricants prices were for the most part very steady with few changes. Linseed oil dropped 1 cent a gallon to 77 and cottonseed oil declined 25 cents a barrel to $10.70. Gasoline is still quoting at 24 cents wholesale with threats of a further rise to about 30 cents. No credence is given to the reports of 40-cent gasoline.

Firestone and United States Tire Companies Out of Tire Suit

CLEVELAND, OHIO, March 24—Holding that there was not sufficient evidence to support a charge of conspiracy against them, United States District Judge Killitz, sitting here, released the Firestone Tire & Rubber Co., Akron, and the United States Tire Co., New York, as defendants in a suit involving $1,000,000 alleged damages sought by the Automobile Co-Operative Association of America, which claimed to have been put out of business and its capital dissipated.

The suit against the B. F. Goodrich Co. and the Diamond Rubber Co., Akron, and the Republic Rubber Co., Youngstown, which were alleged to have been in the conspiracy charged, was proceeded with.

Flint Varnish & Color Works of Canada Formed with Capital of $250,000

FLINT, MICH., March 23—Officials of the Flint Varnish & Color Works announce the formation of the Flint Varnish & Color Works, Ltd., of Canada, capitalized at $250,000. The Canadian plant will be located in Toronto, in the factory buildings formerly occupied by the Dominion Carriage Co., and which consist of a three-story building, 250 by 82 ft., and a one-story building, 250 by 60 ft. A one-story structure, 120 by 120 ft., will be erected for melting, thinning and treating gums used in the manufacture of varnish.

Gilbert Mfg. Co. Winner in Tire Cover Suit

NEW HAVEN, CONN., March 25—Editor THE AUTOMOBILE:—There is some confusion in the trade concerning the decision of the United States circuit court of appeals in a suit of the Allen Auto Specialty Co., against our former New York representative, E. G. Baker. Your news item in THE AUTOMOBILE for Dec. 23 seems unfair to us in that it implies further proceedings in this matter and makes no mention of our connection with this suit.

We wish to make it clear that the decision was in favor of the Gilbert Mfg. Co., Mr. Baker merely figuring in the suit as our New York representative.—E. B. Spaulding, Gilbert Mfg. Co.

U. S. Rubber Officers Re-elected

NEW YORK CITY, March 23—The newly elected board of directors of the United States Rubber Co. met to-day for organization and elected the following officers: President, S. P. Colt; vice-presidents, J. B. Ford and Lester Leland; vice-president in charge of development work, R. B. Price; vice-president in charge of mechanical department, E. S. Williams; assistant to president, J. N. Gunn; secretary, Samuel Norris; assistant secretary, J. D. Carberry; treasurer, W. G. Parsons; assistant treasurer, E. J. Hathorne.

Winding Up Streator Affairs

STREATOR, ILL., March 27—Sidney C. Eastman, referee in bankruptcy, is making an effort to wind up the affairs of the Streator Motor Car Co., a number of modern buildings suitable for a manufacturing plant, and seven acres of land contiguous being included. Bids were received by the referee at his office, 907 Monadnock Block, Chicago, March 28. All creditors have received notice of the proposed sale and that they will be per-

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.65	.65	.65	.65	.65	.65	...
Antimony	.43½	.43½	.44½	.44½	.44½	.44½	+ .01
Beams and Channels, 100 lb.	2.62	2 62	2.62	2.62	2.62	2.62	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	10.95	10.87	10.75	10.60	10.80	10.70	— .25
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb.	7.87½	8.00	8.00	8.00	8.00	8.18	+ .30½
Linseed Oil	.78	.78	.77	.77	.77	.77	— .01
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kansas, crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pennsylvania, crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.75½	.75½	.75	.75	.74½	.75	— .0½
Rubber, Ceylon, First Latex	.90	.91	.90	.90	.90	.91	+ .01
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	50.00	49.00	49.50	50.00	50.00	50.00	...
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

mitted to file objections at a hearing before E. U. Henry, referee in bankruptcy, at his office in Peoria, Ill., on March 31. The plant is now occupied by A. C. Barley, who has formed a new company for the manufacture of automobiles. He has a lease and owns the equipment but not the buildings. It is presumed that Barley will be one of the bidders.

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Twin City Four Wheel Drive Mfg. Co. Incorporated

ST. PAUL., MINN., March 25—The Twin City Four Wheel Drive Mfg. Co., which is completing a plant at University and Cromwell Avenues, has filed incorporation papers, putting capital at $1,000,000. Officers are: President, D. W. Henry; vice-president, J. E. Hayes; secretary, J. R. Hayes. Other incorporators are C. W. Kelly and C. W. Guilder. The first meeting will be April 4. The company makes the Ware truck.

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United Truck Sales 50 per Cent Better

GRAND RAPIDS, MICH., March 25—During the first half of March the sales of the United Motor Truck Co. were 50 per cent in excess of the sales of the month of February, which was itself 119 per cent better than January.

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Frost and Merriman on Jackson Board

JACKSON, MICH., March 24—At the annual election of directors for the Jackson Chamber of Commerce, E. J. Frost of the Frost Gear & Machine Co. and Mark Merriman of the Hayes Wheel Co. were elected to the board of directors.

Security Prices Lower

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Overland, Studebaker, and Maxwell Common Issues Show Decline

NEW YORK CITY, March 28—Automobile issues were erratic last week and prices were much lower. Up to the previous week prices were generally steady and higher. Chevrolet and Chalmers this week continued their rise of last week, while those stocks which have shown strength throughout this month suddenly dropped from 1 to 10 points. Chevrolet closed on Saturday at 164, a record price, while Chalmers closed at 158, having risen 8 points during the week.

Though Maxwell common dropped 3½ points, the stock has shown much strength, due to expectation of larger earnings after April 1. During the early part of last week Maxwell issues were very prominent in the market.

There was little activity in General Motors stocks, the common remaining unchanged and the preferred going down ½ point. It is expected that the directors of that company will meet to take action on the dividend during the first week of April.

Studebaker common and preferred dropped 5 and 2 points, respectively. It is believed that net earnings of this corporation for the quarter ending March 31 will be around $3,000,000. It will be recalled that on March 1 Studebaker paid off from the treasury resources the last of its notes amounting to $2,305,000, so that this year all profits accrue directly to the preferred and common stocks. The preferred dividend takes less than $770,000 yearly.

Detroit issues were steady, with a few substantial gains. Canadian Ford and Paige-Detroit featured with rises of 45 and 10 points, respectively. Maxwell common and second preferred were also strong, with 6 and 6½-point rises. The rise in Canadian Ford may be attributed somewhat to the report that the Canadian government will not make the special war tax as drastic as it was first announced, and that the Ford company will thus not have to pay $2,000,000 or more. Reports also have it that the business of the company has been much better than was anticipated and the demand in that country continues to be such a very good fiscal year is assured.

There has been quite a bit of trading in Maxwell stocks, brokers having received reports indicating that the concern is doing exceptionally well. There were some transactions in Kelsey Wheel stock, which caused this stock to rise 15 points, bid, and nearly 100 points asked. There were a few sales of Paige-Detroit stock at 725, or 35 points better than the previous sale of the stock. General Motors shares were sold at 485.

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Dividends Declared

Gray & Davis; quarterly of 1¾ per cent on preferred, payable April 1 to stock of record March 2.

Kelly-Springfield Tire Co.; quarterly of 1½ per cent on 6 per cent preferred, payable April 1 to stock of record at close of business March 18.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	68½	70½	—1½
Aluminum Castings pfd	96	100	..	..	..
J. I. Case pfd	78	82	75	85	—10
Chalmers Motor Co. com	..	81	158	162	+8
Chalmers Motor Co. pfd	90	92½	99	101	+ ½
Chevrolet Motor Co	..	..	164	167	+4
Electric Storage Battery Co	..	..	60	63	—3½
Firestone Tire & Rubber Co. com	398	402	745	755	..
Firestone Tire & Rubber Co. pfd	110	112	113	..	..
General Motors Co. com	113	115	480	500	..
General Motors Co. pfd	98¾	99⅛	113	116	— ½
B. F. Goodrich Co. com	37¾	38	72½	73½	—2
B. F. Goodrich Co. pfd	97	100	114	116	—2
Goodyear Tire & Rubber Co. com	192	194	340	345	..
Goodyear Tire & Rubber Co. pfd	103½	104½	112	116	—3
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	5½	7	20	24	—2
International Motor Co. pfd	20	22	35	40	..
Kelly-Springfield Tire Co. com	117	118	74½	75½	..
Kelly-Springfield Tire Co. 1st pfd	81	83	96	98	..
Kelly-Springfield Tire Co. 2d pfd	124	126	..	..	..
Maxwell Motor Co. com	32¼	33	69	70	—3½
Maxwell Motor Co. 1st pfd	73¼	75½	85	87	..
Maxwell Motor Co. 2d pfd	30¼	30⅞	54	56	+8
Miller Rubber Co. com	165	170	235	240	..
Miller Rubber Co. pfd	101	103	112	116	..
New Departure Mfg. Co. com	134	135	111	..	..
New Departure Mfg. Co. pfd	106	109	175	180	+10
Packard Motor Car Co. com	80	95	160	175	—5
Packard Motor Car Co. pfd	93½	97½	100	104	—2
Paige-Detroit Motor Car	..	..	690	..	..
Peerless Motor & Truck Corp	..	..	26	27	—1⅛
Portage Rubber Co. com	34	36	70	72	..
Portage Rubber Co. pfd	85	90	106	107	..
Regal Motor Co. pfd	..	..	10	16	..
*Reo Motor Truck Co	11	12	26	28	— ½
*Reo Motor Car Co	28¼	29	33½	34½	+ ½
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	57½	58½	87	88	—1
Stewart-Warner Speed. Corp. pfd	102	105	109	..	+ ½
Studebaker Corp. com	48¼	49¼	141	142	—5
Studebaker Corp. pfd	94	95½	111	112	—1
Swinehart Tire & Rubber Co	74½	76	88	90	+1
Texas Co.	134	135	195	200	—6½
U. S. Rubber Co. com	63½	65	52¼	52¾	—1¼
U. S. Rubber Co. pfd	103	105¾	109	111	— ¼
Vacuum Oil Co	103	108	223	226	—1
White Motor Co. (new)	..	..	51	53	..
Willys-Overland Co. com	120	121	229	232	—5
Willys-Overland Co. pfd	99½	101	104	107	—1

Official Quotations of the Detroit Stock Exchange

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	31	32½	..
Chalmers Motor Co. com	..	80	159	166	—2
Chalmers Motor Co. pfd	90	92½	97	100	—1
Continental Motor Co. com	..	185	34	35	— ¼
Continental Motor Co. pfd	80	85	9¾	10½	+ ¼
Ford Motor Co. of Canada	525	550	..	395	+45
General Motors Co. com	117	..	470	500	+5
General Motors Co. pfd	99	100	114	116	+1
Maxwell Motor Co. com	33	34¼	68½	71½	+6
Maxwell Motor Co. 1st pfd	75	77	84	88	..
Maxwell Motor Co. 2d pfd	30½	32	53	56	+6½
Packard Motor Car Co. com	80	92	167½	173½	—1½
Packard Motor Car Co. pfd	93¾	97½	..	104	..
Paige-Detroit Motor Car Co	..	..	700	725	+10
*Reo Motor Car Co	28¼	29	33¾	34¾	+1
*Reo Motor Truck Co	11	12	..	27	—2½
Studebaker Corp. com	48	50	142	144½	—3¼
Studebaker Corp. pfd	93	95	111	..	..

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	25	..	40	..
Kelsey Wheel Co	195	..	450	540	+15
*W. K. Prudden Co	18¾	20½	29	33	..
Regal Motor Car Co	..	25	..	16	..

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*Par value $10.

Burman Wins at San Diego

Peugeot Covers Freakish 50-Mile Course at 52.14 M.P.H. —38,000 Spectators

Exposition Grounds, San Diego, Cal., March 25—Bob Burman in the Peugeot won the freakiest race of his career today when he captured the Exposition cup race before a crowd estimated at 38,000.

The race on the Exposition Grounds this afternoon was the first boulevard race ever run under the sanction of the A. A. A. and it will probably be recognized as a world's boulevard race record, at least until the Corona classic is run, April 8.

Considering the nature of the course, the time made was remarkable. Burman covered the 50 miles at a speed of 52.14 m.p.h., in 57 min., 30 4/5 sec. Teddy Tetzlaff, on the Los Angeles-built Milac, was second to get to the checkered flag, his time being 58 min., 20 2/5 sec., or 51.42 m.p.h. Barney Oldfield on the Delage finished third, doing the distance in 59 min., 15 sec., or at 50.58 m.p.h., and Cliff Durant on the Durant Special crossed the line after driving 1 hr., 2/5 sec.

An Early Mix-up

On account of the many turns and the narrowness of the course only four cars were allowed to start. On the opening lap, Durant, Tetzlaff and Burman overran a turn and tangled up in the safety zone. Durant's car suffered the most damage. He broke several spokes out of a rear wheel and bent his frame; but after changing the wheel and incidentally losing two laps, he continued in the race and made up a lap before the end of the 50 miles.

Oldfield jumped out in the lead on the first lap and while the drivers were getting back on the course after the near-disastrous affair on the curve, Barney stepped half a lap to the good on Burman and Tetzlaff. On the third lap Barney jarred his oil line loose and for the rest of the race he and his mechanic had to ride through a spray of lubricating fluid. The leaky oil line spoiled Barney's chances for first money and had not Durant lost two entire laps, Barney would have been the last to get to the checkered flag. He knew that he could not stop and repair the damage without losing at least two laps and, therefore, kept up at the best speed possible and gradually dropped back as Burman and Tetzlaff forged ahead.

The arrangements for the race were as novel as the course was freaky. The home of Bosco the snake-eater was used as the judges' stand. The pits were located in an animal cage, vacated for the afternoon on account of the races, and the official grandstand consisted of several hundred benches placed on the main street of Grizzly Gulch, the famous '49 camp.

After Burman passed Oldfield in the fourth lap he held the lead all the way to the finish, although Tetzlaff threatened to overtake him several times on the curves.

Four Entries for Sheepshead Bay May 23 Races

New York City, March 28—Ralph Mulford has entered his Peugeot in the 150-mile Metropolitan Trophy race to be run at the Sheepshead Bay Speedway on May 23. Three Crawford specials have also been entered. These will be campaigned this year by William Chandler. The cars are equipped with sixteen-valve Duesenberg four-cylinder motors. The dimensions are 3¾ by 6¾ in. Chandler will drive one and the others will be handled by Dave Lewis and Art Johnson.

N. G. N. Y. Motor Battery Ready in September

New York City, March 28—Although the first armored motor battery in service in this country was mustered into the service of the National Guard of New York recently at the armory of the Twenty-second Engineers, here, the vehicles will not be completed until next fall, probably next September. Two of the vehicles have already been completed, these being the Jeffery four-wheel-driven service truck and one of the armored Locomobile chassis.

The equipment for the battery will cost in the neighborhood of $100,000, and is in charge of A. F. Masury, chief engineer of the International Motor Co., at whose Metropolitan service station the work is being carried on. The funds have been donated by Elbert H. Gary, Henry C. Frick, James N. Wallace, Dudley Olcott II, Col. William F. Thompson and Lieut. Harry G. Montgomery who will command the outfit.

The company will be mustered into service by Lieut.-Col. N. B. Thurston, chief ordnance officer of the National Guard of New York, and will consist of college men of the type who attended the Plattsburgh encampment last summer. There will be 162 men in the company, commanded by Lieutenant Montgomery, who will be commissioned as Captain, two first lieutenants, three second lieutenants, twenty sergeants, thirty-six corporals and 100 privates.

Inter-State Has a Drive-away

Muncie, Ind., March 25—One hundred and seventy-six distributors, dealers and buyers from Indiana and Ohio drove away from the Inter-State factory last week with 150 new cars. The drive-a-way was originated by George Kanouse, Indiana distributor. A banquet was given Wednesday evening, at which the principal address was made by General Manager B. W. Twyman of the Inter-State company.

Funston Asks for More Trucks

Washington, D. C., March 27—General Funston has sent a hurry call to the War Department for two additional motor trains. This is due to the extension of the line of communication a distance of over 200 miles below the border. The Fifth Cavalry which was ordered to the border a week ago has been sent into Mexico to protect the lines of communication. It is stated that General Funston's request was based upon the excellent work being done by the trucks in Mexico at the present time and that he asked for Jeffery trucks, their four-wheel drive adapting them to the road conditions, which are bad and getting worse.

It is stated that these two companies have already been purchased by the War Department.

De facto President Carranza of Mexico is showing a strong disposition to delay the granting to the American forces of the right to use the Mexican railroads and in some quarters it is thought the permission will not be granted at all. At all events the expedition cannot wait for the negotiations to be completed, as some of the cavalry regiments are stated to be on short rations now. For this reason General Funston will be supplied with sufficient motor transportation equipment to make him independent of the railroads in Mexico.

Packard Preparedness Proved

Detroit, Mich., March 23—Readiness to aid the government in time of need was demonstrated by the Packard Motor Car Co. in filling a special order for a motor truck transport company similar in organization to those recently filled by the White and Jeffery companies. In less than 22 hr. after the receipt of the order, Monday night, March 20, for twenty-seven trucks for the use of the Quartermaster Corps in Mexico, a special train of fourteen steel freight cars and one Pullman left the factory with the right of way to Columbus, N. M. The train carried the complete company of the trucks and thirty-three recruits for the service.

The train was scheduled to make the trip to the Mexican border in 51 hr. The recruits were secured by calling a mass meeting in the Packard shops. It is said that 1000 men volunteered. When the thirty-three were selected, they were given 6 hr. to pack their belongings into small handbags, settle their business affairs and report at the train.

A special night shift was put onto the job of constructing the trucks 2 hr. after the order was received.

50,000 at Pittsburgh Show

Steel and Munitions Boom Renders Territory Prosperous —Expect Big Sales

PITTSBURGH, March 28—The twelfth annual show of the Automobile Dealers' Association of Pittsburgh in Motor Square Garden, East End, which closed March 25, has been an exceptional exhibit in several ways. First, the attendance has broken all previous show records. It is estimated that during the seven nights and six afternoons of the show more than 50,000 different people visited Motor Square Garden.

In the matter of displays this show also took a front rank. Over 300 cars were on exhibit, representing seventy-one different makes. Chief interest centered in the twelves and eights. A considerable number of these were sold right from the Garden. The display of accessories was larger than for several years. Accessory manufacturers have been a little shy the past two years about investing their money, but this year they came forward strongly and there was a large number of exhibits.

Friction Avoided

The management of this show succeeded in putting in a show without any friction such as has characterized the show situation in this city for the past few years. Letters were sent out to more than 1200 dealers in tri-State territory, and a very large proportion of these dealers attended the show. In fact, the interest shown by dealers this week has been far and away the most encouraging feature of the show. It was reported to-day that nearly 100 cars had been sold up to this date, and it is expected that with to-day's sales this number will be considerably increased. Many dealers from outlying points have picked out their favorite cars at the show and have arranged for an allotment of from four to six cars.

The 1200 dealers in tri-State territory, most of them located within 40 miles of Pittsburgh, are looking for very much the best season that they have had for years. The reasons for this are not hard to find. Last year Pennsylvania had very abundant crops, and farmers have been prospering beyond the average on account of this fact and the higher prices which they are receiving for their products. This makes it certain that sales by country dealers will be very much larger than for a long time.

Steel Boom Means Sales

Coming nearer to the city, there is the unprecedented activity in the steel business as a sure forerunner of big sales this year. All steel records have been broken during the past few months. The total number of men employed in the steel mills in the immediate Pittsburgh district would probably be at the present time between 55,000 and 60,000. This is exclusive of all other manufacturing plants which are allied with the steel interests, and shows why the payrolls in this district are now running at a total of more than $1,3000,000 per day, according to bank statements.

Wages are being raised in all the big plants throughout this section.

Bank clearances in this district are running from $1,000,000 to $1,500,000 per day more than the corresponding days of 1915. Added to this is the still more encouraging fact that activity in the steel industry is assured for the entire year. Bookings are now being made in many lines for 1917 delivery. A few of the big concerns in the Pittsburgh district are sold up to late in the fall, and many of them to Jan. 1, 1917. It is to be noted, also, that the average price of steel products, taking the entire list, is $20 per ton higher now than the average of the past ten years.

In the coal and coke industry there is also enormous activity. Coke ovens are running at about 96 per cent or 98 per cent capacity. Coal mines throughout the tri-State territory are doing nearly as well. The question of getting labor is becoming a very serious one, owing to the large number of foreigners who went back to Europe to fight.

In all machinery plants and munition factories it is a hard problem to get enough men to equip the plants. The Westinghouse Electric & Manufacturing Co. is employing by far the largest total of men in its history. Other smaller concerns have similar reports to make. The scarcity of labor in this territory has not been so great for ten years as now.

Hills No Handicap

All this means that there is an enormous amount of money in circulation in the Pittsburgh district and throughout western Pennsylvania, eastern Ohio and West Virginia. Dealers are going to get a large amount of it. The popularity of the motor car was never so great as it is to-day. The feeling that Pennsylvania hills were not made for automobiles has been entirely dissipated.

Dealers report that sales since Jan. 1 are more than double what they were for the first three months of last year. Some agencies have a much better gain than this to report. One organization, for instance, sold four cars in January of 1915 and twenty-six in January of this year. The February and March totals will be in about the same ratio, and the company announces that its sales for three months will be at least four times as large as in 1915. Not only the high-priced cars, but especially the low- and medium-priced cars, are going to make enormous gains in their sales this spring.

The total number of owners in Allegheny County is estimated at 14,000, and in tri-State territory this number would probably come up to over 20,000. There is only one consideration that is going to cut down the sales of cars this year. This is the high price of gasoline. This, according to well-posted dealers, is not likely to affect seriously buyers of cars costing from $3,000 up. It will, however, make a considerable difference probably in the sales of cars ranging in price from $500 to $1,500, and already this factor has spoiled many sales.

May Abandon Danville Show

DANVILLE, ILL., March 27—Being unable to find a building in Danville large enough to accommodate the proposed automobile show of the Automobile Dealers' Association of Danville and eastern Illinois, it was found necessary to ask the City Council to permit the use of Van Buren Street between Hazel and Jackson Streets. The Council, after long debate, denied the petition on the ground that the city would be responsible for any damage that might accrue from the blocking of the thoroughfare. The dealers are now trying to find a lot suitable. If unsuccessful, the show will be abandoned.

Motor-Power Show Soon

SAN FRANCISCO, CAL., March 28—The first annual Pacific Coast Motor Power Show has been scheduled to take place April 26 to May 6 in the new $1,000,000 municipal auditorium of Oakland, Cal. Some 50,000 sq. ft. of floorspace will be occupied by the exhibition. The Lincoln Highway Assn. is interested in the enterprise and L. E. Warford, Pacific Coast representative of the association, is acting as secretary of the show. All types of gasoline-propelled vehicles will be exhibited, including motor trucks and tractors.

Ninth Market Report Coming

CHICAGO, ILL., March 27—In its ninth edition of the National Used Car Market Report the Chicago Automobile Trade Association plans to make the issue more comprehensive than any that has previously appeared. Letters are now being sent to subscribers and also to non-subscribers, urging that the used car prices be placed in the hands of Assistant Secretary T. D. Beard by April 1. The sales asked for are those occurring between Dec. 21 and March 21.

Originally the secretaries of local associations were requested to collect the reports of sales in their cities, but it has been found facilitating to have the information sent by the individual dealers, and this plan is now being followed.

South American Market Needs Delicate Handling

Great Care with Exports Reason of European Success in Southern Continent

UNLESS American manufacturers are willing to transact business with the South American countries on a credit basis, unless they are willing to ship goods as ordered, so that they will reach their destination in good condition, and unless an American merchant marine is established, there is little prospect that after the European war the United States will receive the large business that it could get from South America.

This is the opinion of Peter S. Steenstrup, South American sales representative of the Hupp Motor Car Corp., who returned recently from his third trip to South American ports, during which he investigated present conditions and the future trade possibilities in Argentina, Brazil, Peru, Chile and the West Indies.

Speaking from the point of view of the automobile business, Mr. Steenstrup believes that there will be an increasing demand for American-made cars, especially of medium price. The wealthy class will continue to purchase expensive European cars, to a limited extent, even used cars of European origin in preference to the American car.

Credit Is Essential

The most serious obstacle in connection with our trade expansion in South America is the matter of credit, says Mr. Steenstrup. The merchants, manufacturers, and in fact everybody doing an import and export business, have been and are still operating on a credit basis with Europe. Just now some do business on a cash basis with America because they cannot help themselves, for otherwise they could not get the goods they need. However, as soon as the war is over these importers will again renew their commercial relations with Europe, especially with the German concerns with which they have done business formerly.

This is because they have the assurance that they will continue to be given credit by these German concerns and because that is the only way they want to do business. Practically ever since there has been business intercourse between South America and Europe, it has been on a credit basis and this custom is now national and will not be changed.

Another reason why Europe will most likely again receive the bulk of the South American trade after the war is that the manufacturers of Europe, and especially of Germany, have always been most careful in sending the goods ordered the way they were wanted, that is, packing them carefully and seeing to it that shipments are handled with great care.

Careless Shipping Does Harm

Mr. Steenstrup further complains that American manufacturers do not seem to be willing to follow either the wishes of the South American firms as to what they want, but also are careless in shipping goods. Thus shipments coming from the United States very often arrive in a most unsatisfactory condition, sometimes broken up, sometimes with part of the contents missing, because of the poor and insufficient packing material used. In many instances, also the shipping documents are faulty or incomplete, which often causes long delays and extra expense. But above these great mistakes and evidence of carelessness, is the fact that often the goods shipped are not what was ordered, but something "just about" what was wanted.

European concerns do not do this, and in case they would have to make a substitution, they either write or cable the fact and await instructions. "In a word," says Mr. Steenstrup, "from what I saw and heard, it seems that the American manufacturer really does not want to go to the trouble to take care of his export business in the right way. He often has not the kind of competent men needed to attend to the export end of the business and does not seem to think seriously enough about the matter."

The lack of direct American shipping facilities, in other words, the fact that the United States has no merchant marine, has always been and will continue to be one of the greatest obstacles in the way of the trade expansion of this country with South America.

Business men and government officials find it extraordinarily strange that the United States, with its tremendous export business, is unwilling to provide itself with American-built ships, for direct trade connection with South America. The fact that most goods exported from the United States come in either British or German bottoms instead of American ships, has been and will be exploited to good advantage by the European manufacturers and exporters, with their customers in South America and, as long as this condition prevails the importers in those countries will continue giving their business to Europe.

Money Values Fall

Conditions at the present time are not any too good in South America, except in Argentina. This is the only country where money exchange has not fluctuated and where the national finances are in good shape. All other countries are deeply in debt, owe much money abroad and must keep on borrowing due to the shortage in revenues.

In Brazil, for instance, the value of the milreis, which before the war was 32 cents in American money, has dropped to 24 cents. This means that everything costs one-third more in our money; that an automobile, for instance, which could be purchased for $1,000 before the war, now costs at least $1,300, although identical in construction and equipment. In Chile the peso was worth 18 cents gold before the war. Now it is worth 15 cents gold, and this may drop to 14 cents.

There are at the present time probably about 40,000 automobiles in all South America, and a large percentage of them are in Argentina. In this country touring is enjoyed to a small extent, while in the other countries the roads are generally impossible beyond 10 or 20 miles from the larger cities.

A feature which has impressed Mr. Steenstrup is that nearly all South American countries have excellent trade promotion systems and many very competent trade advisers. The governments spend much money for extensive investigations in foreign countries for the purpose of learning where products of South America can best be sold and where it is best to purchase goods needed. Close business relations are established with Europe and there is a constant interchange with a view to a better understanding and improving trade. Competent men are sent to Europe and they make thorough investigations on the ground, and usually obtain good results.

The History of the American Automobile Industry—23

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four cycles of operation. His conception of the different operations is clearly set forth in his patent. Here is how he expressed it:

"It will be seen that there are four strokes of the piston required for one complete operation, namely: an outstroke for drawing in the charge of combustible mixture and air, an instroke for compressing the gases, a second stroke when the piston is propelled on the ignition of the gases, and a second instroke for expelling the products of combustion. The slide valve *V* consequently has to perform one to-and-fro motion while the piston is performing these four operations."

Otto Type Supersedes Brayton

If we compare the Otto engine with the Brayton two-cycle engine of last week, which was its great predecessor, it will be readily seen that the compressed air in the Brayton engine lost heat in the compressing cylinder and in the storage tank or reservoir, and also in the pipes and valves leading to the cylinder in which it was exploded. Higher crankshaft speeds were also possible with the Otto type as constructed with the knowledge of that day, and therefore the Brayton engine not only disappeared from the market within the next ten years but air engines generally ceased to be a factor in motor vehicle work, although continued for many stationary purposes where small power was required, such as pumping water, until after the end of the century. That this disappearance is due to one of those waves of public opinion which we have seen so frequently recurring is more probable than that the air engine has been finally and fully superseded. They had many points of merit which may some day restore them to public favor, a fact to be noted in these days of multiple-cylinder engines.

The modern gas turbine is beginning to look very simple compared with modern automobile power plants, and some forms of it closely resemble the internal combustion idea introduced by Cayley more than 100 years ago and they show efficiencies nearly as high as did Lenoir's engines at the time of the Civil War.

Increasing the Thermal Efficiency of the Engine

(*Continued from page* 579)

50 per cent further than the induction stroke, but cutting off earlier as the load gets lighter, is shown at *GH*, while *IH* is theoretically the efficiency curve of a complete expansion engine, in which the compression is increased inversely, and the fuel directly as the load.

In solving the mechanical problem provision is made for retarding the beginning of compression when cranking, thereby introducing with the normal high compression no starting difficulties. A standard carbureter would require no change in adjustment for full load, but would require a fuel opening which would vary inversely with the amount of air induced. The fuel valve and cut-off lever would be connected together and operated by the accelerator pedal or hand lever on steering wheel. The rarefaction of the mixture in cylinder at full load induces expansion, gasification and a thorough commingling of the combustible molecules before compression, a condition which insures rapid ignition and perfect combustion.

While the thermal efficiency of complete expansion engines has been excelled only by engines of the Diesel type, there may arise unforeseen difficulties in increasing the compression inversely as the load, yet the possibility of developing an automobile motor whose thermal efficiency is at least 15 to 20 per cent higher than the best engines extant, and one in which the efficiency is as high at the partial load at which it is usually run as at full power, should be of vital interest.

Two of Several Chalmers Dealers' Meetings Last Week

Colorado Chalmers Dealers Hold Get-Together Meeting in Denver

DENVER, COLO., March 24—A bigger-and-better-business dinner for Colorado Chalmers dealers was held last night in the Savoy Hotel and attended by about thirty dealers from the State. The affair was arranged by E. J. Johnson, Chalmers distributor for Colorado and adjacent mountain territory, and by Frank B. Willis, general sales manager from the Chalmers factory. The dinner followed an afternoon meeting, conducted by the Chalmers representatives, but attended also by many local distributors and dealers handling other cars, the earlier meeting being for the purpose of promoting greater co-operation in the motor car industry throughout the Rocky Mountain district, improving efficiency of selling methods, display plans and general management of the business. Speeches were made by Mr. Willis, President W. W. Barnett of the Automobile Trades Assn. of Colorado, E. E. Sommers, president of the Colorado Good Roads Assn. and director of the Denver Motor Club; Frank M. Cochran of the Denver Maxwell agency, and President Thomas B. Stearns of the Chamber of Commerce. Visiting dealers reported favorable prospects for increased sales and for extensive road improvements and other community developments.

200 Chalmers Northwest Co. Representatives Meet in Minneapolis

MINNEAPOLIS, MINN., March 25—More that 200 representatives of the Chalmers Northwest Co. of Minneapolis attended a sales convention March 30-April 1 at the West Hotel. It was the last of a series by the factory company in the United States. Dealers were from Minnesota and the Dakotas. Paul Smith, vice-president, from Detroit, presided. Among the speakers were L. A. Van Patten, advertising counsel; F. B. Willis, sales manager, and Harry Miller, service manager. A banquet and a luncheon and motion pictures of the factory were on the entertainment list.

Factory Miscellany

Meteor Car Co. to Add—The Meteor Motor Car Co., Piqua, Ohio, will soon fit up part of its plant for the manufacture of automobile bodies.

Cowan Truck Increases Space—The Cowan Truck Co., Holyoke, Mass., has let a contract for the erection of a two-story 100 by 200-ft. factory.

North Dakota Co. Builds—The Missouri Valley Motor Co. is planning a three-story reinforced concrete plant. The estimated cost is $30,000.

Oklahoma Body Co. to Build—The Sharpe Motor Car & Body Co., Oklahoma City, Okla., will equip a plant for the manufacture of automobile bodies.

Niles Car to Make Trucks—The Niles Car Mfg. Co., Niles, Ohio, will add to its present line of products the manufacture of trucks and accessories.

Anderson Co. Taking Body Orders—The Anderson Motor Co., Rock Hill, S. C., in addition to manufacturing automobiles, is also making bodies for other concerns.

Stutz Begins Erection of New Addition—The Stutz Motor Car Co., Indianapolis, Ind., has begun the erection of a four-story addition, 70 by 204 ft., to cost $100,000.

Marion Tire Increases—The Marion Tire & Rubber Co., Marion, Ohio, will shortly begin the erection of a new plant which will include two concrete buildings, each 50 by 100 ft.

Warner Trailer Leases Plant—The Warner Auto Trailer Co., Beloit, Wis., has leased the J. Thompson's Sons Mfg. Co. plant and will begin operations as soon as equipment is installed.

Muskegon Concern to Enlarge—Additions necessitating an expenditure of $200,000, it is said, will be made to the foundry works of Campbell, Wyant & Cannon, Muskegon, Mich. This concern started in a very small way in 1909 with only a few employees. Today there are over 1100 men on its payroll.

Babcock Spring Co. Formed—The Babcock Automobile Spring Co., Milwaukee, Wis., has been incorporated with a capital of $15,000. The incorporators are C. Babcock, R. S. Babcock and W. J. McElroy. The plant is located at 192-194 Milwaukee Street, and specializes in the manufacture of automobile and other vehicle springs.

Polson Rubber Building Cleveland Plant—The Polson Rubber Co., Kansas City, Mo., maker of automobile tire accessories, on account of increase in business, is erecting a factory in Cleveland, Ohio, where it will make blowout patches, hook-on boots, reliners, etc. The new plant is under the personal supervision of H. B. Polson, and will be making shipments by Feb. 1. C. A. Polson will continue in charge of the Kansas City plant.

Victor Rubber Adds—Brick and concrete additions will be started in the near future at the Victor Rubber Co., Springfield, Ohio. The additions, five in number, will be one story high. They will practically double the production of the plant. The company employs about 400 persons at present. The new additions will make possible an increase of about 50 per cent in the working force.

Takes Over Superior Auto Parts Co.—The entire business, stock and good will of the Superior Auto Parts Co., Indianapolis, sole distributor of the R & M conform piston ring, has been taken over by the Modern Electric & Machine Co., that city. During the past year the Modern Electric company has added to its line the R & M aluminum piston and has enlarged its plant. T. A. Meyer is president and general manager of the company.

The Automobile Calendar

March 25-April 1	Wheeling, W. Va., Show, Market Auditorium.
March 27-April 1	Danville, Ill., Show, Eastern Illinois Dealers.
March 27-April 1	Johnstown, Pa., Show, Auditorium; Johnstown Auto Show Promoters. A. E. Oldham, manager.
March 27-April 1	Zanesville, Ohio, First Annual Southeastern Show, Airdome.
March 28-April 3	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
April 1-8	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 3-8	Twin Falls, Idaho, Show, Oliver Tabernacle, B. H. Fuller, Mgr.
April 8	Corona, Cal., 300-Mile Boulevard Race, Citrus Belt Racing Assn.
April 10-15	Seattle, Wash., Show, Arena.
April 12-15	Champaign, Ill., Show, Gymnasium Bldg., University, Ill.
April 14-16	Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
April 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Des Moines, Ia., Iowa Derby, 20 Miles; Des Moines Special, 10 Miles.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway 300-Mile Race.
May 30	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 20	Galesburg, Ill., Track Race, 100 miles.
June 28	Des Moines, Iowa, Speedway Free-for-all. 300-mile race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet, Hilles-Riegel.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 11-12	Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City, Sheepshead Bay Speedway Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Nov.	Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in the Industry

Cox Joins Overland—G. H. Cox, Kansas City district manager for Dodge Bros., has resigned to become the assistant director of branches for the Willys-Overland Co.

Welles Joins Overland—J. W. Welles has joined the Willys-Overland Co., Toledo, Ohio. He was formerly designer and general manager of the Matthews Boat Co., Port Clinton, Ohio.

Crooker Chalmers Assistant Advertising Manager—R. H. Crooker, who was advertising manager of the Regal Motor Car Co., Detroit, has been appointed assistant advertising manager of the Chalmers Motor Co.

Buller Liberty Advertising Mgr.—H. L. Buller has been appointed advertising manager of the Liberty Motor Car Co. He was formerly connected with the Oakland Motor Car Co., Pontiac, Mich., and the Apperson Bros. Co., Kokomo, Ind.

Boice Forms New Co.—W. S. Boice, formerly president of the Boice-Perrine Co., Boston, has organized the Boice Motor Equipment Co., Boston, located at 76 Brookline Avenue. This company is agent for the Vesta Accumulator Co. and the K. W. Ignition Co.

Bleiler Joins Miller Rubber—J. B. Bleiler, formerly vice-president of the Overman Cushion Tire Co. and for some years connected with the Diamond-Goodrich organization, has now joined forces with the Miller Rubber Co., Akron, Ohio, as manager of the solid truck tire department.

Lang Joins Detroit Gear—Currier Lang, who was chief of the civil engineering department of the Solvay Process Co. during the past eight years, has resigned to become assistant general manager of the Detroit Gear & Machine Co., Detroit, manufacturer of automobile transmissions and clutches.

Acton Joins Make-a-Truck—Leslie Acton, formerly treasurer of the Flanders Motor Co., has been elected vice-president of the British-American Sales Corp., 1708 Broadway, New York City. This company is engaged in the manufacture and sale of trucks and Make-a-Truck attachments for Ford cars.

Meers Goes to 'Frisco—I. B. Meers, assistant sales manager of the King Motor Car Co., Detroit, is now in the same capacity with the company's headquarters in San Francisco, for the purpose of taking charge of the King business on the Pacific Coast. R. V. Lull has taken Mr. Meers' place here at the King factory.

Motor Men in New Roles

Sohlinger Flint Varnish Sales Mgr.—W. J. Sohlinger has become sales manager of the Flint Varnish Works, Flint, Mich., succeeding A. W. Schaefer, recently resigned.

Bailey Joins Silver Staff—William Bailey, who has been connected with the automobile department of the New York Globe, will join the C. T. Silver Co., New York distributor of the Overland and Peerless.

Van Riper Joins Chalmers in Detroit—L. M. Van Riper has been appointed advertising manager and purchasing agent by the L. J. Robinson Co., Detroit, Michigan distributer for the Chalmers. Mr. Van Riper has for the last two years handled the automobile advertising for the Sprague Publishing Co.

Willard Men Move Up—S. S. Jenkins has been appointed district manager of the Willard Storage Battery Co., in the Detroit territory. He has been the manager of the Willard branch at Indianapolis ever since it was established. F. G. Tobin will be assistant district manager under Mr. Jenkins.

Join Steel Products Co.—G. V. Sevald, for fourteen years manager of the Cleveland office of the Detroit Copper & Brass Rolling Mills, and R. J. Scothorn, formerly manager of the Detroit office of the Columbus Bolt Works, have joined the Steel Products Co. selling organization in Cleveland.

Dealer

Overland Service Station in Memphis—The Memphis Overland Co., Memphis, Tenn., is planning a three-story service station and salesroom at Monroe Avenue and Lauderdale Street.

Hyatt Branch in Seattle—The Hyatt Roller Bearing Co., Detroit, Mich., will establish a direct service branch at Seattle, Wash., thus raising the number of its branches to ten. D. B. Bevier will be in charge at the starting of the new branch. Mr. Bevier was former service manager of the company's branch at Los Angeles, Cal., has been made district manager for all the Hyatt branches on the Coast. J. J. Hanrahan, formerly service manager at San Francisco, has been transferred to Los Angeles, and F. B. Brunton has been made service manager at the San Francisco branch. The Seattle branch will be formally opened about the first of April.

Caister Becomes Sales Mgr.—E. E. Caister has become sales manager for Al. C. Faulkner Co., Inc., Los Angeles, Cal., southern California distributor for Marmon cars. Mr. Caister was for nine years sales manager for the Earl C. Anthony Co. at Los Angeles.

Miller Heads Wolverine Laboratories—The Wolverine Laboratories has been formed to specialize in analysis of iron and steel, non-ferrous alloys, oils and coal. A fully equipped commercial laboratory has been opened at 445 Howard Street, Detroit, and is in charge of L. F. Miller, formerly chief chemist of the Timken-Detroit Axle Co.

Miller Goes West for Abbott—W. S. Miller, newly appointed representative of the Consolidated Car Company, maker of the Abbott-Detroit, has left for the Pacific Coast, as western manager for the firm. Mr. Miller's headquarters will be San Francisco. E. L. Sherwood, traveling representative of the firm, left on an extended trip to cover Southern territory.

Barber Stephens Six Sales Mgr.—A. C. Barber, for many years affiliated with the Moline Plow Co., trade department, has been appointed sales manager for the Stephens Six, the new car which is to be manufactured by the Moline company at the Freeport, Ill., plant. Mr. Barber will maintain offices in Moline and will make that city headquarters of the sales activities of the new motor branch.

Kesser Batavia Mgr.—Franklin Kesser has become Eastern district manager of the Batavia Rubber Co., New York City. Mr. Kesser was for ten years manager of the Hartford Rubber Works branch in Philadelphia, five years in an executive capacity at the Hartford factory, three years in executive positions with Akron tire companies, and for the past year jobbing representative of the Batavia Rubber Co. for the Philadelphia market.

Haas Monroe Sales Mgr.—L. D. Haas has been appointed sales manager of the Monroe Motor Co., Flint, Mich. He was formerly in a similar capacity with the Chevrolet Motor Co.

Schafer Joins Sterling Motor—A. E. Schafer, who was formerly vice-president and general sales manager of the Flint Varnish Works, Flint, Mich., and previous to that one of the directors and sales manager of the old Abbott-Detroit Motor Car Co., has joined the Sterling Motor Co., Detroit, Mich., in the capacity of general business manager.

Winnipeg Items—The business of the Russell Motor Co., Winnipeg, Man., has been transferred to the Western Canada Motor Car Co., and the cars manufactured by the Canadian-Overland Co. will be handled in Manitoba by this company.

S. Doupe, recently manager of the Winnipeg branch of the Russell Motor Car Co., has joined the staff of the Breen Motor Co.

The Alfred Maw Motor Co. has taken the Winnipeg and Manitoba agency for the Scripps-Booth.

The Johns-Manville Co. has opened a new accessory store on Portage Avenue West, Winnipeg, which is attracting a large volume of business.

Detroit King-Dort Co. Splits—A change in the distribution of the King and Dort cars in Detroit and part of the state has become effective today. The King Auto Sales Co. has been formed to handle the King and the George W. Franklin Co. will handle the Dort. Formerly both cars were handled by the King-Dort Sales Co., of which Mr. Franklin was general manager. The new King sales agency will have its quarters at 998 Woodward Avenue, where the King-Dort company was located. The Franklin company, which will distribute the Dort in Detroit and twenty counties of eastern Michigan, will locate at 698 Woodward Avenue.

Mountain Retail News—G. E. Turner, Fourteenth and Arapahoe Streets, Denver, has secured the Colorado distributing agency for the Smith Form-A Truck attachment for Fords.

H. I. Piatt, Grand Junction, Col., Saxon and Hupmobile agent, has sold out to go into another line of business in Michigan.

Miller & Smith, Grand Junction, Col., Ford service station proprietors, have bought H. I. Pitt's general garage business and moved their service station there.

The Fisk Rubber Co. has moved its Denver branch from 1635 Broadway into a new building at 1168 Broadway, constructed with large space for service use.

William Murr, Grand Junction, Col., has secured the agency for the Saxon, formerly handled by H. I. Piatt.

Boston Trade Notes—V. A. Charles, New England distributor of Inter-State cars, has placed a retail agency at Boston, with O. J. Vincent, formerly of the Chevrolet and Buick salesforces as manager. Salesrooms have been opened at 887 Boylston Street.

J. D. McIntyre, who was manager of the wholesale department of the Jackson Motor Car Co. of New England, for the past year, has gone into business for himself as distributor of the Denby trucks.

W. A. Frederick, who has been identified with motor and tire houses for some years, has been made assistant sales manager of the Batavia Rubber Co.

Iowa News Items—The Louis Otto Automobile Co., Davenport, Iowa, has closed the agency for the Moon car.

The Sieg Iron Co., Davenport, has put in a complete line of automobile accessories and garage equipment. A new addition to the plant houses the accessory department, which occupies 65,000 ft. of floor space.

Ohio Trade Items—J. H. Greenwald, Cleveland, Ohio, distributor of the Chalmers, has moved to a new location at 1900 East Nineteenth Street.

The Motor Equipment, Cleveland, has opened a store at 10202 Euclid Avenue, where a complete line of motor supplies will be carried. L. F. Mau is the manager.

W. A. Albaugh, Cleveland, has formed the Ohio Metz-Elcar Co., to act as distributor of the Elcar and Metz for the State of Ohio. He is president of the Albaugh Motor Sales Co.

The Perfection Spring Co., Cleveland, has purchased two more lots, making ten in all, to be used for the extension of its factory buildings on East Sixty-fifth Street, which is now under way.

C. C. Williams has been made sales manager of the Stark Auto Co., Cleveland, Ohio, distributor of the Allen car.

The Overland-Cleveland Co., Cleveland, Ohio, has taken over the ninety-nine-year lease on the buildings and grounds it occupies at 6604 Euclid Avenue. It has been decided to extend the building out to the Euclid Street line and make it three stories high, with an artistic front. At the rear the company will erect a building extending back to Carnegie Avenue, to be used as a service station. This will probably be five stories in height.

Wisconsin Trucks Being Delivered—The Myers Machine Co., Sheboygan, Wis., which took over the Wisconsin Motor Truck Co., Baraboo, Wis., early this year, is now making deliveries of its first products. A large addition which will be devoted to the motor truck works, is now being completed and will make it possible to attain a considerable production, but the company is hampered by the difficulty in getting materials. The Myers company is operating 24 hours a day and has orders ahead to make the extended schedule necessary for many months to come. The first truck, a 1-ton, was delivered to the Sheboygan Railway & Electric Co., and the second, a 3-ton, to the Konrad Schreier Brewing Co., Sheboygan. The trucks are known as the "Wisconsin."

Boston Trade News—The Fostoria Sales Co. of Massachusetts has been formed to handle that car in New England, with G. F. Lombard as manager. Salesrooms are located at 182 Columbus Avenue for the present.

The F. A. Dutton Co., agent for Abbott and Empire cars, has made Percy Reynolds manager of its sales force. He was formerly with the Bishop Motor Car Co., selling Premier and Westcott.

Sales Manager Hadley of the King Motor Car Co. has changed the branch at Boston into an agency. He has also placed an agency for the car at Providence with the Longley Motor Car Co., that has the Dort also.

Harry Fosdick of the Wentworth-Fosdick Co. has sold out his interest in the company to his partner.

W. F. Bennett, who owns the Union Square Garage, and the Ideal Supply Co., at Somerville, Mass., has taken the agency for United Trucks.

The name of the Porter Motor Sales Co., agent for the Pathfinder line, has been changed to the Cottrell Motor Co., after W. F. Cottrell, who has financed it.

The Monroe car is now represented in New England by the New England Whip Co. of Westfield, Mass., of which H. A. Cowles is the sales manager.

A. J. Wicks, former purchasing agent for the Cadillac company, of Boston, has become assistant manager of the Boice-Perrine Co., the big accessory house.

Standard Truck Buys Land—The Standard Motor Truck Co., Detroit, has purchased a tract of land 130 by 160 ft., on Bellevue Avenue, adjacent to the property purchased last year. This gives the company a frontage of 250 ft. on the avenue. A new plant is to be erected soon.

York Carbureter Corp. Formed—The incorporation of the York Carbureter Corp., Detroit, is announced, the capital stock being $60,000. The incorporators are Archibald and L. M. York and W. J. Tinney.

To Make Low-Priced Tractor—The Ohio Mfg. Co. of Upper Sandusky, Ohio, is testing out a new farm tractor in its plant. The tractor is designed to produce great efficiency, and sell cheap. It is expected that the tractor will be placed on the market in the near future.

Automobile Department Store in Peoria—The first automobile department store is to be erected at Peoria, Ill. The structure will be three stories, 150 by 200 ft., and will be located at 1701-7 Main Street. Everything pertaining to automobiles will be found in this building. It will be ready for occupancy Oct. 1.

New Co. for Davenport—The Central Auto & Tire Co., Inc., Davenport, Iowa, has recently been incorporated, with T. L. Kennedy, president and treasurer, and E. B. Kennedy, vice-president; O. R. Arnold, secretary and manager, and C. L. Cockfield, sales manager. Temporary quarters have been secured at 419 Brady Street. This company has secured the agency for the Fostoria light car and light deliveries, for four counties in Iowa and three counties in Illinois. It has also taken on the agency for the U. S. Motor Truck Co.

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The AUTOMOBILE

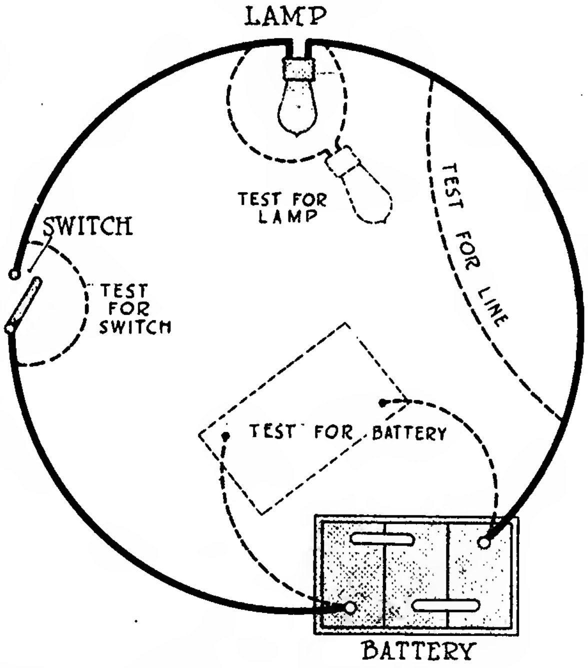
Automobile Electricity

Locating and Curing Troubles

PART I

The Electric Circle and Its Elements—Fundamental Principles of Tracing Faults—Knowledge Necessary Before Taking Steps to Cure Failures

By J. Edward Schipper



A fundamental electric circle or circuit and how it can be divided into arcs in finding trouble

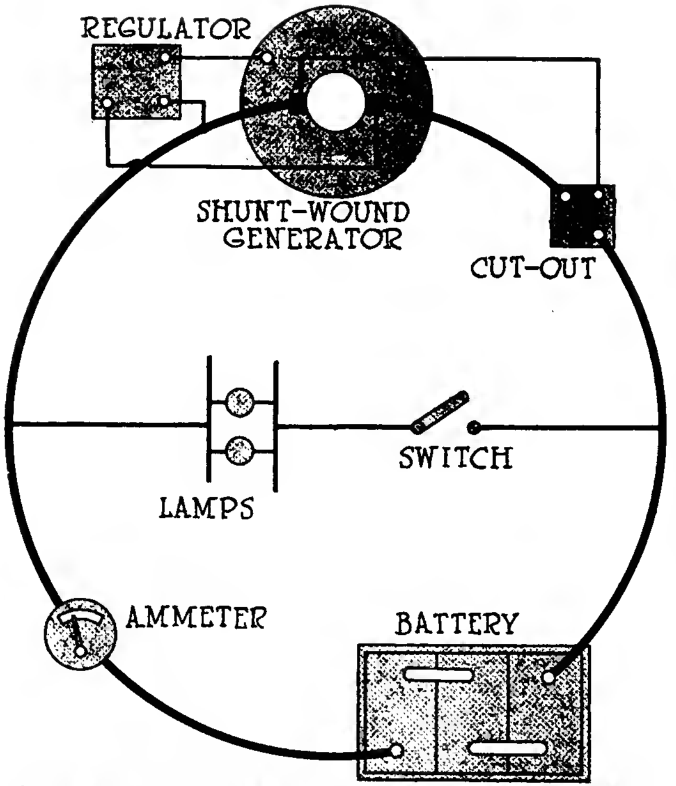
THE symbol of continuity is the circle. It begins at any point on its circumference and it ends where it begins. The flowing line which bounds the circle is complete and uninterrupted and must be so or it ceases to be a circle.

This symbol of continuity well expresses the characteristics of an electric circuit. The circle must be complete, for if it is interrupted current ceases to flow in just the same way as the circle ceases to exist as soon as the peripheral line is broken. This picture must be in the mind of anybody thinking of an electric current. He must visualize the complete circle of flow which begins and ends at the same point, or it may even be said which has no beginning and no ending. It is a continuous flow of energy harnessed to do the desired tasks by devices incorporated in the circular chain. No matter how many of these devices there may be or through how many phases of activity the circle of energy may pass, it must necessarily be complete. The electric current and the circle are synonymous.

This series of articles has to do with troubles in automobile electrical systems. These troubles are expressed and are shown by interruptions in the electric circle, call it circuit if you so desire, of which they form a part.

When a civil engineer has a surveying problem to meet he generally solves it by getting at it on three sides. It is possible to take a leaf from his book and use the same method by taking three different viewpoints from which to gain an insight into the finding and remedying of troubles on lighting and starting systems. These three viewpoints are: First, a grasp of the electric circle or circuit, as it is known in technical parlance; second, a method by symptoms in which the interpretation of visible effects of electrical irregularities is given; third, a viewpoint by units in which each individual part of the complete lighting and starting system is taken up separately and the vulnerable points indicated.

In other words to get a true perspective of the entire electrical layout on the car these three fundamental methods of approach must be consciously or unconsciously followed in order that a logical order is maintained and the process of elimination which was pointed out as the true method of search, carried to its conclusion. The broad idea of electrical flow must be first in mind; second, the symptoms which lend a



The lighting circle—Here the principal units consist of the generator, regulator, cutout, battery and ammeter on the great circle and the lamps and switch on the inner arc

helping hand in reducing the necessary area of search and third, a knowledge of the functions of each part in the system and the points at which troubles may occur.

Must Visualize the Circle

To think electrically the mind must travel in a circle. No matter at what point you start, you must travel around the circle and back to that point before you have completely covered the system or part of the system which you are studying. All through the electrical equipment of an automobile, no matter what part is taken, the mind's eye must visualize that complete circle. No electricity will flow unless the circle is complete and as soon as the circle is complete, whether it is completed wittingly or not the current will flow through the circuit.

On the car there are three great electrical circles to bear in mind. These are lighting, starting and ignition circles. In connection with these systems there may be smaller subcircles, but these are all included in these three major circuits. If the mind can visualize each of these and picture it applied practically to the car, the first great step in becoming capable of handling electrical troubles will have been accomplished.

The elementary principle is the same no matter if the circle under consideration contains the most delicate electrical apparatus. If the circle is made up of a battery, a lamp and a switch it is complete and the other additions only widen the circle without altering any of the fundamentals.

The illustration on the first page brings this out clearly. It shows the circle of flow and also shows how piece by piece this circle can be gone over to locate the trouble. If the circle were broken at any point the current could not flow. It is the function of the switch to make and break this circle and by it the electrical circuit is completed or not according to whether the operator wishes the lamp to be out or lit. This circle idea should be borne in mind when studying the laws of current flow.

First Principles of Electricity

No one knows what electricity is, but many of its qualities are so well known that they can be utilized. The laws of current flow, the methods of generation and the manifestations of electrical energy are the three main points which must be grasped before any conception can be had of the main and sub-circles of electrical flow as manifested in starting, lighting and ignition circuits.

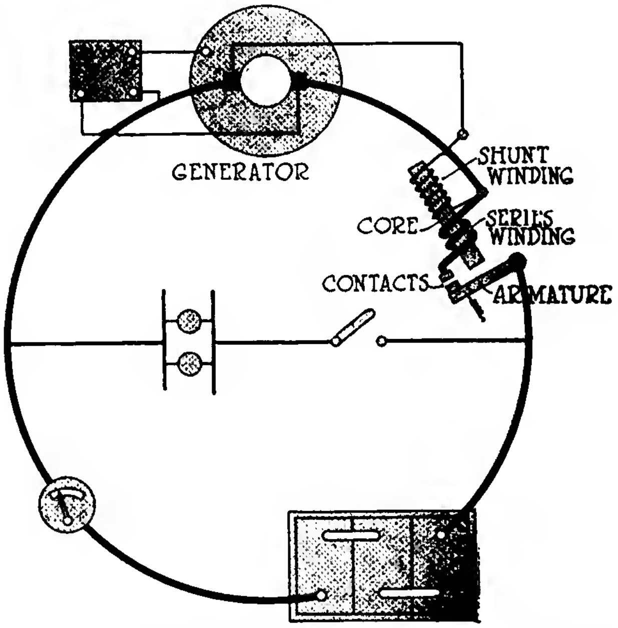
In order to make current flow through an electric circle two conditions are necessary: first, that there is sufficient pressure to force a flow of current around the circle through all the resistances of the line, and secondly, that nowhere on the line is there sufficient resistance to prevent flow. On analysis these two conditions really mean the same thing, that is, that a path is finished for the current and that there is sufficient voltage or pressure to force the current over that path.

Basic Testing Method Explained

This fundamental condition for current flow gives a basic scheme for testing electric circuits. Knowing the cycle of events it is only necessary to apply the process of elimination and to go step by step taking a definite arc of this circle at a time until finally the whole circle has been covered and the weak spot located.

Referring to the simple electrical circle which is described as a battery, switch and lamp with connecting wires, it is possible to see how this simple circle can be divided into a number of smaller arcs when testing for some trouble which causes a total or partial interruption of the current flow. In the first place to know that there was some trouble we would have to have symptoms. These might be shown in a continual leakage of the current from the battery when the switch is not on or they might be shown in a failure of the lamp to light brightly or at all when the switch is turned on. Either of the conditions outlined denotes trouble, and when we set about finding the cause of the trouble we must do so by the process of elimination. Let us say that the lamp does not light when the switch is turned off. Immediately the mind must picture an interruption in the complete circle of current flow from battery to switch, from switch to lamp, from lamp back to battery. This is the external part of the circle and the final connecting link is the internal current from the negative pole to the positive pole within the battery.

One by one we must bridge across these definite arcs of the complete circle to locate the source of trouble. Starting with the most obvious, the lamp, with the switch turned on, we might see if the lamp is tight in its socket. If it is loose

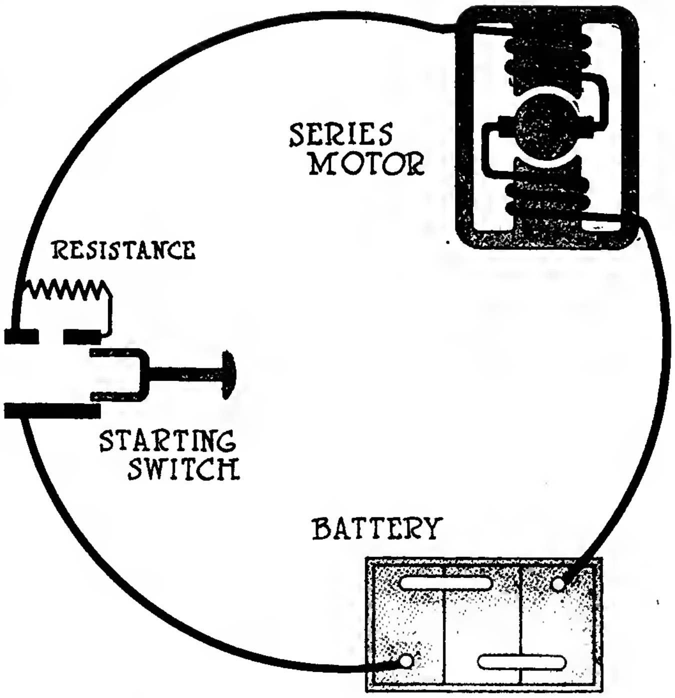


How the circle passes through the cutout unit showing the sub circles which are involved in this particular phase of proper lighting arrangements. The shunt winding is the sub circle while the series winding is a direct part of the main circle the circle is interrupted here. Next it might be found that the lamp is burnt out. This can be determined by examination of the lamp filament by eye or by the substitution of a known perfect lamp. Then the connections of the wire at the lamp are examined. If these things are all found to be perfect we move to the next point in the circle, the switch. Bridging across the terminals of the switch by another wire cuts off this part of the arc and tells us at once whether or not the trouble is at the switch. Should the lamp light when the switch is bridged it indicates a faulty switch. If bridging the switch indicates no trouble here the next move is to the battery and this part of the arc can be bridged by trying a known perfect battery or by using an electrical measuring instrument on the battery to see if the electrical pressure or voltage of the battery is sufficient to send the current over the line and to light the lamp. Should this test fail there remains going over the wire piece by piece to see that there is no break.

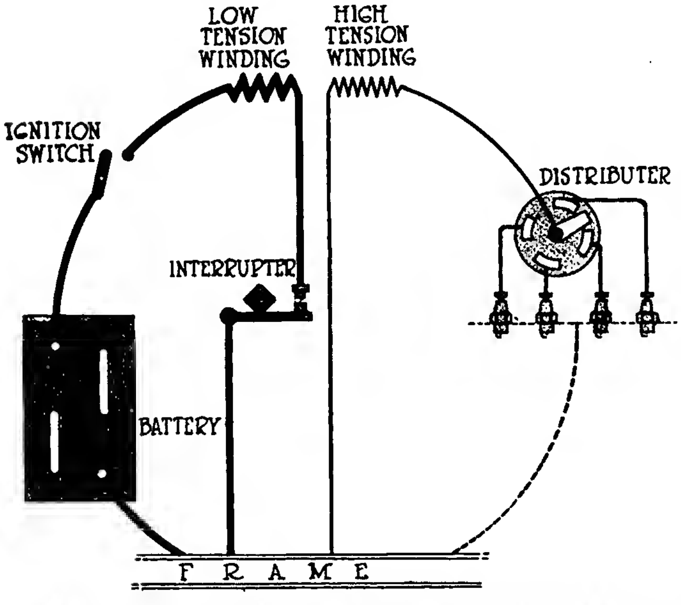
Elementary Principle Applies

In doing this work the most elementary stage of electrical trouble-finding has been accomplished. No matter how complicated the circle may be this original principle applies. The elementary methods may have to give way to more complex systems of testing on complicated electrical installations but nevertheless, the basic scheme must remain. Searching must be done by a process of elimination by gradually working through the entire circle. Of course certain obvious troubles will render unnecessary the complete search, but as soon as this occurs the trouble ceases to be electrical and requires mechanical treatment suggested by the damage. Speaking exactly, there is no such thing as electrical trouble. The imperfection is due to an interruption in the functioning of the electrical units caused by some mechanical fault. Machinery and mechanism may fail but electricity, that hidden form of energy of which no one knows the exact definition, will never fail provided the mechanical paths or circles are kept intact to allow it to perform its work.

Having grasped the elementary law of electrical current flow and the fundamental principle of searching for interruptions in electrical apparatus, the next step is to see how these rules are applied to the great circles of automobile electrical mechanism. Starting, lighting and ignition are these three circles. They can be taken independently, for although on many installations units of one will be units also of the other, still in each case the complete circle exists.



A simple circle is that of the starting motor. Here the current flows from battery to switch, then to the motor and back to the battery again. Often times there is a sub circle for the starting pinion engagement when this is accomplished magnetically



The ignition circle is made up of two parts, low tension and high tension. Nevertheless, the complete circuit idea is clearly shown as each part must be complete before the functions are correct

Simplest of all is the starting circle. Current flows from the positive side of the battery, through the wire to the motor terminal, then through the field winding passing on to the armature winding, then to the switch and back to the negative side of the battery completing the circle.

Study of the Starting Circle

Another part of this article will be devoted to symptoms of trouble. Let it be assumed that it is known that trouble lies in the starting circle. The question becomes how is it possible to apply the basic principle of testing to this more complicated circle? It can be done readily simply by following out the system of process of elimination which has already been stated to be the universal method in finding trouble.

Let the arcs into which the circle is divided be: First, the battery; second, the starting switch; third, the starting motor and fourth, the wires and connections. Let us take for our means of testing a simple test lamp consisting of an ordinary 6-volt bulb with a couple of leads, assuming this system to be a simple 6-volt arrangement. The first arc we have taken is the battery. Placing the ends of the testing lamp wire across the positive and negative poles if the lamp burns brightly it is quite evident that the battery is giving its 6 volts pressure. Remove the negative wire from the battery and put one of the test lamp terminals in contact with the negative pole of the battery and the other terminal of the lamp in contact with the end of the detached negative wire. If there is a short circuit in the system the lamp will light. In case it is a single-wire system instead of touching the terminal of the test lamp to the negative wire it will go to the car frame instead, and hereinafter when the negative wire is spoken of it will mean the car frame on single wire or grounded return systems.

The next arc of the starting circle is the switch. It is not always possible to simply bridge across the switch with a heavy piece of cable because the switch generally incorporates a number of features for the engagement of the pinion of the starting motor, etc. Therefore, it will probably be necessary to take the cover from the switch and examine it carefully, tracing the wiring and seeing that none of the parts are fused or burnt away and that all connections are firm and solid. If the switch is of the two-point type in which the first point of engagement causes the current to flow through a resistance allowing the starting motor to turn slowly while the pinion engages with the flywheel it will be possible to bridge first across the resistance and then across the entire switch. If the motor runs properly and cranks the gasoline engine when this is done the trouble is in the switch and this can be taken off and examined and the trouble corrected. If the starting switch blades do not make contact or the switch terminals are loose this can generally be found from inspection. A grounded or short-circuited starting switch will often be not so easy to locate and the insulation of this part of the circuit should be gone into very carefully before passing on to the next part of the arc.

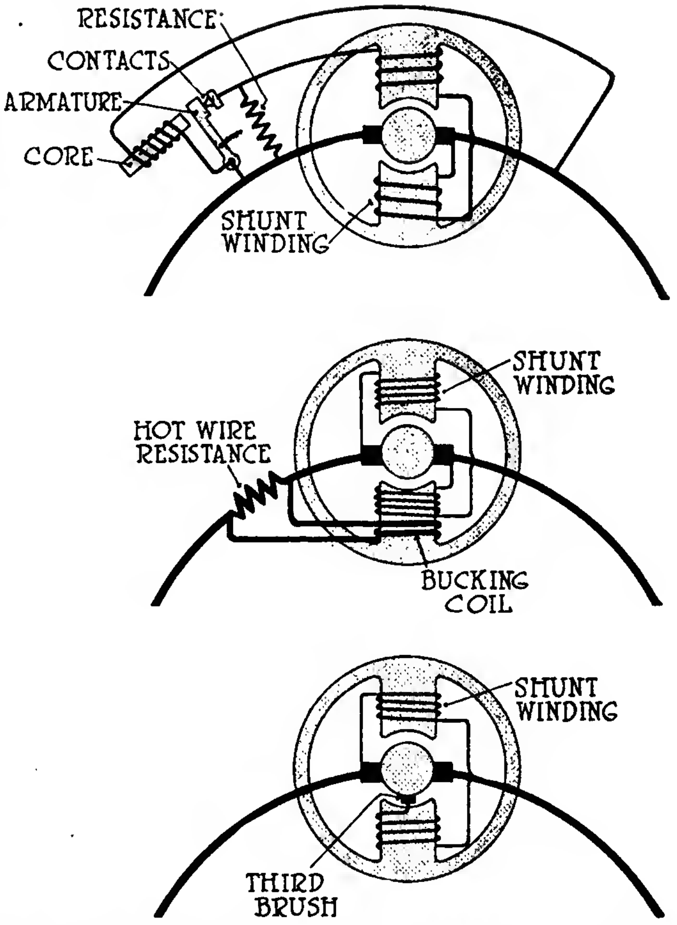
Checking the Starting Motor

After examining all the wiring and connections in the starting circle, it is necessary to come finally to the starting motor itself. The course of the windings through these motors is always the same since they are all series-wound. Current passes from the battery to one of the terminals of the motor which is connected with the winding around the magnetic field. The current passes through this field winding and thence to the commutator of the motor where it is led to the armature winding. The current passes through the armature from one brush to the other and thence back to the battery. There are only certain parts of the starting motor that are susceptible to repairs by any except the factory. The armature is rendered practically impregnable in the insulation process and cannot be generally torn down and rewound. The same applies to the field windings. The commutator, brushes, brush holders, external leads, brush pigtails as the wires to the brushes are called, and other external parts which are accessible by removing the commutator housing are generally susceptible to repair by people with a limited amount of electrical equipment or skill.

The lighting circuit is made up of two circles, one bounded by the battery lamps and control switches with the connecting wires and the other from the generator to the battery including the cutout relay mechanism, the fuse connections and the regulator.

Circle Not Always Plain

The battery lamp circuit on the whole is about the simplest electrical circle on the car. Leaving the positive terminal of the battery the current passes through an ammeter, then to the lighting switch from where wires lead to all the lamps and back to the negative side of the battery. Regardless of how the lamps are connected, whether in series or parallel, each one is a simple part of this circle. Should one lamp go out and the others act perfectly local troubles are certain to be the cause. If the circle is broken as a whole all the lights will go out and it then becomes a matter of searching for the break. Piece by piece this circle can be divided into small arcs and one by one they can be searched for the trouble. It is almost a parallel with the elementary battery switch and lamp circle first described except that here we have an ammeter and several lamps in addition. The battery can be tested with the test lamp across the terminals. The ammeter can be tested by bridging around it with a connecting wire. The switch can also be bridged as can the main leaves to the lamps and the connections to battery and other terminals. Once the trouble is located in such a definite locality as the switch, ammeter or terminal connection it can be definitely determined and the suggested remedy applied. While the battery lamp circle in itself is simple it will be oftentimes puzzling or even impossible for the layman to visualize this circle actually on the car. Some of the wiring systems carry the wires of this circle through such a course that it would be impossible to follow it and therefore it is necessary for the person working with any car to have a knowledge of its wiring diagram. This should be secured before experimenting with the wires.



The regulator sub circle varies in its arrangement. Here are three typical regulation methods, top the vibrator type; center, hot wire resistance; bottom, the third brush method

An instance of this is in a given two-wire system where the battery lamp circuit takes the following course. The positive battery lead runs directly to the starting motor field. From this lead is led the wire to the ammeter. Leaving the ammeter the course of the current is then through the lamps, then through the lighting switches passing through the series field winding of the armature and back to the motor starting switch where contact is made with the negative lead of the battery completing the circuit. This does not sound like the simple battery lamp circle and yet in effect that is all it amounts to.

The other lighting circle includes the generator. It also includes the delicate and ingenious schemes of regulation and contact breaking. Starting on the positive brush of the generator the current flows through the contact breaker and then to the positive lead of the battery. Passing through the battery the course of the current is then through the ammeter and back again to the generator. In the path of this current somewhere in the circle is inserted the regulating means. The position of this depends on the method chosen. Another circle within this greater circle is the means for exciting the generator field. Regardless of what method of regulation and what method of field excitation is used the law of continuity as expressed by the circle exists, and this circle also can be divided into smaller arcs in tracing down the troubles which are apt to occur.

Having incorporated in this circle an ammeter a great amount of assistance is given in determining where to look for the trouble. The ammeter indicates at once if current is flowing from the battery and should this be so with the switches off it immediately suggests a short or ground. Taking up the step by step bridging process a start is made as usual from the battery. The test lamp will show if this is in proper condition to light the lamps. An examination of the terminal connection will show if these are tight. If there is a breakdown in the ammeter, wire can be bridged around it immediately indicating if this is true. Coming to the generator it is a matter of going step by step over the commutator, brushes, brush holders, springs, brush connections or pigtails. Mechanical troubles of course will enter into the reckoning and a seized armature or worn or broken down armature shaft bearings must be looked for. There is very little that can be said about the wiring of the generator as when the winding is impregnated with insulating compound and baked it becomes as hard as a mass of rock. Coming to the contact breaker this can be bridged across and if generator does not charge as indicated on the ammeter it is possible to connect around the circuit breaker momentarily to see if there is a failure of operation here. The connection around the circuit breaker need not be an actual wire connection but generally only amounts to pressing the contact points together with the finger and observing if the ammeter indicates charge when the engine is running at a speed above the charging rate. Theoretically it is the same as the basic principle of testing as first laid down with the battery switch and lamp.

The ignition circuit can be tested by applying the same principle. It is only a matter of systematic step-by-step trying in using the process of elimination to get to the source of trouble. This series deals with starting and lighting but the elementary principles it brings up are applicable to all electric circuits.

Trouble Hunting Notes

In testing the battery it is well to determine if the troubles are distributed throughout the entire battery or confined to one or more cells. The bridging method of testing can be applied to the battery in order to determine this. A small voltmeter is handy as this can be placed across each cell to indicate if it is giving the 2 volts pressure that is required. One of the first places to look for trouble is in the battery electrolyte. This should be kept up to the proper level by adding distilled water frequently so that the plates are covered. The battery in which the plates are not fully covered by the electrolyte has a decreased capacity due to the fact that the active material in the upper parts of the plates becomes hardened and unfit for use. Another point to observe is the specific gravity of the electrolyte which should be between 1.275 and 1.300 when the battery is fully charged. A battery should never be discharged lower than 1.150. The instrument for making these tests is the hydrometer or hydrometer syringe which is especially adapted for storage battery testing. Keeping the electrolyte in proper condition is about all the car owner can do beyond keeping the battery clean without acid on the outside as more complicated repairs require equipment which is only in the hands of battery manufacturers.

When troubles occur, before more serious or complicated parts are disassembled examine the wiring. Two things are necessary in going over the wiring of the car. First a knowledge of the wiring diagram, and second, the application of the elementary testing principle of bridging the trouble. There is always the possibility that in the original wiring of the car an error has been made and therefore when the circumstances seem baffling it is wise to check the wiring of the car against the wiring diagram. The electric circle must always be complete and loose connections or short circuits which interrupt it must be found by going over the wire step by step.

Improper adjustment of the regulator is an example of an electrical trouble which will not be found by the primary bridging method. It is to locate such irregularities as these that the ammeter is placed on the car, or if an ammeter is not used some form of current indicator with the words Charge and Discharge in place of the indicating needle. The driver should know at what speed the battery becomes connected to the generator by the cut-in mechanism and if this does not occur until the speed is too high the battery will not receive sufficient charge in many instances to carry the lamp and starting load as it should. In many instances not every repairman is authorized to adjust the regulator and for this reason it is necessary to take the car to the service station of the starting and lighting company that has made the installation.

Some Extraordinary Conditions

There are other troubles which will not be located by the ordinary bridging method and these are particularly in and around the commutator assemblies. All generators and motors, however, are arranged to have the commutators accessible by the removal of a cover plate and all that is necessary in searching for trouble here is to know the mechanical conditions which should obtain. These are namely, a clean commutator with the mica between the segments undercut so as not to interfere with the contact of the brushes, a good brush contact given by proper spring pressure by a proper fit of the brush in its holder and by a proper engaging surface of the brush and perfect pigtail or brush wire connections. All of these can be determined by inspection.

One word of caution which cannot be expressed too strongly is not to be satisfied after having found the actual manifestation of the trouble because this may be the effect and not the cause. Until the cause is removed the effect will be bound to recur with the annoyance of having an interruption of service and a consequent expense and loss of time.

To put this in another way the circumstances which are causing the trouble may not be in the place where the manifestations of trouble are noted. One or two examples to illustrate this point will give a clear view of what is meant. A man drives his car into the repair shop with a stripped ring gear on his flywheel. Evidently nothing else is wrong. The repairman simply performing the obvious renews the ring gear, the car starts satisfactorily and the owner drives away. In a few days he returns with another stripped gear. The point is that when the repairman renewed the gear he only remedied the effects of the trouble but did not cure the cause, which was in a faulty starting switch which did not always make contact with the resistance circuit giving a slow movement of the armature of the starting motor before it went into full engagement and secured the full torque of the starting motor.

Examine Entire Circuit

No one would say that when a fuse blows or melts that the trouble is in the fuse. Before replacing the fuse it is well to look for the trouble on the circuit in which the fuse is connected. The test lamp can be employed to great advantage in doing this. For instance, if the blown fuse is in one of the lamp circuits the lighting switch can be turned so that all the lamps should light. The test lamp terminals should be put on each of the fuse clips and if the lamp lights the ground trouble is still there. Connect the test lamp to the negative wire of the battery and then with the other side go over it piece by piece until the lighting lamp indicates the position of the ground or at least what parts of the circuit are grounded. In each step that is taken remember the electric circle and bridge it arc by arc until the whole system has been covered.

(To be continued)

Cheapening Cars by Reducing Varieties

A Scheme for Cutting Cost by Establishing Standard Engine Dimensions, Etc.—A Speculation of Standardization's Possibilities

By William Kent

IN The Automobile for Dec. 30, 1915, appeared a complete list of specifications of the 1916 cars, with their sizes and prices. They are divisible into four classes, viz.: two-, three- and four-passenger, five-passenger, seven-passenger and closed cars. The list shows a most confusing variety in size of cylinder, length of wheelbase and price.

During the experimental stage of the automobile industry such a variety was to be expected, for designers had no precedents to guide them, and it was necessary to try out a great number of proportions before standards could be determined upon. The time has now arrived, however, when the multiplicity of sizes and proportions can be considered only as a great economic waste, causing unnecessary duplication of the work of designers, draftsmen and pattern makers, and in the case of all except the largest manufacturers, a high manufacturing cost.

From the lists given, I have selected the list of the five-passenger cars as an example, and have subdivided it into four-, six-, eight- and twelve-cylinder cars, as in the accompanying Table 1. The table shows that on the average the price of a car bears some relation to the size, but individual cars of one size show extraordinary variations in price. Thus, of four-cylinder 22.5-hp. cars, the range of prices is from $440 to $2,700, and of six-cylinder 38.4-hp. cars the range is from $1,095 to $4,300. Of course, the size of an automobile is only one of the factors in its prime cost. Other important factors are quality of material, workmanship, finish, upholstering, size of tires and miscellaneous accessory equipment. The prime, or factory cost also is only one of the factors of the selling price, the margin between the two depending on the selling policy, the cost of making sales, including in many cases expensive advertising, the commissions or profits of dealers, and the manufacturer's profit per car.

High Price Causes High Cost

As a general rule, a high selling price is a cause of high factory cost, for it limits the volume of business and thus increases the overhead factory expense per car, which decreases as the volume of business increases.

Table 1 shows that seventy-seven makers are producing 103 styles of five-passenger cars, ranging from 13.2 to 60 hp. and 100 to 147-in. wheelbase, and priced from $440 to $5,900. As regards size, it would seem reasonable that ten or twelve different sizes would cover all the possible needs of the users of the cars, but the manufacturers are furnishing no less than forty-five different proportions of cylinders, including twenty different diameters from 2⅝ to 5⅛ in. and fourteen lengths of stroke from 3½ to 7 in.; thirty-three different horsepowers from 13.2 to 60, and twenty-eight different lengths of wheelbase from 100 to 147 in.

Table 2 is an attempt to show the relation of the selling price to the size of a car, arbitrarily taking the "size" as the sum of the horsepower and the wheelbase. By dividing the total range of this so-called size, from 115 to 207, into seven classes, and taking the average price for each class—after omitting from one to three cars in each class which appear to have fancy prices—we discover that, with the exception of the ten smaller and the four larger cars, the average price varies approximately as the cube of the size. The formula representing the relation of price to size is

$$\text{Price} = [0.01\ (\text{hp.} + \text{w.b.})]^3 \times C.$$

For eighty out of 102 cars averaged the value of C ranges from 354 to

Table 1—Sizes and Prices of Five-Passenger Touring Cars

Dia., in.	St'ke, in.	Name	Price	H.P.	Wheel Base, in.
		Four-Cylinder Cars			
2⅞	4	Sterling	$550	13.2	102
3⅛	4	Argo	495	15.6	103
3⅛	5	Overland	615	15.6	104
3⅛	4½	New Era	660	15.6	104
3¼	5	Dort	665	16.9	105
3¼	5	Moore	660	16.9	106
3¼	5	Arbenz	675	16.9	108
8¼	5	Coey Flyer	740	16.9	106
3 7/16	5⅛	Briscoe	750	18.9	114
3½	4	Regal	650	19.6	106
3½	5	Partin-Palmer	675	19.6	110
3½	5	Crow-Elkhart	725	19.6	112
3½	5	Bell	775	19.6	112
3½	5	Elcar	775	19.6	114
3½	5	Inter-State	850	19.6	110
3½	5	Farmack	855	19.6	112
3½	5	Jackson	985	19.6	112
3½	5	Oakland	1,050	19.6	112
3½	5	Oldsmobile	1,095	19.6	120
3⅝	4½	Maxwell	655	21.0	102
3 11/16	4	Chevrolet	490	21.8	102
3¾	4	Ford	440	22.5	100
3¾	4¼	Mecca	695	22.5	104
3¾	4¼	Pullman	740	22.5	114
3¾	4¼	Monitor	795	22.5	108
3¾	4¼	Detroiter	985	22.5	112
3¾	5	Regal	985	22.5	115
3¾	5	Dispatch	1,000	22.5	120
3¾	5	Moline-Knight	1,375	22.5	118
3¾	5¼	Jeffery	1,000	22.5	116
3¾	5½	Hupmobile	1,085	22.5	119
3¾	5⅝	Stearns	1,395	22.5	119
3¾	5⅝	Biddle	1,800	22.5	120
3¾	5⅛	White	2,700	22.5	115
3⅞	4	Metz	600	24.0	108
3⅞	4½	Dodge	785	24.0	110
3⅞	5	Empire	935	24.0	116
3⅞	5	Auburn	985	24.0	114
3⅞	5⅝	Lexington	1,375	24.0	115
3⅞	5½	Kissel	1,250	24.0	115
4	4½	Herff-Brooks	885	25.6	110
4	4½	Richmond	885	25.6	110
4	6	Moline-Knight	2.500	25.6	128
4⅛	4½	Reo	875	27.2	115
4⅛	4½	Willys-Knight	1,095	27.2	114
4¼	5½	Spaulding	750	28.9	120
4⅝	5	Morse	3,600	34.2	127
4¾	5½	Stutz	2,550	36.1	130
5⅛	6¾	Fiat	4,850	42.0	128
		Six-Cylinder Cars			
2 13/16	4¾	Oakland	795	19.0	110
2⅞	4½	Saxon	815	19.8	112
3	4¼	Grant	795	21.6	112
3	4¼	Elgin	845	21.6	114
3	5	Sun	...	21.6	116
3	5	Cameron	1,000	21.6	122
3	5	Auburn	1,050	21.6	120
3	5	Madison	1,085	21.6	120
3	5	Marion	1,090	21.6	120
3	5	Paige	1,095	21.6	112
3	5	Glide	1,095	21.6	119
3	5	Pilot	1,100	21.6	119
3	5	Jeffery	1,350	21.6	122
3	5	Halliday	1,385	21.6	122
3⅛	5	Monitor	895	23.4	115
3¼	4½	Buick	1,020	25.3	115
3¼	4½	Paterson	985	25.3	117
3¼	4½	Chalmers	1,050	25.3	115
3¼	4½	Velie	1,065	25.3	115
3¼	4½	Kline	1,095	25.3	120
3¼	4½	Empire	1,095	25.3	120
3¼	4½	Moon	1,195	25.3	118
3¼	4½	Westcott	1,395	25.3	120
3½	5	Mitchell	1,250	29.4	125
3½	5	Haynes	1,385	29.4	121
3½	5⅛	Apperson	1,485	29.4	122
3½	5⅛	Lenox	1,985	29.4	128
3½	5¼	Velie	1,400	29.4	124
3½	5¼	Pathfinder	1,695	29.4	122
3⅝	4	Franklin	1,950	31.5	120
3⅝	5½	Kissel	1,250	31.5	126
3¾	5⅛	Marmon	2,900	33.7	136
3¾	5½	National Newport	2,375	33.7	134
4	4½	Richmond	1,095	38.4	120
4	4½	Herff-Brooks	1,095	38.4	120
4	5½	Standard	2,100	38.4	126
4	5½	Chalmers	2,175	38.4	132
4	5½	Pierce-Arrow	4,300	38,4	134
4	6	McFarlan	2,680	38.4	132
4⅖	6	Fiat	5,350	46.6	135
4½	5½	Pierce-Arrow	4,900	48.6	142
5	7	Pierce-Arrow	5,900	60	147½
		Eight-Cylinder Cars			
2⅞	4¾	Jackson	1,195	26.4	112
2⅞	4¾	Oldsmobile	1,295	26.4	120
2⅞	5	King	1,150	26.4	113
3	4½	Regal	1,200	28.8	115
3	4½	Ross	1,350	28.8	115
3	5	King	1,350	28.8	120
3	5¼	Mitchell	1,450	28.8	125
3⅛	5⅛	Cadillac	2,080	31.2	122
3¼	5	Daniels	2,350	33.8	127
		Twelve-Cylinder Cars			
2⅝	3½	Enger	1,095	33.1	115
3	5	Packard	2,750	43.2	125
3	5	Packard	3.150	43,2	135

429, generally increasing as the size increases.

For the ten small cars the average value of C is only 338, and for the four large cars it rises suddenly to 702.

If there were a uniform demand for all sizes of cars it would reasonably be expected that the factory cost of cars would vary, not as the cube of the size, but approximately as the square; but the fact is that there is an enormous demand for small cars, which tends to reduce both the factory cost and the cost of selling these cars, and a small demand for the large cars which increases their factory cost and greatly increases the cost of selling them. Hence the result that the price of the large car increases more rapidly than the cube of the size does not seem to be unreasonable.

Taking the Ford car, the smallest and also the lowest priced car on the list and the one for which there is the greatest demand, and applying the formula to it, we find the value of C is only 242. The low price of this car, together with its excellent quality, causes the great demand for it, reduces the expense of selling it, warrants the investment of a great amount of capital in its manufacture and the use of the best machinery in making it, making possible the smallest labor cost together with the highest wages to workmen, and produces the largest annual profit.

One of the causes which makes it possible to sell the Ford car at its low price is the fact that only one size of car is made. If the Ford factory, with its present size and its present capital, should undertake to make half a dozen different sizes of car, ranging from 22 to 60 hp., it is safe to say that the profits of the business would be greatly reduced, and that the factory cost of the present car would be increased. But if Mr. Ford or a combination of makers should with increased capital undertake to meet the demand for different sized cars from 22 to 60 hp., it is certain that not more than six or eight different sizes of cylinders would be selected within that range, instead of the forty-five different sizes that are now made by the seventy-seven makers.

Of the forty-three six-cylinder cars in Table 1, thirty are found with only six diameters of cylinder, viz.: ten 3 by 5, 21.6 hp.; five 3¼ by 4½, 25.3 hp.; six 3½ by 5 to 5¼, 29.4 hp.; three 3¾ by 5 to 5½, 33.7 hp.; and six 4 by 4½ to 6, 38.4 hp., while the other thirteen are all of different sizes, including seven different diameters of cylinder. If the makers of say ten out of these thirteen cars were to abandon their present exceptional sizes of cylinder and adopt one or other of the five sizes of the thirty cars, it would be possible for numerous economies in factory costs to be effected and considerable reduction in selling price to be made, with consequent increase of business and annual profits.. With standardization of sizes of cylinders would come standardization of pistons, piston rings, connecting-rods, crankshafts and their bearings, springs and other parts of the machine.

Possible Standard Sizes

Table 3 is a tentative list of standard sizes, thirteen in all, with five diameters of cylinders. The average price is figured from the formula, with the values of C for different sizes taken approximately as those given in Table 2, rejecting those of extreme price. Figures are

Table 2

Classification of Cars into Seven Groups According to Suggested Formula for Size Determination. ("Size" = Horsepower + Wheelbase)

Size 115 to 125

Size	Price	No. of Cyls.
122	$440	4
124	490	4
119	495	4
115	550	4
120	615	4
122	665	4
120	660	4
123	660	4
125	675	4
123	740	4
Av. 121	$599	

Size 126 to 135

Size	Price	No. of Cyls.
132	$600	4
126	650	4
132	655	4
130	675	4
126	695	4
132	725	4
133	750	4
132	775	4
134	775	6
130	795	4
129	795	6
134	795	6
132	815	6
130	850	4
135	875	4
132	985	4
132	985	4
134	985	4
132	1,050	4
134	1,095	4
Av. 132	$815	

Size 136 to 145

Size	Price	No. of Cyls.
136	$740	4
136	845	6
136	885	4
136	885	4
138	895	6
140	935	4
137	985	4
138	985	4
142	985	6
138	1,000	4
144	1,000	6
142	1,000	4
140	1,020	6
142	1,050	6
140	1,050	6
140	1,065	6
141	1,085	4
142	1,085	6
142	1,090	6
140	1,095	4
141	1,095	4
141	1,095	6
145	1,095	6
145	1,095	6
141	1,100	6
139	1,150	8
143	1,195	6
138	1,195	8
144	1,200	8
139	1,250	4
144	1,250	6
144	1,360	8
144	1,360	6
140	1,375	4
139	1,375	4
144	1,385	6
141	1,395	4
145	1,395	6
142	1,800	4
142	2,500	4
137	2,700	4
Av. 140	$1,190	
Av. omitting last three,	$1,102	

Size 146 to 155

Size	Price	No. of Cyls.
149	$750	4
148	1,095	12
154	1,450	8
149	1,350	8
150	1,385	6
151	1,400	6
146	1,295	8
153	1,485	6
151	1,695	6
151	1,950	6
153	2,080	8
Av. 150	$1,449	

Size 156 to 165

Size	Price	No. of Cyls.
158	1,095	6
158	1,095	6
157	1,250	6
157	1,985	6
164	2,100	6
161	2,350	8
161	3,600	4
Av. 159	$1,925	
Av. omitting last one,	$1,646	

Size 166 to 175

Size	Price	No. of Cyls.
170	$2,175	6
168	2,375	6
166	2,550	4
170	2,680	6
168	2,750	12
170	2,900	6
172	4,300	6
170	4,850	4
Av. 169	$3,072	
Av. omitting last two,	$2,572	

Size 178 to 207

Size	Price	No. of Cyls.
178	$3,150	12
191	4,900	6
182	5,350	6
207	5,900	6
Av. 190	$4,825	

Formula for Average Price. Price $= \left(\frac{\text{HP.} + \text{W.B.}}{100}\right)^3 \times$ C. Prices and Values of the Constant C

No. of Cars Averaged	Av. Size HP. + W.B.	Av. Price	$\left(\frac{\text{HP.} + \text{W.B.}}{100}\right)^3$	C
10	121	$599	1.771	338
21	132	815	2.300	354
41	140	1,102	2.744	402
11	150	1,449	3.375	429
7	159	1,646	4.020	409·
8	169	2,572	4.827	533
4	190	4,825	6.859	702
102				

Ford car, 3¾ by 4 in., four-cylinder, 22.5 hp., wheelbase 100 in. $\left(\frac{\text{HP.} + \text{W.B.}}{100}\right)^3 = 1.84$. Factor for price $\frac{440}{1.84} = 240$, or 28 per cent below the average factor for ten small sized cars given in the table.

also given for low-priced cars 30 per cent below average, and for high-priced cars 30 per cent above average. Low price and high price have no necessary relation to either the quality of the car or to the profit per car, to either the manufacturer or the dealer. If the price of a certain car is $1,000, cutting its price to $700 may increase its sales so that $100 per car may be saved in selling expense, $100 in factory cost and $100 per car taken from manufacturers' profits without reducing the annual profits of either the manufacturer or dealer.

A similar car may sell for $1,300, with a reduction in the number of sales, an increase of $100 in the selling cost, $100 in factory cost and $100 in manufacturers' profit per car, but with no increase in annual profits. The difference between the low-priced car and the high-priced car is $600, but the high-priced car may not be any more profitable as regards annual profits than the low-priced car.

The great reduction in selling prices of automobiles during the last two years has surely not yet reached its limit.

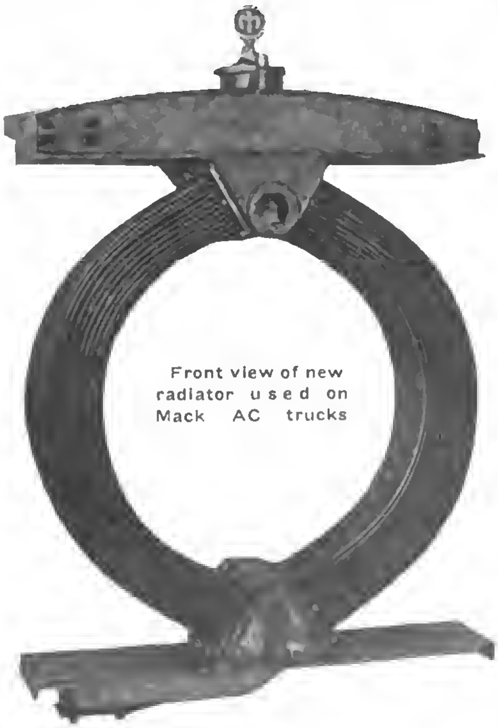
Table 3—Proposed Standard Sizes of Automobiles

			(5 passenger)			
Diameter of cylinder, in.	....	3	3½	4	4½	5
Length of stroke, in.....	....	4	4	5	5	5
Or................	....	5	5	6	6	6
Horsepower	4 cyl.	...	19.6	25.6	32.4	40
	6 cyl.	21.6	29.4	38.4	48.6	60
	8 cyl.	28.8	39.2	51.2	...	..
	12 cyl.	43.2	...	...	...	..
Wheelbase, in...........	4 cyl.	...	110	120	130	140
	6 cyl.	115	120	130	140	145
	8 cyl.	120	130	140	...	...
	12 cyl.	128	...	...	...	...
Sum of horsepower and wheelbase	4 cyl.	...	130	146	162	180
	6 cyl.	136	149	168	199	205
	8 cyl.	149	164	191	...	...
	12 cyl.	171	...	...	...	...
$\left(\frac{HP. + W.B}{100}\right)^3 = S$	4 cyl.	...	2.20	3.11	4.25	5.83
	6 cyl.	2.52	3.31	4.74	7.88	8.62
	8 cyl.	3.31	4.41	6.97	...	...
	12 cyl.	5.00	...	...	...	...
Factor C for Average Price	4 cyl.	...	350	425	475	550
	6 cyl.	400	450	480	?	?
	8 cyl.	480	480	?	...	...
	12 cyl.	480	...	...	...	...
Average Price	4 cyl.	....	770	1322	2019	3207
	6 cyl.	1008	1490	2275	?	?
	8 cyl.	1589	2117	?	....	....
	12 cyl.	2400	....	....	....	....
Low price 30 per cent below av.	4 cyl.	....	539	925	1403	2244
	6 cyl.	706	1043	1593	?	?
	8 cyl.	1043	1473	?	....	....
	12 cyl.	1680	....	....	....	....
High price 30 per cent above av.	4 cyl.	....	1001	1719	2625	4168
	6 cyl.	1310	1937	3957	?	?
	8 cyl.	1937	2752	?	....	....
	12 cyl.	3120	....	....	....	....

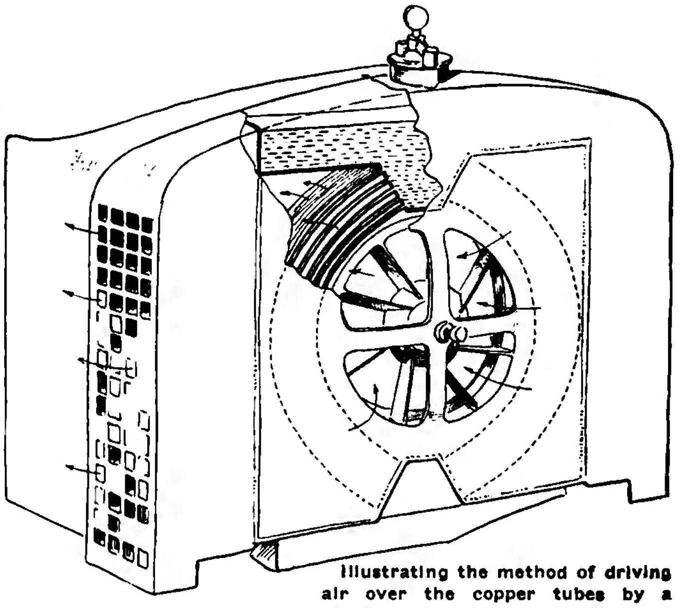
Solderless Radiator Used in Mack AC Trucks

THE radiator used on the Mack model AC trucks is a new design. By the use of a large number of practically semicircular sections of copper tubes, which are expanded into plates that in turn are bolted to top and bottom headers, a solderless radiator is obtained, which expands within itself and withstands severe vibration without failure.

Both top and bottom headers are of aluminum alloy and the upper header forms part of the cowl, while the lower is part of the frame that supports the radiator. The tubes are expanded into the end plates and no solder is used in the construction. As each tube is a unit in itself, one or more of the tubes can be blocked or pinched off in case of emergency without interfering with the others.


Front view of new radiator used on Mack AC trucks

Instead of being placed in front of the engine the new radiator is installed back of it, and a centrally located fan draws air from the driver's cab as well as the motor compartment, and discharges it at the sides. Thus a constant stream of cool air is passed over the radiator tubes, and, as screens are provided on each side of the hood, cool air is also drawn past the engine.


Illustrating the method of driving air over the copper tubes by a radial fan. Arrows show air currents

Freezing Leaves Tubes Uninjured

An illustration of the way tubes of this radiator will stand expansion and contraction without leakage is shown in the case of an AC truck that was left standing outdoors on a very cold day. The water in the radiator was frozen solid, and so great was the strain upon thawing that the lower section of the bottom header burst, yet the tubes remained in perfect condition. Replacing the broken header was an easy matter. The bolts were removed from the two plates holding the tubes, after which the header was unbolted from the chassis and a new one bolted in its place.

Testing Aeroplane Motors with a Fan Dynamometer

When Testing Air-Cooled Types Allowance Must Be Made for Temperature of Air in Which Blades Rotate—If Apparatus Is Correctly Designed and Installed Results Should Be Accurate

By Lawrence Hodgson, B. Sc., A. M. Inst. C. E.

From a Paper Presented Before the Institution of Automobile Engineers

DURING the past year the author wished to use the fan brake dynamometer for accurately determining the horse-power developed by aviation engines. He had available an apparatus which he had designed for testing small propellers in water, and he decided to use this apparatus in order to obtain a better general view of the laws of resistance of fan brakes than could be obtained from the paper above referred to. All tests were carried out with the fan rotating in water, with the exception of one check test (marked A, Fig. 1) which was taken with the fan rotating in air.

In the water tests, the vertical spindle carrying the fan was rotated in a covered tank of still water, 20 ft. square and 5 ft. deep. The blades used were ½ in., 1 in., and 2 in. square, and ½ in., 1 in., and 2 in. in diameter. They were cut from smooth German silver sheet 0.012 in. thick, and the edges were left sharp and at 90 degrees to the face of the blades. The fan spindle was driven by a small air turbine attached directly to it, and the driving torque measured by means of a manometer which indicated the pressure at the turbine jet. The relation between the driving torque and the readings of the manometer was determined by a series of brake tests taken at various jet pressures and turbine speeds. The plane of the fan arms was 10 in. below the surface of the water, the coefficient of resistance having been found to be constant for the largest diameter of fan used for all depths of immersion greater than 6 in. The apparatus and the observer were carried on a platform which bridged the tank. In every case, before a reading of the speed of rotation was taken, the fan was rotated under constant torque until there was no further increase in the speed. The speed of rotation was measured by timing the revolutions of a slow-moving wheel geared to the fan spindle. The temperature of the water during the experiments was approximately 50° F.

Analyzing the Tests

In analysing the results, it was assumed that for geometrically similar fans, the resisting torque due to the blades alone varied as the fifth power of the linear dimensions, as the square of the revolutions, and as the density of the fluid in which the fan rotated. It was further assumed that the coefficient of resistance, κ, would be different for fans which were not geometrically similar. For the square and round-bladed fans which the author used in his experiments, the proportions of the fan were specified by the ratio r/s, and the values of κ in the equation

$$\mu_b = \kappa N^2 r^3 s^2 W \quad \dots\dots\dots\dots\dots\dots (1)$$

were therefore determined for various values of this ratio for each shape of blade. A separate series of tests established the fact that the torque due to the arms alone (μ_a) was given with sufficient accuracy by the formula

$$\mu_a = 0.35 \times 10^{-8} \sigma N^2 r_a^4 t W \quad \dots\dots\dots\dots (2)$$

In order to increase the accuracy of the measurement of the torque due to the blades alone, when r/s was large, μ_a was made as small as possible by using arms of steam-line form. The outside radius, r, was used in Equation (1) in preference to any other linear dimension which varied with the diameter of the fan, such as the radius of the centre of pressure or of the centre of gravity of the blades, because it was the linear dimension most easily measured.

Fig. 1 shows the values of κ for square and circular blades plotted against the ratio r/s, as determined from the author's experimental results. It will be seen that κ varies very considerably with r/s, when r/s is small, but approaches a constant value when r/s is large; further, that this constant value of κ for the circular blades is about 0.7854 times less than for the square blades.

Fig. 2 shows the author's values of κ for square blades, compared with the values deduced from Messrs. Morgan and Wood's tests when analysed on the basis of Formulæ 1—5. It will be observed that Messrs. Morgan and Wood give no tests on fans for which r/s is greater than 2.5. The point marked P in Fig. 2 corresponds to the value of the constant in Mr. Poppe's formula, Mr. Poppe's tests being made on fans for which the values of r/s varied from about 2.5 to 10.

It will be seen that there is a close agreement between the author's values of κ and those deduced from Messrs. Morgan and Wood's tests. This agreement is all the more remarkable when it is remembered that the author's experiments were made with small blades in water, and using a motor of less than one-thousandth of one horse-power. Such close agreement between tests taken in media of widely different densities appeared to indicate the probability of some error in Messrs. Morgan and Wood's observations on the barometer and temperature effects.

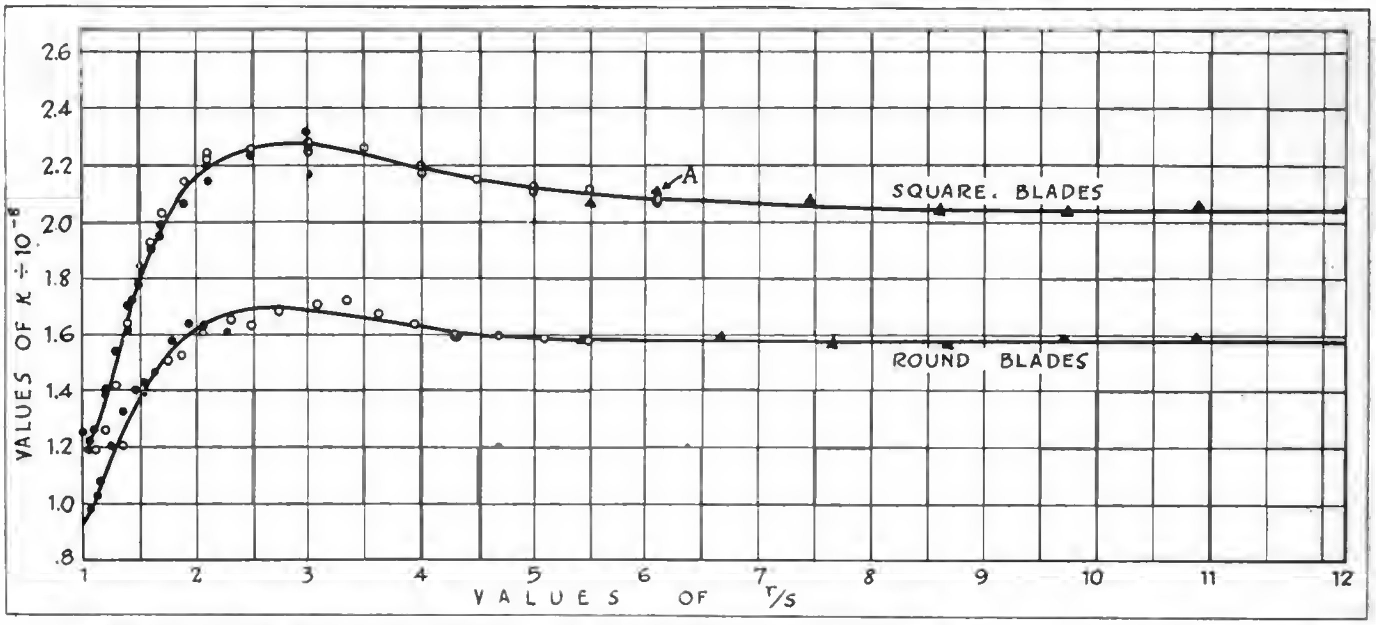
In order to investigate this point further, the author carried out a series of tests on a fan rotated in air under constant torque in a closed chamber. The density of the air in this chamber was changed by small steps from 0.076 to 0.540 lb. per cubic foot by increasing the pressure, and from 0.076 to 0.600 by increasing the temperature.

Over the whole of this range, the relation

$$N^2 W = \text{constant}$$

was found to hold. The check point, marked A in Fig. 1, which was taken with the fan rotating in air, further confirms the conclusion that the resistance to rotation varies directly as the density of the fluid in which the fan rotates.

When testing air-cooled aviation engines an error may be introduced if the temperature of the air in which the blades rotate is not allowed for. This temperature may be obtained by means of a small alcohol thermometer, some 2½ in. long encased in a perforated brass tube, and reading between 60° F. and 120° F., attached to the blades or the extremity of the fan arms. The thermometer should be fixed with its



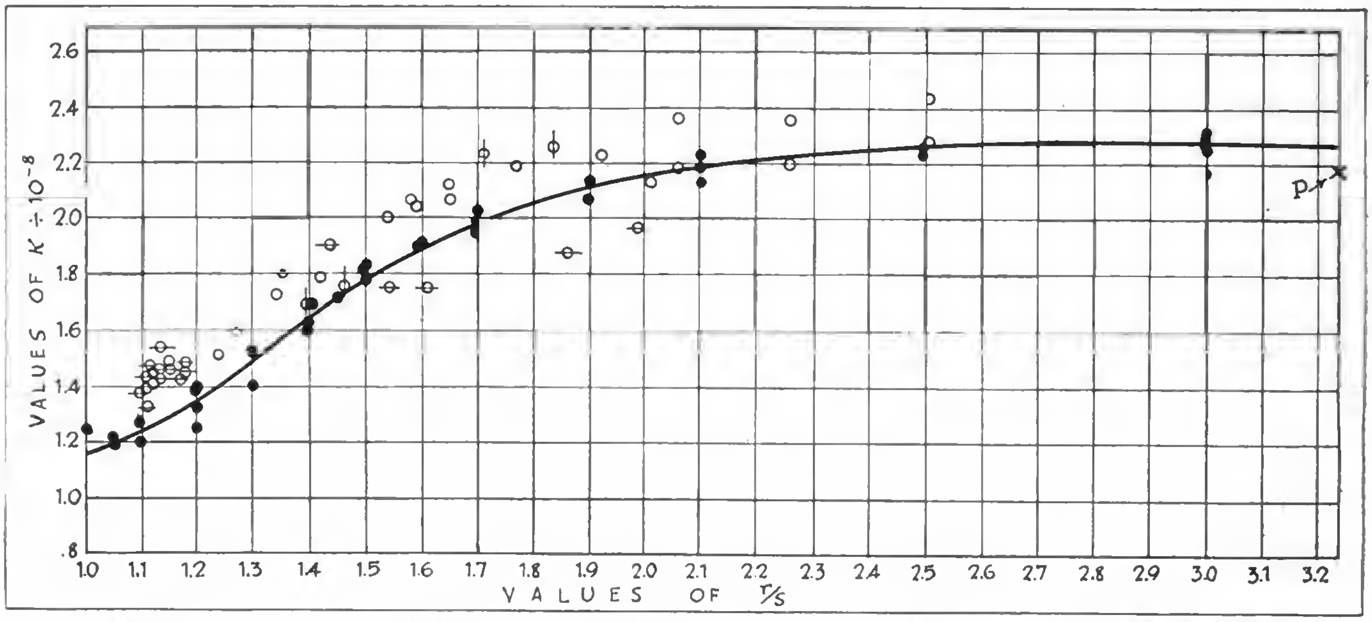


Fig. 1—Above—Curve showing the values of K for square and circular blades plotted against the ratio r/s, as determined from the author's experimental results. Fig. 2—Below—Curve showing the author's values of K for square blades, compared with the values deduced from Messrs. Morgan and Wood's tests when analyzed on the basis of Formulae 1-5

stem radial, so that it does not appreciably interfere with the stream-line flow past the arms and blades. Or, alternatively, the thermometer may be clamped to a pillar resting on the ground, so that its bulb is in the same plane as the fan arms and an inch or so beyond the tip of the blades. In the author's experiments N was varied for any one fan only over a range of 1:3; in Messrs. Morgan and Wood's experiments, over a range of 1:2. These ranges are too small to prove that the N^3 law is followed exactly.

On further reference to Fig. 2, it will be seen that a curve drawn through the mean of Messrs. Morgan and Wood's points would be 2 or 3 per cent higher than the author's curve, and it is somewhat difficult to say whether or not the higher values should be taken.* Values of κ obtained by testing the same engine successively with a fan brake and a Froude dynamometer seem to indicate that the author's values are the more correct. In any case, the discrepancy between the two sets of results is not great for commercial testing.

Resistance Coefficient Easily Affected

It will be obvious that the presence of the engine and flywheel or of a wall or floor in the vicinity of the fan will affect its coefficient or resistance. The author has found that the coefficient of resistance is affected by less than 1 per cent for fans for which r/s is greater than 3, provided that the diameter of the flywheel (to which the fan arms may be bolted) is less than r_0, that the clearance between the tip of the blades and the floor is at least one and a half times the radial width of the blade, and that there is a distance of at least one and a half fan diameters between the plane of the fan and the wall. Too small a clearance between the blade tip and the floor introduces the greatest source of error. If it is not convenient to mount the engine sufficiently high to obtain the floor clearance specified above, a shallow trough should be dug. This should not be deeper than one and a half times the radial width of the blade, and its breadth should be about four times the axial breadth of the blade.

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*Messrs. Morgan and Wood do not say how the speed of rotation of the fan was measured in their tests. If a tachometer was used, this may have been in error.

They also do not state the temperature and pressure of the air. In analyzing their results the author has assumed that the density of the air was 0.0763, a figure which corresponds to mean atmospheric temperature and pressure.

In fan brake dynamometers as usually constructed it is customary to make the value of r/s small. It will be seen, however, on reference to Fig. 1, that the experimental accuracy is greatest for the larger values of r/s. Further, the shape of the $\kappa.r/s$ curve is more easily defined from theoretical considerations when the value of r/s is large. The curve can, therefore, be drawn with much greater certainty at these values. Then again, the influence of the engine and flywheel on the resistance coefficient of the fan used is less when r is large, and, for fans installed with similar clearances, the effect of the proximity of the floor diminishes as r/s is increased. For these reasons, it is desirable to design the fans so that the ratio r/s is not less than 2.5 or 3.

Not Highly Accurate

The author has usually found that the fan brake dynamometer is not considered capable, under the conditions of ordinary commercial testing, of giving results of any very high degree of accuracy. It would seem to him that if the above points are taken into account when designing and installing the fans, and if the speed of rotation is correctly measured, and if any variations in the temperature and pressure of the air in which the fan rotates are measured and allowed for, the accuracy of the results should compare very favorably with those obtained by much more elaborate apparatus. A summary of the equations and symbols used is given below:

$$\mu_b = \kappa N^2 r^3 s^2 W \quad \dots\dots (1)$$

$$\mu_a = 0.35 \times 10^{-8} \sigma N^2 r_a^4 t W \quad \dots\dots (2)$$

$$\mu = \mu_a + \mu_b \quad \dots\dots (3)$$

$$\text{H.P.} = \frac{\mu N}{63{,}000} \quad \dots\dots (4)$$

Where

W = Density of the fluid in which the fan rotates, in lb. per cubic foot

= 62.33 for water at 50° F.

= 1.347 × barometric pressure in inches of mercury (460 + temp. in °F.)

μ_a = Torque due to arms alone, in inch-lbs.

μ_b = Torque due to blades alone, in inch-lbs.

μ = Total torque in inch-lbs.

H.P. = Horsepower.

N = Revolutions per minute.

s = Length of side of square blade, or diameter of circular blade in inches.

r = External radius of fan in inches.

r_a = Radius of arms in inches, measured to the inside of the blades.

t = Thickness of arms in inches.

κ = A coefficient depending upon the value of r/s and the shape of the blade for fans rotating in free space.

σ = A coefficient depending on the section of the arms as given below.

It will be obvious that the relation

$$\mu_b = \kappa N^2 r^3 s b W \quad \dots\dots (5)$$

where κ is the coefficient for square blades given in Fig. 1, should be approximately correct for rectangular blades of radial width s and breadth b inches. The values of κ calculated from Messrs. Morgan and Wood's tests on rectangular blades by means of this equation are shown in Fig. 2.

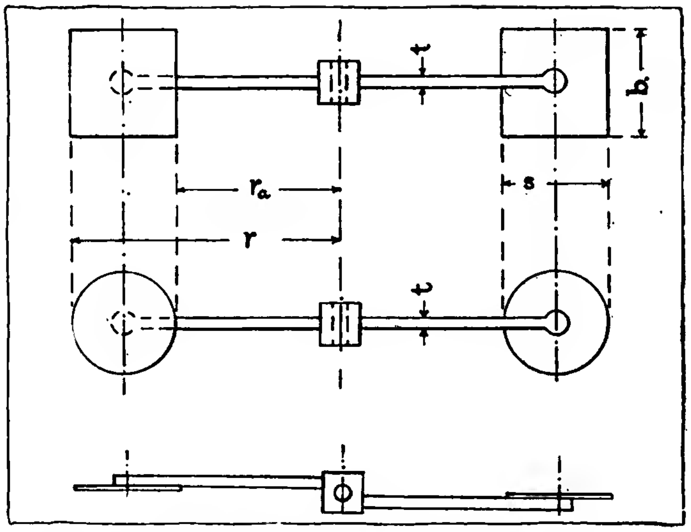


Fig. 3—Measurements of square and circular-bladed fans

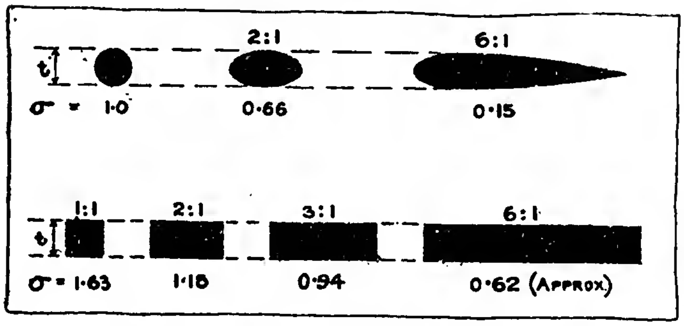


Fig. 4—Values of σ for representative fan arm sections

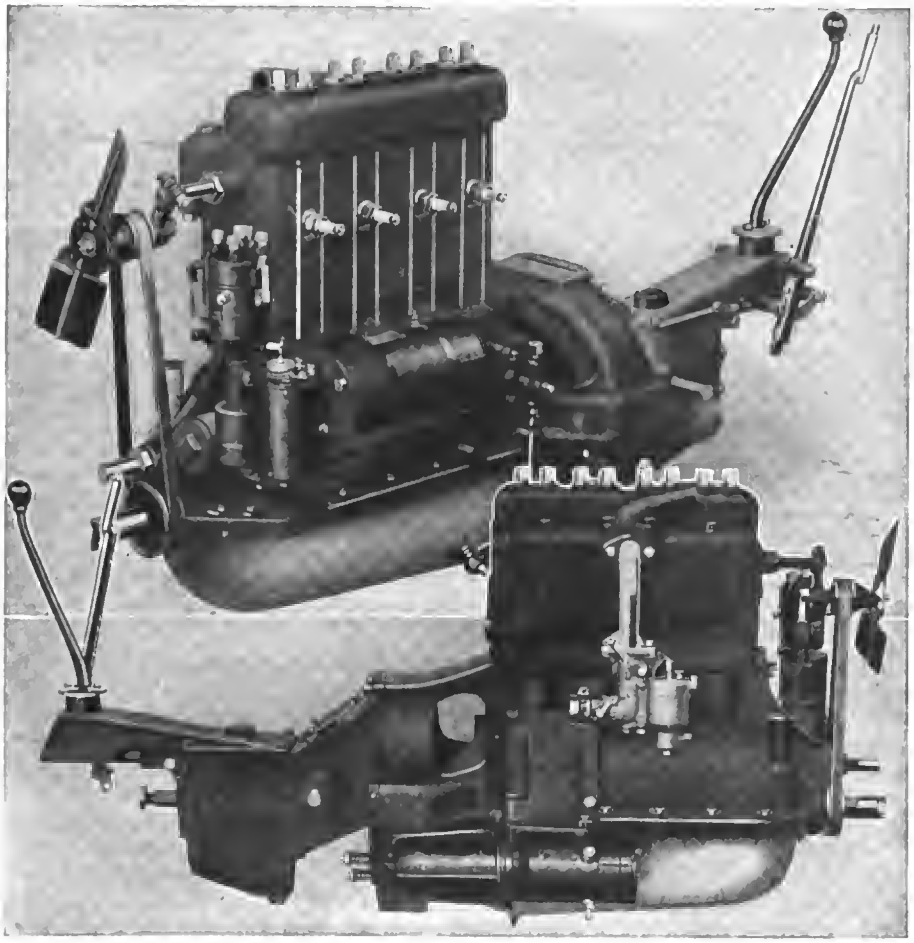
It is interesting to note that when *comparing* the performances of a number of petrol engines by means of the same fan, no correction need be made for variations in the temperature or barometric pressure of the air, as these factors affect the resistance of the fan and the torque of the engine at any given speed in almost exactly the same ratio. The author would like to draw attention to the theoretical interest of this investigation, in which tests made on small models in water are used directly to predict the behavior of much larger apparatus in air. The conditions under which such comparisons may be made with accuracy, and the economies which are possible by carrying out tests in a dense medium such as water, are further dealt with in a paper by the author on "The Commercial Metering of Air, Steam, and Gas," which is shortly to be read before the Institution of Civil Engineers. In conclusion, the author wishes to acknowledge his indebtedness to the careful work of Messrs. Morgan and Wood, and to thank the Aeronautical Society for permitting him to republish in this paper certain matter which he has already contributed to their journal; also his firm, Messrs. Geo. Kent, Ltd., of Luton, at whose works the tests were made, and Mr. F. Gray, who assisted in the preparation of the paper.

California 1915 Registrations

	Cars and Trucks	Chauffeurs
Alameda	11,440	1,297
Alpine	11	0
Amador	241	17
Butte	1,363	57
Calaveras	225	9
Colusa	502	34
Contra Costa	1,232	79
Del Norte	96	3
El Dorado	203	15
Fresno	6,177	265
Glenn	558	23
Humboldt	1,259	215
Imperial	1,785	79
Inyo	247	11
Kern	3,320	267
Kings	1,144	16
Lake	234	38
Lassen	241	7
Los Angeles	55,217	7,754
Madera	435	17
Marin	333	112
Mariposa	86	19
Mendocino	627	45
Merced	383	40
Modoc	230	16
Mono	18	1
Monterey	1,048	119
Napa	883	84
Nevada	299	23
Orange	4,913	239
Placer	630	45
Plumas	148	22
Riverside	2,844	111
Sacramento	4.655	688
San Benito	471	37
San Bernardino	4,404	192
San Diego	7,232	1,083
San Francisco	17,763	5,931
San Joaquin	3,644	228
San Luis Obispo	978	101
San Mateo	1,500	231
Santa Barbara	2,469	218
Santa Clara	5,275	292
Santa Cruz	1,173	54
Shasta	401	15
Sierra	72	8
Siskiyou	563	39
Solano	1,011	74
Sonoma	2,535	134
Stanislaus	2,486	86
Sutter	445	17
Tehama	556	29
Trinity	43	8
Tulare	3,125	65
Tuolumne	360	29
Ventura	1,797	73
Yolo	1,045	44
Yuba	421	48
Total	163,301	20,848

Scripps-Booth Eight Is Four-Passenger

Has Individual Front Seats—Other Models Are Four-Cylinder Roadster and Coupe—Motor More Powerful Than in 1915—Characteristic Body Lines Continued



Both sides of the 3 by 4¼-in. four-cylinder motor used in the 1916 Scripps-Booth roadster and coupé. Above is illustrated the electric generator and ignition apparatus, and below, the mounting of the starting unit

ALTHOUGH it was made known at the New York and Chicago shows that the Scripps-Booth Co., Detroit, would offer for this year a higher-powered four-cylinder model as well as an eight, and some of the details were given it was then too early to obtain complete details of the new productions of this concern, but these are now available and show the main differences are in the power plants.

Like most other automobile manufacturers, the Scripps-Booth company has been obliged to raise the prices of its models somewhat, due to the materials situation, the four-cylinder roadster now selling for $825 and the coupé which is mounted on the same chassis commanding a price of $1,450. The eight-cylinder engine is put in the four-passenger car only, and the chassis for this has a 120 in. wheelbase instead of 110 in., as is the case with the four-cylinder models. This eight is priced at $1,175.

A New Four-Passenger Body

The really new thing in the present Scripps-Booth announcement, however, is the four-passenger body, which follows closely the idea that was prevalent at the shows of making it a sociable affair. There is an aisle between the two front individual seats, this admitting to the rear seat which is 34 in. wide. Entrance to the rear compartment is through the doors at the front seats. The general body lines of this larger Scripps-Booth are the same as those which have been followed in the four-cylinder roadster ever since its inception, and which have occasioned much favorable comment from the motoring public. The radiator is of the V-type and the hood and front of the body carry out the same slope without any disturbing transitory curves. The rear deck of the new body also carries out much of the same shape as the roadster, and there is a wire wheel rakishly positioned at the end of it. The wire wheels, in fact, add a great deal to the appearance of the car.

Overhead Valves on Both

Very little has been altered in the general chassis layout of the new Scripps-Booths as compared with the earlier model, but considerable change has been brought about in the power units. In fact, the influence of the same designer is to be seen in both the new four-cylinder and the eight-cylinder engines, for they both adhere to the overhead valve construction with adjustment for the rockers outside in an exceedingly convenient position. The four has a bore of 3 in. and a stroke of 4¼ in., whereas the eight is 2⅝ by 3¾ in. Needless to say, the new four, with its larger motor, has considerably more power than the 1915 motor, and like the eight, is very accessible for various adjustments or repairs.

Two-Unit Electric System

A change of importance is the fitting of a two-unit starting and lighting system of Wagner make to replace the single-unit system that was formerly fitted to the roadster. The starting motor is placed on the right and close to the flywheel so that it can connect with the flywheel for performing its function. The popular Bendix automatic meshing and de-meshing apparatus is used, whereby the operation of throwing on the starting current by means of a switch in the footboard automatically meshes a pinion on the starter shaft with teeth in the flywheel rim, and once the speed of the engine exceeds that of the starting unit this pinion de-meshes again. The details of this starting connection have been thoroughly covered in previous issues, and are well understood by the public. The starting motor is entirely out of the way, being hung from a bracket below the upper part of the crankcase.

On the four the generator is carried on the left and is driven by the camshaft through inclosed gearing. In the case of the eight the generator is carried in the block between the cylinder castings, and is driven by a belt.

Adjust Valves While Running

One of the motor illustrations herewith indicates clearly how the overhead valves are inclosed completely at the top of the motor. Adjustment of the clearance between the end of the valve rod and the rocker which actuates the valve stem is afforded by the adjusting nut which protrudes through the top of the plate. By means of these adjustments it is possible to adjust the valve clearance while the engine is running if desired. First the cap which goes over the adjustment proper is removed and then a screwdriver may be used to turn the slotted head of the adjusting nut, the locking nut having to be loosened first. An experienced person can tell by the feeling of the valve rod just how much clearance there is. This valve adjusting scheme has been described in previous issues in connection with the Ferro eight-cylinder engines designed by the Brush Engineering Assn.

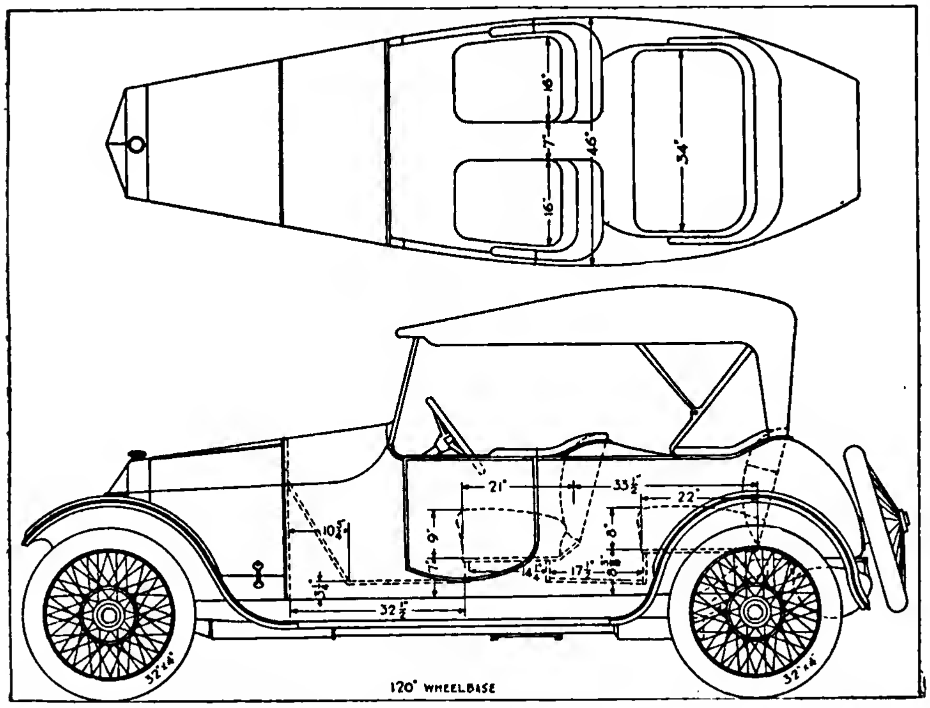
Motor Mounting More Rigid

Support of the four-cylinder motor in the chassis has also been changed. Instead of hanging the rear end from a bridge, the back part is supported directly in the frame on either side. This makes a more rigid mounting.

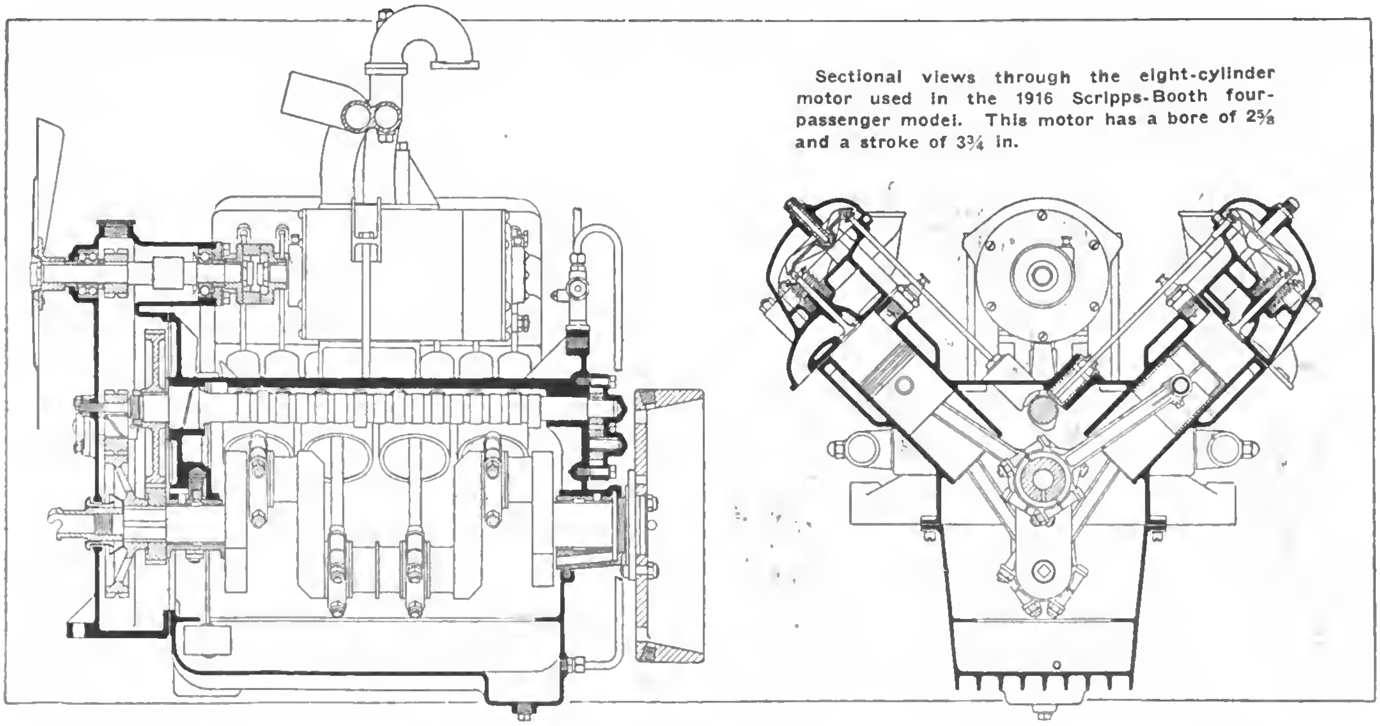
Remy ignition is fitted to the new motors and the means of attachment and drive on the four is clearly brought out in the illustrations. The distributer is vertically mounted, so as to be driven by a worm gear off the front end of the camshaft. The coil is mounted in close proximity to the distributer and both are adjacent to the generator. Centralization of the electric apparatus is the result and it tends to shorter wiring. As the spark plugs are carried in the left side of the cylinder block, it is difficult to see how they could be brought much closer to the distributer.

No External Manifolds

Simplicity has evidently been striven for in the application of other motor accessories in addition to those already mentioned, a fact which is forcibly brought out by the mounting of the carbureter on the right side and the absence of external manifolding. Distribution of the incoming gases is cared for within the cylinder casting, since there is but a single opening for connection to the carbureter. The exhaust manifold is of large proportions and therefore gives free exit for the burned gases.



Layout of the new Scripps-Booth four-passenger body which is mounted on the eight-cylinder chassis for 1916, showing some of the principal dimensions



Sectional views through the eight-cylinder motor used in the 1916 Scripps-Booth four-passenger model. This motor has a bore of 2⅝ and a stroke of 3¾ in.

The oil pan is a pressing which attaches in the usual manner to the bottom of the crankcase and is sloped to send the oil back to the reservoir at the rear, from which it is drawn by a pump and delivered to the troughs under the connecting-rods. This is what might be termed a circulating splash system and applies to the four-cylinder motor only. On the eight the lubrication system is of the pressure type, in which the oil is fed by a pump to the motor bearings, and thence through drilled passages in the shaft to the crankpins. It is not splashed.

Eight's Maximum 2500 R.P.M.

These new Scripps-Booth motors attain moderately high speed, the four having a maximum of 1800 r.p.m., and the eight running up still higher to 2500. The reciprocating parts have been designed to take care of the speed running with a marked absence from vibration. In both designs the crankshaft and camshaft are each carried on two bearings of the conventional plain type.

Back of the motor there is practically nothing new to the chassis. A multiple disk, dry plate clutch is used and a conventional form of three-speed gearset that is very compact and bolts to the semi-housing that covers the top of the flywheel and is an integral part of the cylinder casting. The rear axle is a three-quarter floating type, to which the power is conveyed by an open propeller shaft fitted with two universal joints. Front springs are semi-elliptic and the rear set are of cantilever type. In the braking system, the use of piano wire cable to connect the brake operating levers with the grounds. These cables are provided with a very easy form of adjustment to take up the slack and have the advantage of extreme simplicity along with freedom from rattles. Scripps-Booth, in fact, is the pioneer in this form of brake control.

Vacuum Fuel Feed on Four-Passenger

One other new feature of the four-passenger model is the use of the vacuum system of supplying the fuel to the carbureter, the supply tank being carried at the rear below the wire wheel deck.

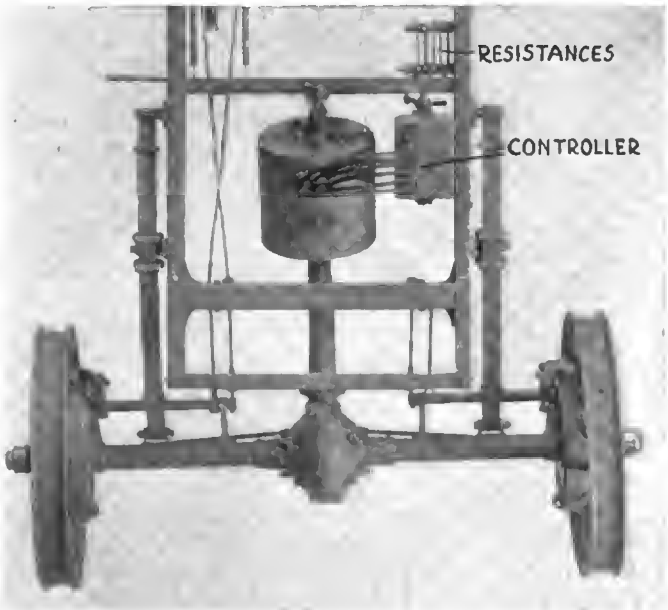
Some of the dimensions of the four-passenger body which the Scripps-Booth designers have been able to fit to the wheelbase of 120 in. will indicate the cleverness with which all of the available space in the body has been used to advantage. From the front to the back of the front seats the dimension is 21 in. and they are 16 in. wide with an isle between that is 7 in. wide. The greatest width inside the body is 46 in., and from front seat to back seat is 33½ in., the distance from the front of the front seat to the front of the dash being the same amount. Easy riding in the back seat of the new four-passenger is fostered by bringing the seat sufficiently forward so that the passengers really sit ahead of the rear axle with the obvious advantages resulting from such a position.

Tire equipment of the eight-cylinder model consists of five 32 by 4 tires carried on wire wheels. One extra tire and wheel are also supplied to the four-cylinder cars, the tires in this case being 30 by 3½.

Milburn Adds a Brougham to Its Line of Electric Cars

New Model Will Sell at $1,585 and Is Mounted on Same Chassis as the Roadster

The new Milburn electric brougham selling at $1,585



Rear of Milburn chassis which carries the new brougham

BESIDES continuing its model 15 chassis on which are mounted the coupé and roadster models, the Milburn Wagon Co., Toledo, Ohio, has added to its line of electric cars a new model. This is a brougham to be known as model 22 and sells for $1,585, being designed primarily for those who desire a larger electric than the other models.

The brougham is not unlike the coupé in appearance, but considerably larger. It measures 63½ in. from front to rear glass; its doors are 26½ in. in width and its cushions are wider and deeper than those in the other cars. The windows are raised and lowered by the Dura mechanical window lifter.

New Car Is Not Heavy

Although the new model is larger and even more luxurious than the company's former models and has a wheelbase of 105 in. as compared with 100 in., and 32-in. wheels as compared with 30-in. wheels on the coupé, it weighs but a few pounds more than the latter. Improvements in designing and the use of steel drop forgings and high grade steel have made this possible.

Cantilever Springs in Rear

Cantilever springs are used in the rear, which give the best possible riding qualities; General Electric motor and controller are used and the spring bolts are provided with self-lubricating bushings, which obviate the necessity of turning up grease cups; the standard battery consists of twenty-two cells of 17 W. T. X. I. Philadelphia diamond grid plates. For those who desire even greater speed than normally provided, a larger cell equipment is offered at a small additional expense. Edison batteries also can be obtained at extra cost.

The FORVM

KEROSENE MUST BE NATIONALLY DISTRIBUTED—NO DRAWBACK TO TRANSVERSE STEERING LINK MOUNTING—EFFICIENCY IN CAR COLORS

Difficulties To Be Met in Kerosene Carburetion

By E. H. Sherbondy

Clay & Sherbondy

IN review of the use of kerosene and heavy oils in automobiles and trucks the first matter of importance is that of distribution of kerosene. We now have nation-wide distribution of gasoline, a matter which has required a great deal of thought and effort on the part of refiners and manufacturers, and really good distributing facilities for gasoline have only been available for about four years past.

May Use Heavier Fuel Oils

If the refiners do not develop commercial methods of distillation, which very largely increases the yield of gasoline, or more properly motor fuel, it will undoubtedly be absolutely imperative to operate at least a part of the motor vehicles on the heavier fuel oils, kerosene, benzol, etc. It is therefore apparent that one of the first steps will have to be to arrange the distribution of kerosene in much the same manner as has been done with gasoline. It is not now possible to conveniently purchase kerosene in quantities for motor vehicles.

The next step of importance is to adapt that class of motor vehicles which most readily lend themselves to the use of kerosene for a fuel. Unquestionably the motor truck will come first, especially the slow-speed, heavy type truck.

There can be no doubt whatever that the cost of distribution must increase the price of kerosene, when such distribution is arranged broadcast as is now the case with gasoline.

Because the truck motor carries a very much heavier normal load (b.hp.) than the pleasure vehicle, it operates with a higher average compression, and within a narrower speed range, thus approaching conditions met with in the operation of stationary and marine engines. All of this is favorable to the use of kerosene as a fuel.

Disadvantages of Jacketing

For many years past, marine and stationary four-stroke cycle kerosene engines have used vaporizing chambers to effect the carburetion of combustible mixtures, and the general method pursued has been to jacket the vaporizing chamber and heat the liquid fuel-air mixture by means of the exhaust gases. There are a great many disadvantages to this mode of procedure, since with varying load, the heat available in the exhaust gases varies and is greatly reduced during closed throttle operation, and when operating at full load too much heat is supplied by the exhaust gases, resulting in serious decrease in the volumetric efficiency. The slow choking up of the vaporizing jacket chamber is also a problem encountered, and is caused by partially burned fuel and lubricating oil vapor being thrown into the exhaust passages when the motor is throttled close. (Poor vaporization and great depression in the cylinder during suction stroke.)

A kerosene vapor-air mixture cannot be compressed more than 47 lb. above atmosphere without encountering preignition and severe pounding, excepting when water injection is used to reduce the compression temperature. The quantity of water necessary is from two to five times the quantity of fuel supplied, depending on the homogeneity of the mixture.

When using a vaporizing chamber in connection with an ordinary metering device, such as a gasoline carbureter, the distribution of the fuel particles throughout the volume of air aspired is usually very poor, and when combustion takes place within the motor cylinders the localized oil vapor is subjected to a cracking process, in which hydrogen gas is liberated and solid carbon particles are formed, part of which adhere to the walls of the combustion chamber, and part of which are rejected with the exhaust gases. The carbon formed in this way may be of two varieties, amorphous or crystalline. Amorphous carbon will be readily consumed under full throttle conditions, and its formation is not particularly detrimental, but crystalline carbon is formed under very different conditions than the amorphous variety, and requires enormous temperatures for its combustion to be effected. Adhering to the combustion chamber walls, whose temperatures are always relatively low, crystalline carbon builds up in the manner well known to motorists in the case of gasoline engines.

The use of water is a further palliative in motors operating on kerosene, since the steam particles act as carrying agents for the carbon, and tend to prevent its formation within the motor cylinders.

Combine Carbureter and Vaporizer

The best solution for the use of kerosene in present design truck motors is to build a combined carbureter and vaporizer, in which a very thorough distribution of the fuel throughout the air is arranged for, so that a homogeneous oil-vapor-air mixture is supplied to the motor, at as low a temperature as is possible.

It is extremely important that the constant level chamber and metering orifice of such a device be not greatly heated, since the changes in viscosity in kerosene at varying temperatures will upset the mixture proportions, which may have been determined for any initial temperature and size of metering orifice.

Two Methods of Starting

Two methods of starting are available with vaporizing carbureters. One is to start the motor on a small quantity of volatile liquid fuel and then utilize the heat of the exhaust gases for vaporization of the kerosene after the motor has started. The other is to burn part of the kerosene which has passed the metering orifice, in what may be termed a producer chamber, to insure vaporization of the oil fuel required in the combustible mixture. The products of combustion, oil vapor and air may be very thoroughly intermingled and then supplied to the motor cylinders through the usual intake manifold. Ignition in the producer chamber may be started, and if necessary continued, by means of high-tension electrodes disposed within the producer chamber and

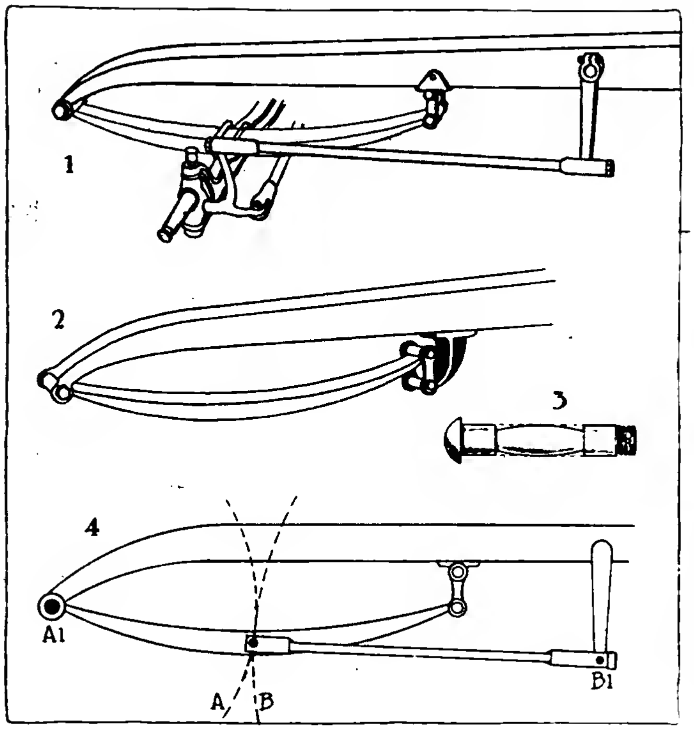


Fig. 1—Usual fore and aft type of steering link. Fig. 2—A pull shackle as an improvement on the push variety. Fig. 3—How a front spring bolt usually wears. Fig. 4—Cause of front wheels wobbling

arranged to discharge the current supplied from a high-tension vibrating coil and battery system.

Another means is to use a blast lamp for initial heating of a "hot tube" disposed within the producer chamber.

The very rich and highly heated oil vapor produced in this way must be reduced in temperature, before admixture with the main air supply, in order to prevent combustion of the entire fuel within the intake manifold.

Even with such carbureting devices as outlined, operation is not entirely satisfactory, nor is combustion complete.

A constant load, with compression in the neighborhood of the limiting values, makes possible only fair operation, with fuel consumption greatly in excess of what would be the case were gasoline used.

Further, because "localized" oil vapor in the charge is usually the rule, rather than the exception, combustion proceeds during the entire expansion stroke and sometimes during the entire exhaust stroke. Of course this results in enormously increased heat losses to the walls of the cylinder and requires more active cooling.

Temperature Changes Are Factors

Oil engines of all varieties are very sensitive in operation to temperature changes, usually because part or all of the vaporization of the fuel depends on the heat of compression to effect the vaporization. In oil-vapor-air mixture engines, low temperatures result in condensation during the suction stroke to a greater or less extent, and high temperatures cause pre-ignition, firing compression of the mixture.

The real solution of the vehicle oil motor problem lies in a rational design and construction of a motor to suit the fuel, and the future freight automobile and probably the aeroplane must have motors capable of highly efficient operation on heavy oils.

It should be the immediate business of the S. A. E. and the National Automobile Chamber of Commerce, Inc., to investigate thoroughly the possibilities of present design carbureters and vaporizors for use with kerosene. For the future necessity of the industry, a concentrated effort should be made to break away from tradition and evolve new types of internal combustion engines which will embrace the present facility of operation and reliability possessed by light fuel oil motors, together with efficient operation on heavy fuel oils.

Transverse Steering Link Not Objectionable

By Theo. D. Stanley

General Service Engineers Co.

THE article by H. H. Dyke in THE AUTOMOBILE for March 23 on "Faults in Front Spring Suspension" has come to my attention, and appears in error in one or two particulars.

In the description of the effect of up and down movement of the car as producing a movement of the axle in the arc *A*, Fig. 4, because anchored at one end *A*1, if there was no flexibility this would be true, but, owing to the spring deflection, another reverse arc is created. The increasing or straightening of the curvature of the spring produces a shortening or lengthening of the distance between the axle and the forward end pivot or anchor of the spring, producing a slight lengthening or shortening of the wheelbase of the car. This movement still further accentuates the action noted by you.

It does not appear to me there is any "obviously undesirable" reason why a steering link should not run crosswise to the car, but, on the contrary, some advantages.

In the mounting of the steering-gear, the farther forward it is placed, the less distortion by the rear wheel and spring deflection is produced to be added to the fore wheel displacements in the fore and aft steering-gear mounting.

The link connections are longer and possible of suitable curvature, for those parts in equipping by cross link method as indicated in A. L. Clayden's article on Improving the Steering in THE AUTOMOBILE for Sept. 2, 1915, create an arc of greater radius.

Since the tie rod has to cross the car, there is no reason why the link should not, and with a full irreversible steering-gear is, theoretically, the best way with present form of spring suspension.

Lighter Colors Are Most Efficient for Cars

By M. C. Hillick

THE AUTOMOBILE has consistently and with convincing logic set forth, in past issues, the drawbacks and disadvantages of the blacks and blues and greens, the two latter of the deepest shade, as colors for use upon automobiles. These pigments, it must be conceded, are, at the outset of their career on the surface of the car, and when given the full radiance of a fine fabric of varnish, exceedingly beautiful to behold, and if they could be made to wear on with the same magnificent effects, and at the minimum outlay of cleaning processes be maintained at a high rate of efficiency under the stress of everyday service, their value and usefulness would pass unquestioned. Unfortunately this is not the case, and wherever these colors are found doing service on the average American highway, there you may expect to find difficulty in keeping them clean and neat, and showing a reasonable amount of luster. Moreover, they are colors ground in japan, and therefore afflicted with a brittleness which under severe road and garage treatment is certain to suffer. They will, of course, give a better account of themselves if kept well protected under an ample supply of varnish, but in the face of all that may be done for them—speaking now of the colors used upon the cars exposed to the conditions of the average country and village highway—the tendency is to show a dingy, unkempt, and generally unsatisfactory appearance.

Must Consider Conditions

The exception to this rule is the color used upon the car employed for service upon city pavements, where the conditions of service are of a modified order, as compared to those encountered in the rural districts. These black, deep blue and green colors require a dressing-up with some of the ornamental embroidery of relief colors to take them from under the funereal aspects which such field colors always invite. In other words, they require an artificial stimulation to keep them in presentable condition for even a temporary show.

In respect to the employment of lighter colors, such, for example, as maroon, some of the browns, the grays, creams, wine and the lakes. These colors, some of them also ground in japan, have the important advantage of being comparatively easy to clean up and to be kept clean. Also, they retain their brilliancy of effect to the maximum limit. They show dirt less than darker colors, and respond to the cleaning operations quicker. They render service in proportion to the attention bestowed upon them but at the same time they flourish under neglect and display color effects that would make the darker pigments look like a vain show. The grays, and the creams, and lighter yellows, all are permanent pigments by virtue of the ingredients composing them, white lead being an important one, and a basic feature of the greatest value as a surfacing medium. Such a pigment, naturally supple and elastic, imparts to the color a surfacing property, a density of fiber and film, and an elasticity quite unsurpassed, and explains the tenacity and the durability which characterize these pigments with a pronounced lead base. Give these colors a proper fabric of varnish, and a decent measure of care taken, including proper washing processes, and the service they will render cannot fail to equal that of the very best pigments.

Stand Washing Well

Practically all these colors stand washing and cleaning operations excellently, which may be accepted as evidence of their durability and strength of film. Likewise, they show road dirt and the accumulations of the highway less than the darker colors. They require less of the ornamental effects to bring them into notice, the field color being capable of making an impression without the aid of any ornamental lines, although, of course, these lines serve to lighten the effect and bring into greater relief the true and distinctive character of the field color.

White Lead Gives Elasticity

All colors having a portion of white lead in their composition may be accepted as pigments of an elastic nature, and capable, under reasonable conditions, of giving a masterful measure of durability, at the least possible outlay on cleaning and renovating. The black and the darker colors referred to fail in the capacity to stand the renovating processes without detriment, especially when the protection of varnish has become of no effect, whereas the lighter colors bear these erosives with fewer indications of injury to their luster and general appearance. In making choice of color for the car, its class of service may well govern the selection.

Robbins & Myers Clubrooms for Employees

THE Robbins & Myers Co., Springfield, Ohio, is one of the progressive companies which have established clubrooms for their employees. About two months ago this company organized and equipped at its own expense a club which is now occupying the entire fifth floor of the Bushnell Annex, Springfield, an office building in the down-town part of that city.

The club is for the use of employees only and no charge is made for membership, all expenses being paid by the company. The membership is composed of the male employees only, and there is no separate club for female help connected with this particular club; however, at the factory building a music room, rest room, and other conveniences in the nature of a club is provided for the female employees.

The club contains a reading room and lounge, pool and billiard room, large dance hall and auditorium. These have proved popular with the employees who have made a good attendance every evening since it has been opened.

About once a month a speaker is engaged to address the club members in the auditorium and a banquet or buffet luncheon is served at these meetings. The auditorium is also used by a band composed of the company's employees.

A manager is employed by the Robbins & Myers Co. to run the club, and there are no officers other than the factory superintendent of the company, who is in charge.

Above—Auditorium of the Robbins & Myers clubroom. Below—Billiard and pool room

Motor Trucks Expedite the U. S. Army's

Left—Above—An old blacksmith shop where army carpenters did tha forging of braces and brackats for the wagon bodies that were mounted on White trucks

Left—Below—Loading with rations at the Q. M. depot in Columbus, N. M., where the Villa bandits killad many Americans and attempted to burn the town

Middle — Fleet of White trucks loaded and awaiting the order to go to Casas Grandes with aupplies for the American columna pursuing the Villa bandits

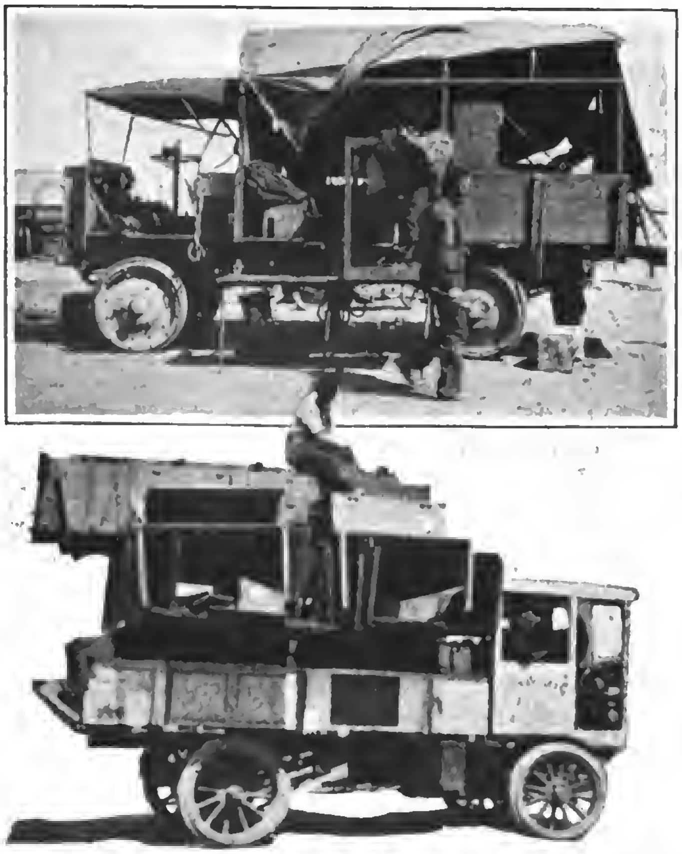
Bottom—White army trucks on the road to the field base at Casas Grandes

Pursuit of Bandits into Mexican Deserts

EL PASO, TEX., March 26—It was but a few days ago that government orders were received at the Packard and Jeffery plants for a squad of trucks for Mexican service. Day before yesterday the chassis arrived here; this morning the entire fifty-four, fitted out with regulation U. S. Army bodies, set out on their 20-mile trip over border roads to headquarters at Columbus, N. M., fully equipped, each with a full load of army supplies, and not so much as a single screw missing.

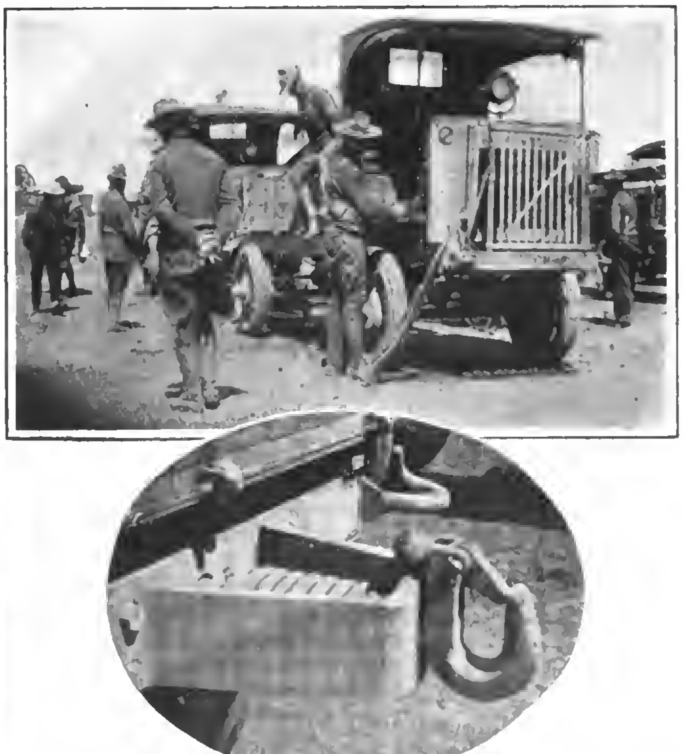
Hardly had the trucks been driven off the flat cars under their own power than a crew of carpenters went after them with hammer and saw and the regulation army bodies were fitted at the rate of one every fifteen minutes. These, bodies, taken from two-mule-team army transports, are equipped with side boards and easily hold the 2-ton capacity of the trucks, in compact army supplies.

The civilian drivers, recruited in Detroit and Kenosha, fitted out in regulation army uniform, were eager to get under way, and made a decidedly businesslike impression as they lined up for inspection before the start. Each man is equipped with a big .45 army automatic, cartridge belt, canteen, sweater jacket, knickers, canvas puttees, substantial tan army shoes, khaki shirt and the regulation U. S. sombrero. Truckmaster Carl W. Newell has been connected with the Packard service in Mexico for six and a half years and is thoroughly familiar with the territory in which his charge of twenty-seven trucks will operate. Truckmaster E. H. Mahoney of the Jeffery contingent is confident of the success of his cars in the desert country, as the squad which preceded him has demonstrated their efficiency.



Above—A Jeffery quad fitted with a completely equipped machine shop. Below—A load of bodies for the new trucks

Upper—General view of the camp at Columbus, N. M., looking toward Mexico. Middle—Jeffery quads with bodies completed. Lower—Some of the trucks loaded and waiting the word to start



In the foreground of the upper illustration is the first Jeffery quad to make the round trip to the front at Casas Grandes, Mexico. Below is shown the substantial Jeffery coupling

Mack 2-Ton Armored Truck for N.G.N.Y.

First Vehicle To Be Completed Carries Two Guns

Mack AC 2-ton armored truck for N. G. N. Y. motor battery

AN armored motor truck battery, with a quota of 160 men and six officers, has been formally mustered into the New York National Guard. For its equipment, which will probably comprise ten vehicles, four experimental armored cars are being prepared. These are to be built on the following chassis: a 2-ton worm-driven AC Mack, a White 1½-tonner, a four-wheel-drive 2-ton Jeffery, and a Locomobile six-cylinder touring car chassis; there is also a 2-ton four-wheel-driven Jeffery with a steel service body. Funds for this equipment were provided by Judge E. H. Gary, H. C. Frick, Col. R. M. Thompson, D. Olcott, J. N. Wallace and Capt. H. G. Montgomery, who will command the battery.

New Rear Drive Steering Device

A new device to provide rear-end drive has been developed and will be applied to all of the vehicles. This consists of a dummy steering wheel and an electric signal at the rear by which an indicator on top of the front steering wheel will be turned, permitting the rear steersman to direct the actual steering by the driver when running backward. This is considered superior to the dual-steering means which has been used in Belgium and experimented with in this country, owing to the concentration of the actual driving at one point and to the elimination of the lost motion which seemed inseparable from the other construction.

The Mack AC Armored Truck

The International Motor Co. has just finished the construction of the Mack armored truck. This is the heaviest of the experimental types and is fully armored. The chassis is the AC model of 2 tons' capacity and with the body and equipment weighs 9052 lb.

It is designed to carry two rapid-fire guns, ammunition and a crew of gunners. The armor is made of a special heat-treated steel of great hardness and resists regulation U. S. Army rifle or machine gun fire at 50 yd. It completely houses every portion of the chassis and practically every surface is above the wheels on such a slant that bullets will be deflected.

It consists of four sections; the hood, the cab and two body sections, each of which has its own angle-iron frame. Each unit is capable of being dismounted separately, and with the two rear sections removed, a platform truck for the transportation of supplies is formed. It stands 100 in. high overall, the armored sides extending down to within 1½ ft. of the ground and up to a height of 6½ ft. The floor is about 2¾ ft. above the ground and the sides extend 3¾ ft. above the floor, so that in a sitting, kneeling or crouching position, the men are entirely protected.

Two Rapid-Fire Guns

The armament consists of two rapid-fire guns, mounted on fixed tripods, fitted with barbettes or shields which extend above the armored sides. One of these is located in the front section of the body and on the right side and the other at the rear and to the left. For rifle fire, seven loop-holes or ports, with sliding shutters are provided, one at the rear, two on each side of the body and one on each side of the cab. The wheels are of wood with steel disk armor, the rear wheel being half covered by the armored sides.

The motor occupies the front portion of the vehicle, as usual, the radiator in front being protected by a curved steel box. This box has a large air opening at the bottom, below the bottom of the radiator, above which is a sheet of armor which effectually prevents bullets reaching the radiator, either directly or by deflection, regardless of the direction from which they come. The motor hood is hinged at the dash and may be raised entirely, or the two sides, hinged at the eaves, may be raised independently. The armor belt extends down below the crankcase, so that bullets intended for the crankcase will be stopped.

Driver's Seat Is Low

So that the driver's cab may be below the range of the guns, the driver's seat is very low, as in racing cars, and protected by a deep cowl. This cab is 4 ft. 4 in. long and 4 ft. 7 in. high. The driver sits at the left. The cowl is fitted with two ventilation doors at the top, the right one of which carries a Gray & Davis 10-in. searchlight on its bottom, so that when the door is opened, it extends upward. On the roof of the cab is a hatch, hinged at the front, which provides ventilation and may serve as an additional shield to the rear portion. At the front of the cab is a shutter hinged at the top and extending the full width, which is adjustable to provide a wide or narrow vision for the driver. Two rear-view mirrors are placed in front of each cab port-hole to give the driver a view behind.

No roof is provided, and there is only one door, which is at the rear. The rear wheels are given clearance under the low floor by steel wheel houses. All doors, hatches, etc., have either refrigerator type latches or wheel-nut hold-downs.

Electric lighting and starting are features, so that the motor may be stopped and started while under fire without exposing any of the men to fire. Besides the disappearing searchlight, there are two headlights and two tail lights. Both of these are placed very low, so as to concentrate the light on the ground and prevent its carrying any great distance.

Ignition Circuit Is Separate

The storage battery used for lighting and starting is separate from the ignition, the latter being supplied by a Bosch magneto and a dry battery. There is an electric dash light under the cowl to light the instruments and a socket for an extension light. Two fire department kerosene lanterns and two Pyrene fire extinguishers are mounted inside the body. A tool box is placed to the left of the driver's seat.

The radiator is of specially large size to insure cooling under difficult operating conditions and to compensate for the somewhat restricted air circulation. The fuel tank is located below the floor, completely protected by the armor and feeding by the Stewart vacuum system.

For towing purposes, a special spring-cushioned drawbar is provided at the rear, anchored to the rear frame cross-member and extending in a ring back of the rear armor plate.

As most of the armor slopes toward the top, the joining of the plates has been difficult. For this reason and also to prevent chipping the edges of the plates by bullets, butt straps are provided at all joints, thus making these doubly strong and preventing opening of seams.

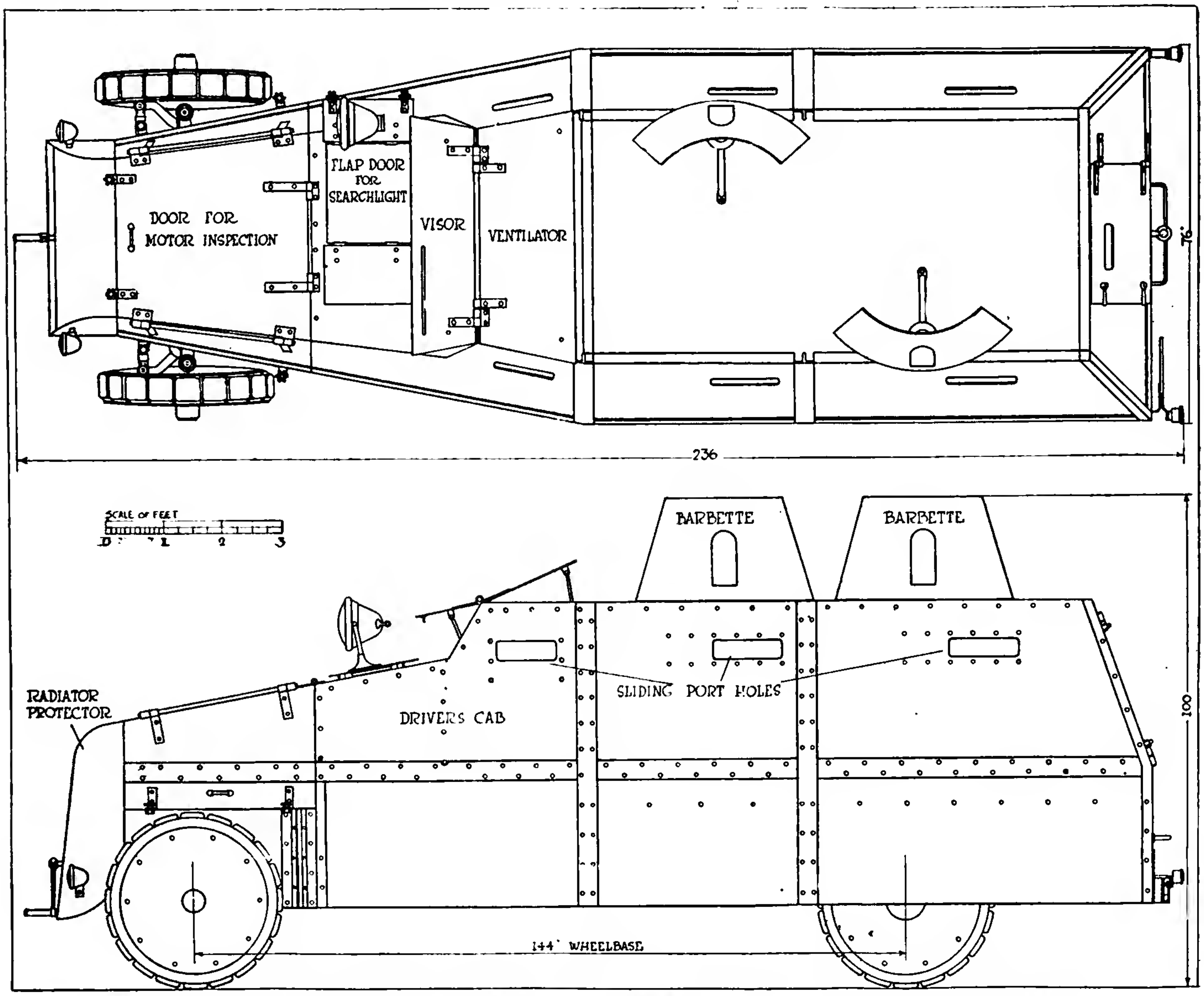
Armor Plates Heat Treated

To illustrate the painstaking care with which this armor has been constructed, the armor itself is cut and drilled at the steel mill and then the plates straightened to conform exactly with the drawings. They are then heat-treated and cannot be drilled or machined again without re-annealing. All bolts and nuts used in the construction of the armor are of special steel, heat-treated and hardened, to prevent their being shot away. There are 600 of these bolts.

Barbettes are mounted on cast bronze frames and are arranged to pivot fore and aft and to swing from side to side. Their backward slope not only provides for bullet deflection, but permits of considerable elevation of the aim, useful in case of use in anti-aircraft work.

Detail weights of the different components follow:

Part	Lb.	Part	Lb.
Chassis	5000	Extra wt. radiator	15
Armor	2400	Fuel tank, etc.	50
Frame for armor	600	Battery	67
Platform	200	Butt straps	250
Drawbar	40	Special bolts	60
Radiator guard	120	Barbettes	250
Total	9052		



Plan and elevation of the 2-ton Mack AC armored truck. Complete with body and equipment, it weighs 9052 lb.

The History of the American Automobile Industry—24

Clerk's Two-Cycle Engine First Construction to Avoid Infringement of Otto's Patent—Selden Begins Work on a Brayton-Type Engine—His Patent of 1895

By David Beecroft

AFTER Nicolaus Otto developed the first four-cycle explosion type engine in 1877, and demonstrated its practicability, it was not long before the general value of this engine was recognized, and as it was broadly covered by patents manufacturers had to pursue one of two courses, namely, pay royalty on the Otto design, or develop some different type of engine which produced fairly satisfactory results and did not infringe on the Otto patents.

Clerk's Two-Cycle Engine

A pioneer in this development of a different type of engine was Dugald Clerk, an English engineer, still living, and looked upon as one the greatest authorities to-day on the explosion engine. Clerk has a large following abroad and visited this country some years ago to give expert evidence in the famous Selden patent case. It was in 1878 that Clerk developed his first engine which did not infringe on the Otto patent. Otto developed a four-cycle engine, Clerk developed what is known to-day as the two-cycle engine. Otto had an explosion every other revolution of the crankshaft, Clerk had an explosion every revolution of the crankshaft. Thus we find Otto and Clerk the two names that stand for the two broad types of explosion engines, and even to-day the four-cycle engine is frequently referred to as the Otto cycle, and the two-cycle engine, now in very little use, as the Clerk cycle.

Clerk's engine, Fig. 1, used two cylinders, one a working cylinder C, in which the piston operated, and the other a pumping cylinder P, which was used to force a charge of explosive mixture into the working cylinder. The explosive mixture entered through a positively-controlled valve in the head of the cylinder, which was given a conical or hemispherical construction.

The Modus Operandi

The modus operandi of Clerk's engine was similar to that of the two-cycle design of later years. At the lower end of the stroke the piston uncovered an opening X through which the exhaust escaped. In the head was a rotary, slide, or other form of valve, correctly timed to admit the fresh charge from the pumping cylinder. He used a conventional type of connecting-rod used by Otto and invented by Gilles.

After Clerk started the two-cycle movement there was much general activity in the development of two-cycle engines during the life of the Otto patent which restricted the use of the four-cycle principle. Some of the keenest inventors took up the two-cycle principle because it furnished an explosion for every crankshaft revolution which was considered a more efficient type than the four-cycle Otto. Some of the other names of early inventors in the two-cycle field were Day, Robson, Stockport and others. Practically all of them employed the same mechanical arrangements for regulating the intake and the exhaust. All of them did not make use of the pumping cylinder to inject the mixture. Some used what has come to be known as the differential piston in which the piston itself served as a pump. Others used the pressure in the crankcase and took the mixture in through the crankcase so that the down-stroke of the piston served to force it into the combustion chamber.

Daimler's Compound Engine

It is not surprising that after the development of the four-cycle and two-cycle engines so close together, Otto and Clerk, that other methods of getting greater efficiency from explosion engines would be developed. Thus we find in 1879 that Gotlieb W. Daimler of Deutz-on-Rhine, Germany, and later founder of Daimler Motoren Gesellschaft, the home of the German Mercedes car, patented a compound explosion engine with the hope of getting higher

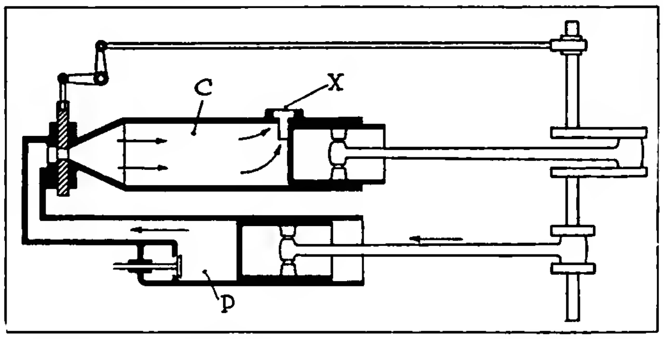


Fig. 1—Clerk's two-cylinder, two-cycle engine of 1878, which comprised a working cylinder C, in which the piston operated, and the pumping cylinder P which was used to force a charge of explosive mixture into the working cylinder. The mixture entered through a positively-controlled valve in the head of the cylinder, which was given a conical or hemispherical construction

efficiency than was obtained in the Otto type. Many to-day remember the compound explosion engine which was manufactured in this country for many years, the car being known as the Compound.

Daimler's patent on the Compound engine, dated Dec. 9, 1879, shows a design of three-cylinder engine, the cylinders arranged parallel. The two end cylinders were explosion types which received the explosive mixture and in which it was ignited. The middle cylinder was a low-pressure one, and in which no explosion occurred, but in which the expansion of the gases from the end cylinders was utilized to drive the piston downward and thus get more use from the explosion and increase the efficiency. The cycle of operations is thus described by Daimler:

"There occurs during each revolution of the crankshaft two impulses, the one being from the two high-pressure cylinders and the other from the low-pressure cylinder. The passage of the gaseous products from the high-pressure cylinders to the low-pressure cylinder can commence before the pistons and the former arrive at the extreme end of the out stroke; but the low pressure piston must at the same time have just arrived at the extreme end of its end stroke."

Not Commercially Practical

Daimler's patent contains a symptom of doubt as to the practicability of the low-pressure cylinder in that the patent sets forth that the two high-pressure cylinders can be used without the low pressure one, in which case their products of combustion are discharged direct into the atmosphere. This form of motor showed an increase of 15 per cent in efficiency but never came into successful use due to the added weight and the complications it required.

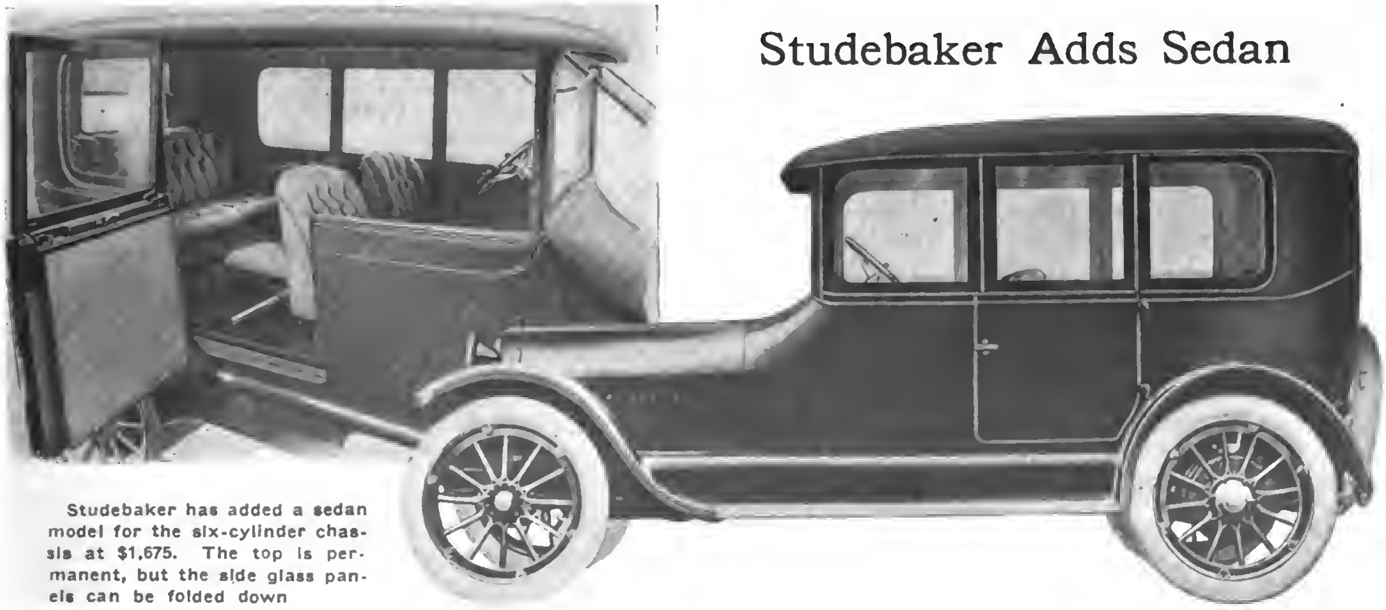
Selden Enters the Field

In America at this same time matters were developing that later were of great moment in the automobile industry. It was in May, 1879, that George B. Selden filed his application on his patent relating to an explosion engine and also an automobile which later brought about the celebrated Selden suit which was defeated by Henry Ford and others five years ago. It was the activity of Otto, Clerk, Gilles, Holton, Brayton and others that brought the importance of the explosion engine to the attention of Selden, who was a patent attorney. Selden's engine was built on the Brayton air-tank design and not on the Otto four-cycle, or the Clerk two-cycle principle.

Engine of the Brayton Type

With his brother, A. R. Selden, he had discussed horseless carriages while visiting the Centennial Exposition in 1876 at Philadelphia, at which place he saw the Brayton engine and talked with Brayton. In the latter part of 1877, he did some work on a small brass model engine and in the spring of 1878, got out drawings and had a crankshaft forged for his three-cylinder engine of the Brayton type. He seems to have recognized the necessity of light weight and compact arrangement and as compared with Brayton engines built for stationary or boat use, his conception was superior, even though in many respects faulty. He made no provision for waterjackets but claimed to cool by introducing water into the crankcase, a method that when accidentally tried by modern gas engine users has customarily caused trouble. He applied for his patent in May, 1879, and slowly fought it through the Patent Office, taking frequently the permitted two years between actions which was his legal right. When the case was finally ready for issue, he prepared a smooth copy for the office which contained some changes not properly belonging therein but which apparently passed unnoticed by the office. His patent was issued in November, 1895, after the industry had developed to a practical point without his aid, as demonstrated by the Chicago contest of that month.

Studebaker Adds Sedan



Studebaker has added a sedan model for the six-cylinder chassis at $1,675. The top is permanent, but the side glass panels can be folded down

The Rostrum

Suggests Screening Air Intake

EDITOR THE AUTOMOBILE:—I take the liberty of writing you on a subject which seems to have escaped the majority of manufacturers of carbureters. I will ask you a question and give you one answer. Although I know there may be several answers to the question, I think mine deserves consideration.

Where do scored cylinders originate?

Answer—Through the air intake of the carbureter through which is drawn all the dust and dirt which comes within the radius of the suction, and I think you will agree with me that a considerable amount of dust and dirt accumulates around the engine. I think it would be a good thing if a proper screen were provided on the air intake, to prevent the dirt from being drawn into the cylinders and made easily accessible for cleaning purposes.

Montreal, Que. J. B.

Inadvisable to Enlarge Valves

Editor THE AUTOMOBILE:—I wish to increase my compression to 100 lb. How much can I plane off my cylinder head and how much will I have to raise my pistons?

2—How much can I enlarge my valves without coming too close to the waterjacket?

Chicago, Ill. W. S.

—It is impossible to tell you how much to reduce the volume of your combustion chamber to reach 100 lb. compression without knowing what the original volume is or how much the bore of the cylinder is. The method of procedure, however, which you can follow to work out the problem for yourself is as follows: Multiply the compression pressure by the volume of your present combustion chamber and divide it by 100 to secure the total volume of the new combustion chamber.

For example: If your present compression is 70 lb. and the volume of the combustion chamber is 20 cu. in. to have a compression of 100 lb. the volume of the combustion space would have to be $\frac{70 \times 20}{100}$ or 14 cu. in.

2—It is inadvisable to enlarge them at all.

Timing Pope-Hartford for Speed

Editor THE AUTOMOBILE:—We have a model T 1909 Pope-Hartford motor which we have rebuilt. The cylinders have been rebored from 4 5/16 to 4⅝ and it has 5⅛ stroke with racing pistons. It is equipped with a Bosch magneto. Will you please tell us how to time the cams and ignition so as to get the most speed and power?

Oneonta, N. Y. ONEONTA GARAGE CO.

—To work out a racing timing is a matter of experiment as the timing not only depends on the general design of the engine itself but also on the conditions that obtain in the manifolds. It is assumed from your questions that it is your idea to have this engine operating at high speeds and in that case an early exhaust opening and a late intake closure coupled with high compression will probably be the scheme under which you will work. It might be well to start with an intake opening at top center and intake closure at about 20 deg. past lower center. Exhaust opening 45 deg. before bottom center and closing 10 deg. after top center. The ignition should be carried as far in advance as possible without having a knock. This is done by advancing the magneto one tooth on the timing gears so that your advance is carried forward as far as possible.

Diagrams of Electric Systems

Editor THE AUTOMOBILE:—Kindly publish diagrams of the North East systems for former Metz and Marmon four and six cars?

2—Are the Jesco, Adlake, and Rushmore systems being made this year?

3—Would like to see the circuit diagrams of the Owen Magnetic car and its transmission.

4—How should roller clutches be lubricated? Is any one way of lubrication better than another?

5—How many elements enter into the function of spark advance? Lag of current, combustion, etc.? Theoretically, is the position of piston exactly the same at low speeds as at high speeds after allowing for lag of current, process of combustion, etc., and is this position at or near top of center?

Weymouth, Mass. H. R. B.

—The diagrams you request of the North East systems for Metz and Marmon cars are shown in Fig. 1.

2—Yes.

3—The circuits of the Owen Magnetic car are as follows:

A—Charging position means, starting and lighting battery being charged by generator through engine running. Car stationary.

B—Starting, generator connected in series with starting and lighting battery, generator acting as a motor.

C—Neutral, car stationary with engine running. When car is coasting motor becomes an electric brake controlling car to maximum 15 m.p.h.

D—First speed. Generator and motor in series resistance shunt across generator field.

E—Second speed. Generator and motor in series. No resistance.

F—Third, fourth and fifth speed. Generator and motor in series resistance shunted across motor field.

G—Sixth speed. Generator short circuited on itself. Motor independent from generator circuits acts as a generator for charging battery.

4—The clutch must be lubricated once every week with high grade engine oil injected in the oil openings.

5—Yes. The nearer explosion occurs to top dead center position of the piston the better. It is only to allow for the relative lag that spark is advanced at higher speed.

Fuel Leak Cuts Lubricant

Editor THE AUTOMOBILE:—The discovery of a new condition in the oiling system of gasoline motors we believe is of sufficient importance to warn all users of automobiles to-day, to be on the lookout for this trouble. The existence of this condition, after careful study, has been determined to be caused by condensation of a part of the gasoline which will not explode when the motor is cold or immediately after having been started on a cold morning.

The present low gasoline contains a large amount of kerosene and less volatile oils. This passing into the motor while it is cold, passes the rings and the pistons and apparently condenses and mixes with the oil in the crankcase. Such a condition will naturally thin down the oil until it lacks all of its lubricating qualities, and if this condition is allowed to continue it will eventually ruin the motor. This is particularly noticeable in motors where the drivers are in the habit of using them for a few miles at a time, and is especially noticed in small towns in the country where it is a short distance to and from the various places of business, when the motor never gets hot enough to assist in evaporating the heavy gasoline procurable at the present time.

Oil Becomes Very Thin

The first symptom of this condition is the apparent economy of oil at the oil level, which remains at a standstill or shows a tendency to rise. In some cases it is necessary to drain the oil from time to time to keep the oil level from causing the motor to smoke. It will be found in draining this oil that it is very thin and in some places equivalent to kerosene.

Careful attention and the frequent draining of oil anywhere from 500 to 1000 miles, and replacing with fresh oil during cold weather is the only thing that will guarantee the user against an injured motor from this cause. The writer has been in the automobile business for the past fourteen years and has never known this condition to exist such as it is now, and believes that it is a public benefit to warn all motorists to be on the lookout for this trouble, which is so easily avoided.

Numerous complaints of fouled motors, even though they have been used but a few hundred miles, have come to my attention, motors which before this condition had arrived had never given any trouble in the accumulation of excessive carbon in the combustion chamber, and we have found this condition to exist in motors of practically every type.

Changing Oil in Vain

The average garage man and the average motorist immediately blames the oil. Then he tries another brand of oil and it does the same, and he shifts again and divides the responsibility between the oil and the car until the cold weather is over and things right themselves.

The reason for this I shall not pretend to determine. Possibly in the mad effort to make three gallons grow where before there was but one, may be the answer. Apparently the lower distillates are so broken up that it all passes for gasoline long enough to be sold as such; but in the engine on a cold morning, you may just as well try burning a mixture of gasoline and kerosene.

Anyway, watch your oil. Drain a half pint of oil out of the bottom of your crankcase and see for yourself.

ANDREW AUBLE, Pres. Akron Auto Garage Co.
Akron, Ohio.

Correct Timing of Chandler

Editor THE AUTOMOBILE:—What is the timing of a Chandler sixteen?

2—What are the meanings of the markings on the flywheel of the Chandler sixteen?

3—What is the price of the Landis shock absorber as illustrated in THE AUTOMOBILE, Chicago show number, and also the address of the manufacturer?

4—What is meant by a cam which is variable at different speeds? What is the profile of such a one like?

Malone, N. Y. F. J. D.

—The firing order of the Chandler motor is 1-5-3-6-2-4. The inlet valves are 2-4-6-8-10-12; the exhaust valves are 1-3-5-7-9-11. The exhaust valve closes 1⅝ in. past dead

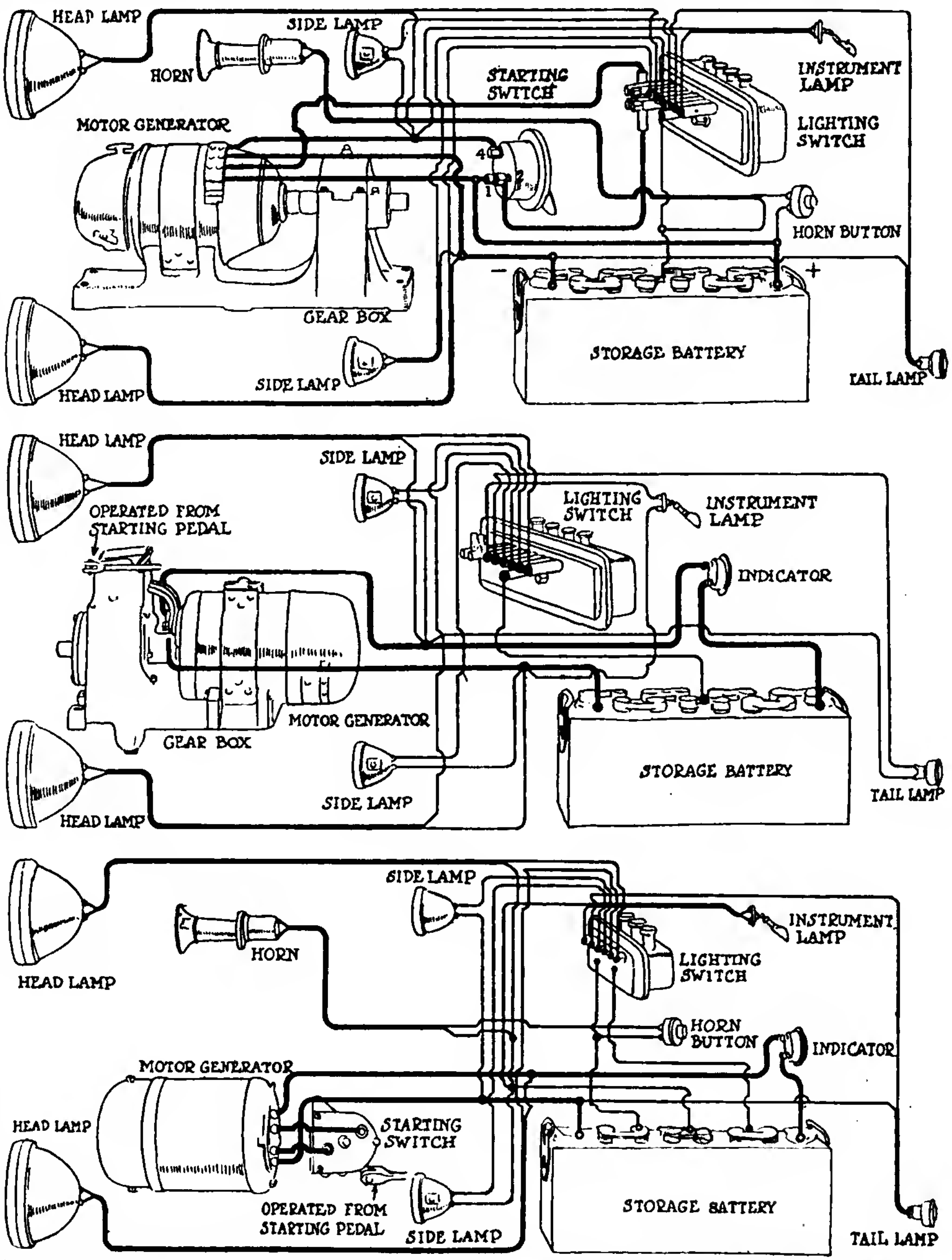


Fig. 1—Wiring diagrams of the North East electric systems used on the Metz and Marmon cars. Top—Old four-cylinder Marmon. Center—Former Marmon six. Bottom—1914 Metz

center on the suction stroke. The inlet valve opens 1⅞ in. past dead center on the suction stroke.

2—The flywheel is marked, as is the top of the flywheel housing at the filler plug. When the marks on the flywheel and case are opposite one another, No. 1 piston is at top center. With the valves closed the clearance between the valve plungers and valve stems should be 0.004 in. and for best results should be set when motor is hot.

3—The price of the Landis shock absorber is $30 a pair, or $60 for a set of four. This shock absorber is manufactured by the Landis Engineering & Mfg. Co., Waynesboro, Pa.

4—Presumably you mean a cam which can be varied by manual shifting. Such a cam has one profile at one end and another at the other, being made perhaps three or four times as wide as the roller which it operates. The profile changes slowly so that by sliding the camshaft the different portions of the cam can be brought underneath the roller and so different valve timings are obtained.

Lost Motion in Steering Gear

Editor THE AUTOMOBILE:—The steering wheel of my Chevrolet Royal Mail has about 3 in. of lost motion, and there is no reason for this, as the car is a new machine and has been run only about 2000 miles.

2—Is it practical to mix gasoline and kerosene, and burn same in a Chevrolet?

3—What are the advantages and what proportion will give the best results?

Back Bay, Va. J. L. G.

—The best way to take up the lost motion would be to remove the Pitman arm, revolve the gears one-half way around to a new position, as there are no provisions made on this steering gear for an eccentric adjustment, as is found on some types of steering gears. Again this lost motion might be helped some by adjusting the adjusting nut, which is found at the upper end of the steering gear housing to its furthest position in, without binding. This adjustment is for the up and down movement of the steering column, which would have a great deal to do with the lost motion of the wheel.

2—We would not advise mixing kerosene and gasoline, as the carbureter furnished is a strictly gasoline type, and with the low grade of gasoline now being produced with a mixture of kerosene would certainly cause a lot of carbon deposits. This is a trouble that we all like to eliminate, if possible, as it takes a motor expert to disassemble the overhead valve construction and remove the head in order to clean out this carbon which has deposited.

3—These proportions can only be settled by experiment.

Cleaning Fluid for Motor Parts

Editor THE AUTOMOBILE:—Please give me information regarding the potash kettle for cleaning motor parts on dismantling a motor for machine shop use and the proper mixture for use in the kettle. I am told sal-soda will do the same thing. I tried it without much success and it turned aluminum black. There is a demand for a cleaning mixture other than gasoline.

Harvey, N. D. R. M.

—The cleaning fluid which you desire will naturally depend upon the metal to be cleaned. Since you mention aluminum, it is probable that the information wanted covers aluminum cleaning, and a formula for making this fluid is simply a solution of 30 grams of borax in 1 liter of water containing a few drops of ammonia water. To remove discoloration use a solution of one heaping teaspoonful of oxalic acid crystals to one gallon of warm water. Leave the part standing in this solution over night and then clean it thoroughly with water.

A strong soda solution for cleaning grease from machinery and metal parts can be made by taking 10 to 15 grams of caustic soda or 100 grams of soda for each leader of water. This solution should be applied boiling hot and the parts, if not too large, should be dipped into the solution. All that has to be done after this is simply rinse and dry the parts thoroughly.

Hydrometer vs. Voltmeter

Editor THE AUTOMOBILE:—I would like to have you answer through your columns whether it is more accurate to use a hydrometer syringe or a voltmeter to get the results of the life in a storage battery. In the garage where I store and in a number of battery service stations I find that the majority use the hydrometer for testing and will say that the battery is all right. I have been troubled with my starter and the service men say that my battery is at fault, so I have taken the battery to a number of stations but they can find nothing the matter with it. An electrical man I was talking to told me to put on a voltmeter when I put the starter on. I tried this and found that the voltage dropped to about 4½ and stayed there for a few minutes and then gradually came back to the 6½ volts. Can you tell me the reason for this and also to satisfy some of my friends' curiosity as to which is the most reliable for testing the real juice in a storage battery? J. C. W.

Detroit, Mich.

—The hydrometer will tell you one thing and the voltmeter another in examining the condition of a battery. The hydrometer tells you the specific gravity of the electrolyte which must be within certain limits in order for the battery to function properly. If a hydrometer shows between 1.275 and 1.3 when the battery is fully charged the electrolyte is in proper condition. However, it is quite possible for the electrolyte to be in good condition and the battery to show a low voltage on the meter because the plates may be broken down or some other internal trouble not giving the full voltage.

Regarding the particular trouble you mention in which you applied a voltmeter and found that the voltage went to 4½ and stayed there a few minutes and then gradually came back to 6½, it looks as if the trouble were more in the voltmeter than in the battery because the potential would not increase by putting a voltmeter across the terminals. A sticking voltmeter hand was probably the cause of this apparent contradiction.

Pressure Required to Close Brakes

Editor THE AUTOMOBILE:—What is the approximate pull in pounds necessary to operate the service and emergency brakes, direct without any levers, on a medium weight touring car? Also the difference in the perimeter of the two brakes when expanded and contracted and vice versa, or otherwise the brake displacement in fully applying the brakes.

Springfield, Mass. C. M. E.

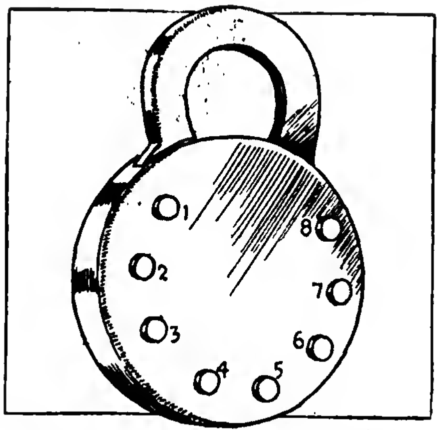
—This varies through such a range that it is impossible to give any definite figures. It is also difficult to determine whether you mean that the brake is locked on the wheel or whether just applied gently. It may be stated, however, that an application pressure of 20 lb. should firmly close the brakes.

The difference in perimeter of the two brakes when expanded and contracted and vice versa is simply the difference between the internal and external diameters of the brake drum. Since you do not mention the size drum you refer to it is again impossible to give you a definite figure, but taking a standard 14-in. drum external diameter having a thickness of ¼ in., the difference in diameter between the inner and outer circle would be ½ in. and the difference in circumference would be one-half of 3.1416 or 1.57 in.

ACCESSORIES

No-Key Auto Lock

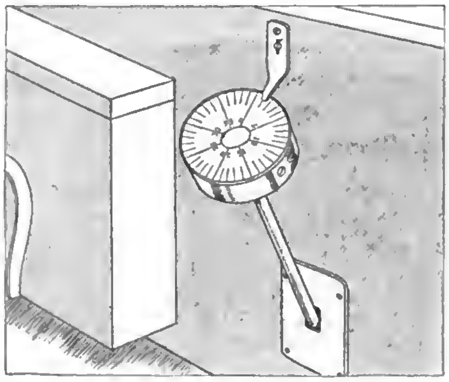
As its name implies, this lock does not require the use of a key, being constructed on the combination principle so that a gentle pressure on certain of the eight buttons shown in the illustration as called for by the combination of each particular lock opens the hasp. There are 40,000 combinations possible so that no two are alike. With this lock there is no danger of a thief picking it open, no trouble or expense due to the loss or duplication of keys, no trouble in opening it in the dark. The combination may be changed as often as desired and there is no danger of the lock getting out of order. Some of the buttons push down and some up and the lock may easily be operated with one hand. It is made of brass and bronze and is consequently very durable. There is no iron or steel about the lock to rust and impair its operation. The locks are useful for protecting garages, cars, toolboxes, spare tires, and all sorts of general purposes. Packed in an individual carton, one lock weighs 5¼ oz. Price, $1.50—Manufacturer, American Keyless Lock Co., Chicago, Ill.; Kapp Specialty Sales Co., New York City, distributor.



No-Key Lock for automobile use. It is a combination type using buttons

Schoener Carbureter Adjuster

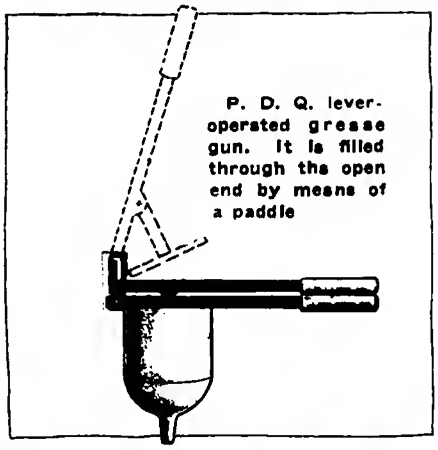
This adjustment for the Ford carbureter is connected by a rod to a dial on the dashboard. The dial is graduated and the graduations are numbered so that when the mixture is changed it can always be brought back to the original position. The device sells for 50 cents.—Schoener Mfg. Co., St. Cloud, Minn.



Schoener carbureter adjuster for Fords

P. D. Q. Grease Gun

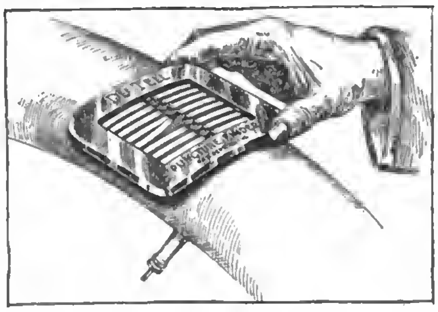
The barrel of this gun is of large diameter and has a conical end and tapered nozzle. The plunger is hinged to a handle which is jointed to swing on a link attached to the top of the gun, and a second handle is attached to the barrel. The gun is filled through the open end by means of a paddle, and the process of expelling the grease is like squeezing a lemon. The gun is quickly loaded and quickly emptied; the large open barrel makes it a simple matter to get in a full charge without smearing grease on the outside. Price, $2.50.—Star Brass Works Co., Kansas City, Mo.



P. D. Q. lever-operated grease gun. It is filled through the open end by means of a paddle

Du-Tell Puncture Finder

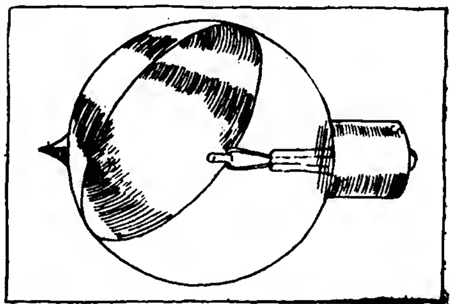
This is a light metal casing, not much larger than a good-sized cigarette-case, with a transparent window on one side and open on the other, contains a number of strips of very thin cork, arranged in two rows; the strips are free to move to a limited extent. The device is used by passing the open side over the punctured tube, close to it. When the escaping air impinges on the cork strips they are made to move, instantly locating the hole. The cork will move under a stream of air that cannot be felt by the wet hand. The device sells for 50 cents.—J. W. Anderson, New York City.



Du-Tell puncture locating device

Glargon Electric Bulb

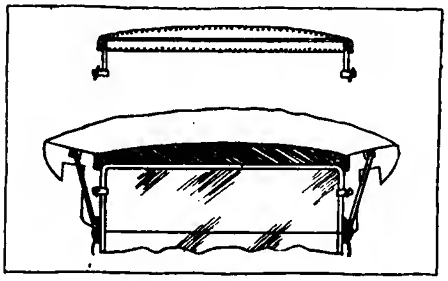
The feature of this bulb is that about one-half of the bulb surface is silvered so that the rays are reflected and thus prevent glare; no rays leave the headlight at an angle above the horizontal.—Greenwood Mfg. Co., East Templeton, Mass.



Glargon non-blinding lam

Limousette for Fords

This attachment is placed on the windshield for the purpose of closing the space between it and the top, thus excluding cold and rain. It lists at $1.50—Lion Buggy Co., Cincinnati, Ohio.



Limousette attachment for Fords

Re-Ac Auto Heater

A hot air car heater has recently been put on the market under the name of the Re-Ac. It is a simple device consisting of a stove for the exhaust pipe, a register permitting a flow of hot air into the car, a hose connecting the tube and a valve for regulating the amount of heat flow.

The hot air stove is readily clamped in position on the exhaust pipe and the register is mounted flush with the floorboards. The valve can be pushed by the toe to any degree of opening desired. The device sells for $10 complete.—The Re-Ac Co., Newcastle, Pa.

Ever-Ready Polish

The maker states that this metal polish is suitable for all finished metal surfaces, hard or soft, that it leaves no sediment, is non-greasy and requires little rubbing. It is put up in cans in the form of a cream.

The Ever-Ready carbon remover, another product, is put up in cans, each can containing sufficient liquid to decarbonize three average motors. The makers point to the fact that it is put up in sheet-iron cans, tinned, as proof of its harmlessness to iron. The polish sells for 35 cents per can and the carbon remover for $2.50 per can.—Every-Ready Mfg. Co., St. Louis, Mo.

Buckbee Self-Adjusting Bearing

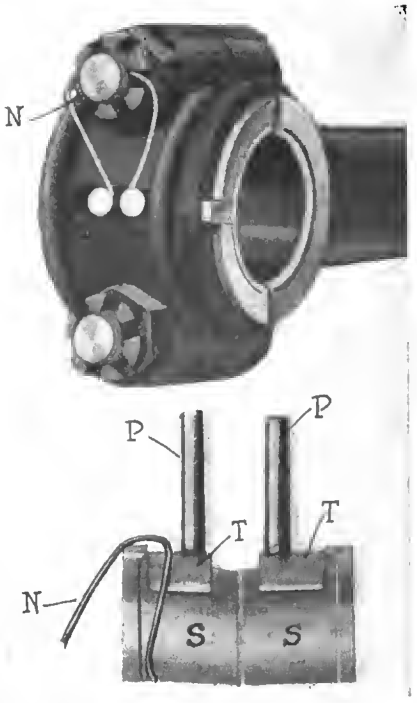
Means for automatically taking up wear are provided in the Buckbee Self-Adjusting bearing for crankshafts and connecting-rod big ends. It is particularly adapted to the connecting-rods, and utilizes the principle of contracting on the shaft as wear occurs.

One of the illustrations shows a connecting-rod fitted with this new type of plain bearing, while the other gives the details of how the outer surface of the cap bushing is inclined and fitted with wedge-shaped segments, the combination acting to automatically set up the bushing to compensate for wear.

The result is accomplished by forming the bushing of two halves, each half being slightly less than one-half the diameter of the shaft, so that they are spaced slightly apart when in place on the shaft. This is to allow for the automatic take-up as the wear occurs.

The part of the bushing carried by the cap member is provided with two cone-shaped surfaces disposed at opposite angles, as shown at *S*. Fitting these surfaces and also the inner surface of the cap member are two similar segments *T* wedge-shaped in cross section and each fitted with a pin *P*. These pins extend through a slot in the cap. A spring *N* attached in some way to the rod end is so looped that one end engages each pin and thus tends to force the wedges up the inclined faces of the bushing. This movement of the wedges forces the cap part of the bushing toward the other part and thus takes up any wear.

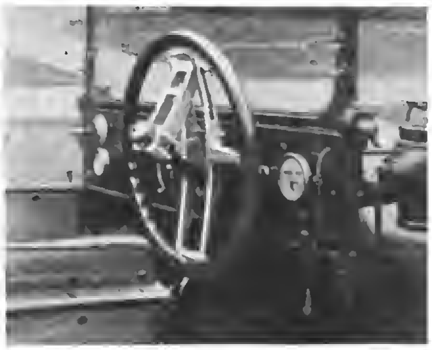
At each end the bushings are flanged to prevent any longitudinal movement in the box, and rotation is prevented by a pin in the usual way. This special type of bearing can obviously be attached to any engine having plain bearings, with very little trouble. Practically the only mechanical change is the cutting of a slot in the bearing cap.—Self-Adjusting Bearing Co., Detroit, Mich.



Buckbee self-adjusting bearing. Above—Fitted to a rod end. Below—Cap bushing

Clear-Room Steering Wheel

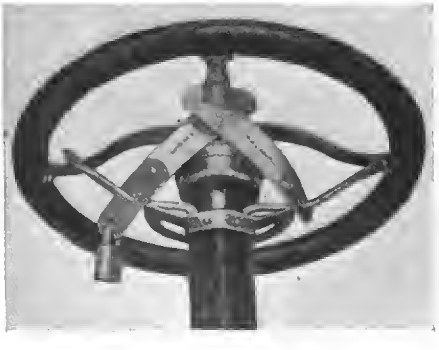
The driver has plenty of room to get in and out of his seat when this wheel is folded; a lock is provided which holds the wheel in either position. Model A is designed for cars with the spark and throttle levers under the steering wheel, and Model B is for cars with the levers over the wheel. Price, Model A, for Fords, 16 in., plain rim, ebony finish, $5.75; 17 in., for Fords, corrugated rim, walnut finish, $6; 17-in., standard type, corrugated rim, walnut finish, $6.50. Model B, corrugated rim, walnut finish, 17 in., $9; 18 in., corrugated rim, walnut finish, $9.50.—Vincent Clear-Room Steering Wheel Co., Detroit, Mich.



Clear-Room folding steering wheel

Bulldog Lever Lock

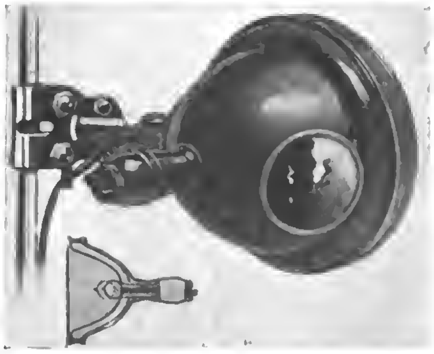
This lock for Fords consists of a set of jointed steel arms which hold the steering wheel, the throttle and the spark lever rigidly in one position when locked. A jaw is formed which grips one spoke of the wheel, while the arms extend to the two levers and are held by a padlock which is supplied with the device. Price, $1.—Koehler Mfg. Co., St. Louis, Mo.



Koehler's Bulldog lock for Fords

Old Sol Spotlight

This light is for reading road signs at night, etc., and is clamped to the side of the windshield within easy reach of the driver. It is supported on a universal joint which allows it to move in any direction. The universal is constructed so that it will not rattle. There is an on and off control on the end of the handle which is at the back of the lamp, so that the light may be used with greatest ease. A focusing device is located just forward of the control switch, where it is ready for instant manipulation. There is a mirror on the back for daytime use which shows what is behind. All models have silver-plated reflectors, 6-volt and 15-c.p. bulbs. The lamps are enameled black. Price, $4.50 for 6 in., $6 for 7 in., and $7 for same light, including pilot light. Tungsten bulbs, 25 cents extra.—Buckeye Motor & Cycle Co., Akron, Ohio.



Old Sol spotlight with mirror

Auto-Lac Top Dressing

This is a black liquid for top dressing and lining dye. It is applicable to all kinds of top fabric and will restore the silk luster and dull original mohair finish to the lining. The preparation sells for $4.50 per gallon can and $1.25 per quart can.—Auto Top Co., Portland, Ore.

Smooth-on Radiator Cement

Leaky radiators are quickly repaired by this cement. The contents of the can will mend up a radiator having a capacity of 4 gal. of water. The can of cement is mixed with sufficient water to form a thin paste and is poured into the radiator while the motor is running; the motor must run until the water is well heated before putting in the cement. The motor is allowed to run until the leak stops, when the water is drained out and the radiator allowed to stand for a short time before refilling with fresh water. If the leak is a bad one the cement is kept in the radiator for a day before draining it off. Price per can, 50 cents.—Smooth-on Mfg. Co., Jersey City, N. J.

THE AUTOMOBILE

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Used Car Shows

THE thin edge of the wedge is just being entered in the solution of the used-car situation. A year ago the publication of the used-car market reports quoting actual sale prices of used cars started a movement that has gained much headway since then, the Chicago dealers fathering the movement. This spring another wedge is being entered in the used-car problem, namely, staging spring shows for used cars. One or two of these used-car shows have already been held, and now Chicago is contemplating holding one in May. The working out of these shows will be watched with particular interest, and it is hoped that by this means many of the used cars that have been reposing on upper floor storage spaces and in storage warehouses will be brought to the light of day again and perhaps pushed into the outer world. Much money has been tied up in used cars that have remained stagnant in some cases for many months, and often for more than a year. There should be no better season than the present to properly present these used cars to the public. Heretofore the used car has been considered a millstone. It should not be so. The used-car phase of the business is as legitimate as the new-car one. Chicago and other associations are to be congratulated on bringing up-to-date merchandising atmosphere into the used-car field.

Thermal Efficiency

FOR years past engineers of the older school, accustomed to the use of large engines where the work obtained from every pound of fuel has to be checked and rechecked, have regarded the automobile with some surprise. From the viewpoint of the engine builder who has to show so many horsepower hours per ton of fuel or lose his business, the automobile appears an utterly uncommercial machine.

The reason for this apparent disregard for the fuel efficiency of self-propelled vehicles has been that it has taken years of development to combine the requisite power with the desirable weight. Fuel cost has been so small a proportion of the total maintenance that weight and power became considerations of far greater importance. We have been wasteful of fuel in order to obtain other advantages gained by a rather prodigal expenditure of gasoline.

The use of a cheaper fuel has been an ideal; and it is a curiously happy coincidence that engines designed to give a better thermal efficiency with gasoline are, in general, much more adaptable to the use of kerosene, so in developing a kerosene engine it is more than probable that an engine of better efficiency will be discovered.

Thinking Electrically

IT is essential to-day to think electrically. This is particularly true with garagemen, with those operating machine shops and all other forms of repair depots where diseased electric starting, lighting and ignition systems are repaired. A few years ago, in diagnosing troubles in the automobile, it was primarily essential to think mechanically—that is, to visualize the mechanics of the machine. To-day we have to go a step further and, in addition to visualizing the mechanical systems of the car, also visualize the electrical systems. This latter stage means ability to think electrically.

Thinking electrically presupposes a clear conception of the elementary or first principles of electricity. It is impossible to think electrically without such knowledge. You cannot diagnose electrical troubles unless you know the alphabet of electricity. Perhaps one of the first letters in the electrical alphabet is the circle, the circuit as termed in electrical parlance. Electrical thinking must operate in the circle, starting at a point and coming back to that point. The physical path traveled may not be circular; it may be rectangular—in fact, everything except circular; yet the circular concept is there—you start at a point and you must come back to that point. There must be a complete physical path. That path cannot be broken in a single place without trouble. To detect the trouble you must follow the circular concept. It is the first stage in thinking electrically.

THE AUTOMOBILE starts this week a series on electric units in the car. This series includes an analysis of such systems. It takes up the ills and diseases that beset and tells how they can be corrected.

Automobile Manufacturers Form Co. To Produce Gasoline at Lower Prices

United Motor Fuel Corp. of Manhattan Will Also Supply Information Regarding Cost of Production—Will Safeguard Stock Against Anyone Securing Control

NEW YORK CITY, April 5—The most important result of the increasing agitation against excessive gasoline prices is the organization of automobile manufacturers into a company for the production of gasoline and also to supply complete cost information on gasoline production with a view to protecting the makers and users of automobiles, motor trucks and other users of the fuel. It is the United Motor Fuel Corp. of Manhattan which was formally incorporated at Albany yesterday with $25,000 capital. The company will distribute its stock throughout the whole country in such a way that it cannot possibly pass into the control of any competitive interest. The capital will eventually be increased from $5,000,000 to $10,000,000.

The directors of the United Motor Fuel Corp. of Manhattan are: S. A. Miles, manager of the New York and Chicago Automobile Shows; J. A. Royall, for many years identified with the production of gasoline; A. L. Prindle, C. H. Mapledoram, a lawyer with offices at 100 Broadway; E. L. Gluck, T. R. V. Fiske, E. W. Stettit, C. H. Adams, C. J. Elias, W. Sterin, A. T. Swords, W. Little, New York; H. Fobes, Ridgewood, N. J.; H. Carter, Plainfield, N. J., and J. C. Barr of Brooklyn.

Offers of Land, etc.

The new company will prospect, produce, act as jobber in crude oil, build refineries and develop a large selling organization. Alfred Reeves, general manager of the National Automobile Chamber of Commerce, Inc., who is in close touch with the promoters, states that they have received numerous offers of oil land, refineries, equipment, etc.

Before any active steps were taken exhaustive reports of the conditions surrounding the oil business were quietly prepared, with the result that the manufacturers evinced their willingness to test the theories advanced by the oil companies concerning the reasons for the high prices now prevailing and the further advances so frequently threatened. It was during the lengthy conferences held within the past few days between representative automobile manufacturers, officers of the N. A. C. C. and men of experience in the oil industry that the plan to form an organization which would produce results in the way of reducing the price of gasoline to the automobile and truck user was decided upon.

The purpose of the new company will be to produce gasoline, kerosene, lubricating oil and other products of petroleum, not necessarily for the purpose of injuring any business at present in operation but to demonstrate that gasoline can be profitably produced and sold at a price lower than that now prevailing.

"This," said Mr. Royall, "we regard as the only real remedy for existing conditions. We shall, at the very least, demonstrate that no further increase is necessary, and so protect the business of the automobile makers and their hundreds of millions of invested capital.

"From 1859, when Drake discovered oil in Pennsylvania, down to the present day, the oil business has been one of constant agitation and concern to people.

"Yet in all these years, with Government, State and other investigations actively concerned in providing a remedy to deal with it, none has been found.

Two Possible Remedies

"So the only remedy to apply is actual Government control, which is neither feasible nor desirable at this time, or the formation of a company owned, managed and operated in the interests of the whole people.

"This corporation, when it is finally launched, will include all interests outside of the oil interests; and in this latter designation I include the so-called 'competitive oil interests,' from which no relief can be expected. They are all founded upon the same selfish interest, and maintain prices rather than provide real competition to the business.

Other Industries Included

"This company," continued Mr. Royall, "will have upon its board of directors a large representation of the automobile and other allied industries, which, despite their hundreds of millions of invested capital, are now wholly without representation in business so vital to their present and future welfare. In addition to its board and managing directors it has been suggested that the company have an advisory board of at least 250 non-resident advisors, elected pro rata according to the population of the various States, who will act without compensation. In applying the remedy it is not the purpose to disturb the great oil industry by resorting to destructive methods of competition, nor to single it out for attack by any other method, but only to create a highly organized competitive company, operating for profit, with the highest ideals of business integrity in all of its dealings with the people and, further, to open the book of knowledge concerning the oil business."

Life Insurance for Makers

Mr. Miles, who has been in consultation with manufacturers and others, stated that in connecting himself with the new company he felt assured of their hearty co-operation. Declaring that the new company will really attempt to provide life insurance for the builders of automobiles, motor trucks, etc., Mr. Miles pointed to the fact that the consumers' cost is now at the rate of $157,248,000 per year more than in August, 1915. Supporting this contention, Mr. Miles pointed out that the production of gasoline last year, as reported by the Department of the Interior, was 41,600,000 barrels of 42 gal. each, or 1,747,200,000 gal. The price has gone up in some places 100 per cent and in few places less than 40 per cent. In twenty of the principal cities of the United States the average price of gasoline in August of last year was 12.46 cents per gallon. The latest reports indicate that the price in the same twenty cities is now 21.56. Calling the increase 9 cents per gallon, the above figure of $157,248,000 increase is obtained.

Perlman Buys Jackson Rim Co.—To Boost Output

NEW YORK CITY, April 5—The Perlman Rim Corp. has purchased the entire capital stock of the Jackson Rim Co., Jackson, Mich., and the transfer of the property will take place on April 10, after which date it will be called the Perlman Rim Corp. Jackson plant. The Perlman corporation will erect additional factory buildings and will increase the equipment to such an extent that within three months the plant will be producing 4000 sets of demountable rims per day, or at the rate of over 1,000,000 sets a year.

The Perlman organization is also concluding contracts with other rim manufacturers for quantities of rims which will be ample to meet the requirements of the car manufacturers, so that there should be no delay in production because of lack of demountable rims. Rims are also being made at the Mott Wheel Works, Utica, N. Y., the Perlman corporation controlling the rim plant of the Mott works.

Contract has been closed by the Perlman interests with the Willys-Overland Co., the largest user of demountable rims in the world, for its requirements during the remainder of the season, and contracts with other car manufacturers are being arranged on a satisfactory basis.

Used Car Show for Chicago

Trade Assn. To Hold First Exhibition in Coliseum May 8-15

NEW YORK CITY, April 5—The Chicago Automobile Trade Assn. has gone one step farther in solving the used car situation. On May 8 to 15, it will hold a used car show in the Coliseum in Chicago, sanction for which has just been given by the National Automobile Chamber of Commerce. This is the first used car show that has been staged on a large scale in this country.

E. G. Westlake, Henry Paulman and Edwin Grier compose the show committee. Mr. Westlake, who has been in New York, to-day has requested sanction from the N. A. C. C. and has returned to Chicago, where he is going ahead with the plans of the show.

About eighty dealers will be represented at the exhibition, which will be purely a Chicago affair. These will represent about 95 per cent of the dealers in that territory. According to plans no trucks, accessories or 1916 cars will be on exhibition. All cars that are sold may be taken out at night and other cars put in their places.

A public drawing for space will take place in the near future and the dealers will be charged 25 cents a square foot for space. Each dealer is expected to take 800 sq. ft. of space, thus bringing the charge to $200. This amount, however, is expected to be made up in rebates.

Admission will be either 50 or 25 cents. The dealers will receive their tickets at half rates. The building will be decorated with flags, and will be opened from 10 a. m. to 10 p. m.

Freight Car Situation Improves But Shortage Continues

DETROIT, MICH., April 4—For the first time in several months, automobile traffic managers, railroad officials and others having something to do with the traffic matters in this city, reported a slight improvement in the freight car situation. Some say that this is due to better weather in the East, others claim that the publicity given to the matter of increasing demurrage rates from $1 to $2 has brought about quick action by many consignees and shippers in taking prompt delivery of shipments, thus releasing a large number of freight cars for further use. Still there are others who say that in New York, Boston, Philadelphia and other Eastern cities more actual activity has been shown during the past week in relieving the congested roads, than in many weeks.

Whatever the reasons for the better conditions are, the fact that several railroads have lifted existing embargoes is sufficient evidence that there has been a betterment.

During March, 75 per cent more freight cars entered and left Detroit than during the corresponding month in 1915. It is estimated that fully 40 per cent of all the carloads which left the city contained automobiles or automobile parts. Of the 75 per cent increase, more than 50 per cent is credited to the automobile industry.

Automobile manufacturers are reported to be offering high premiums for regular automobile freight cars.

28,600 Carloads of Automobiles Shipped During March

NEW YORK CITY, April 5—Shipments of automobiles during March, 1916, were the biggest for that month that the automobile industry has ever known, amounting to 28,600, as compared with 17,192 in March, 1915 and 23,809 in February, 1916, the best previous record. Six thousand of these carloads were made in box cars, by taking off the fenders and covering with tarpaulin.

The shortage of freight cars is reported just as bad as ever by the National Automobile Chamber of Commerce, which held its monthly meeting to-day. At this meeting the Chamber voted the indorsement of the action taken by the New York Automobile Dealers' Assn. against examining and licensing all owners of automobiles, believing this measure would fall short of accomplishing what its advocates claimed it would do.

The Chamber also voted that the automobile industry should co-operate with H. E. Coffin, Chairman of the Production and Standardization Committee of the Naval Consulting Board, and with the U. S. Government, on a plan for mobilization of trucks for preparedness.

After the monthly meeting of the directors, the members present met to consider reports of the proceedings in the matter of the United Motor Fuel Corp. The manufacturers gave tangible evidence of enthusiastic co-operation and pledged additional financial support to the preliminary work of the company.

58,329 Fords Built in March

DETROIT, MICH., April 4—In March, the Ford Motor Co., made 58,329 Ford cars. This is 14,450 more than in March, 1915, which was the record thus far for a month's output at the Ford. The total value of this year's March production was $24,176,535. The average daily output was 2243 cars. On March 25, the record for a day's output was established when 2768 cars were completed.

Three Makers Raise Car Prices

Anderson Electric, Chalmers and Pathfinder Announce Price Increases

NEW YORK CITY, April 3—Three more automobile makers announced price increases this week, making a total of eleven which have done so; three have made reductions.

The Chalmers Motor Car Co. has advanced the prices of the three models built on the new 6-30 chassis, effective April 15. The touring car and cabriolet will each be increased $40, making the former $1,090 and the latter $1,440; the price of the roadster will be raised $20 to $1,070. All of these figures are f.o.b. Detroit. The increased cost of materials is responsible for the higher prices.

The Pathfinder Co., Indianapolis, has raised the price of its twelve touring car, $275, effective April 15. The cloverleaf roadster is $425 higher.

The Anderson Electric Car Co., Detroit, is the first among the electric vehicle makers to announce an increase in the price of its cars. This increase will be $100 for each of the five models made by the company and will go into effect April 8.

A summary of the price changes since Jan. 1, 1916, follows:

INCREASE

Co.	New	Old
Chalmers 32B	$1,450	$1,350
35 roadster	1,070	1,050
35 touring	1,090	1,050
35 cabriolet	1,440	1,400
Anderson Electric cabriolet, 3-pass.	2,175	2,075
Brougham, 5-pass., front drive	2,350	2,250
Inclosed type, 4-pass	2,275	2,175
Brougham, 5-pass., rear drive	2,325	2,225
Brougham, 5-pass., double drive.	2,375	2,275
Dort	665	650
Studebaker:		
Roadster four	850	825
7-pass. four	875	845
Landau roadster four	1,150	1,145
3-pass. six	1,060	1,025
7-pass. six.	1,085	1,050
Saxon six	815	785
Marmon:		
5-pass.	2,900	2,700
7-pass.	2,950	2,750
3- and 4-pass	2,950	2,750
Buick six:		
Roadster	985	950
Touring	1,020	985
Empire four	935	895
Scripps-Booth four:		
Roadster	825	775
Stearns-Knight:		
L4 5-pass	1,445	1,395
Eight, touring	2,100	2,050
Pathfinder Twelve:		
Touring	2,750	2,475
Roadster	2,900	2,475
Joliet Tractor:		
Bates Steel Mule	895	865
Avery Tractors:		
5-10 hp.	365	295
12-14 hp.	1,195	1,125
18-36 hp.	1,775	1,680
25-50 hp.	2,190	2,145
40-80 hp.	2,625	2,475

DECREASE

Co.	New	Old
Maxwell (Canada):		
Touring	850	925
Roadster	830	900
Cole	1,595	1,785
Overland	695	750

Seven Divisions of S. A. E. Standards Committee Report Rapid Progress

Nomenclature, Miscellaneous, Engine and Transmission, Research Discuss Many Subjects—Many Important Topics Scheduled for General Meeting in Cleveland

NEW YORK, April 3—Last week was a busy one for the standardization work of the S. A. E., seven division meetings taking place in New York, Detroit and Buffalo. The main points in the work of the Electrical Equipment division which met on March 28 were dealt with in the last issue of THE AUTOMOBILE, and mention was also made of the proceedings of the nomenclature division. The truly immense task of finding names capable of universal application, for all the parts of a chassis is nearing conclusion, and it is practically certain that a complete dictionary of terms will be ready for presentation to the Society in June. There are now only quite a few portions to be completed, and it is judged that two more meetings of the division will be sufficient. Since active work was started only last summer the progress has been very rapid indeed, for the difficulty of the work is quite great.

Fuel-Economy Test Specification

At the meeting of the Research division held in Buffalo April 1, some eight hours were spent in working out a specification for testing automobiles for fuel economy. This division had previously prepared such a form and presented it to the last meeting of the Society in January, 1916, but it was then voted that the restrictions were insufficiently rigid and the matter was referred back for further consideration.

The idea of this work is to provide full instructions for testing and checking tests so that manufacturers or others can make fuel economy demonstrations on a standard basis, so that the results will be directly comparable. It was felt that the motorist desires to know as closely as possible what his own car may be expected to do rather than what can be done with a car of that make when economy is everything.

Must Be Speedway Test

Thus the division is going to recommend a very rigid test indeed. The specification will be discussed at the next general meeting of the whole standards committee which takes place on April 21, and will then come before the whole society on the summer trip in June. It is possible that the present recommendations may be modified, but there is little doubt that a test carried out along their lines would be conclusive.

After much discussion it was agreed that the test to have any standard value must be made upon a speedway, where conditions vary less than on any road. Next that it was not fair to allow just one speed to be chosen, as that would allow the carbureter to be adjusted for that particular speed. The following schedule is suggested:

M.p.h.	Distance	Time
10	10	1.00
15	10	0.40
20	10	0.30
25	10	0.24
30	10	0.20
40	10	0.15
50	10	0.12
Total	70	2.41

Each run is to be repeated in the opposite direction, that is, two runs at 10 m.p.h. will be made, then two at 15 m.p.h. and so on.

When all the gasoline consumption runs have been made there must be an acceleration test, the results of which must be entered on the test form together with the consumption figures; this being to guard against the use of phenomenally weak mixture.

There are many other restrictions. For instance, it is laid down that the cooling system must be fully operative, meaning that the radiator must be full, that the fan must be running and no blanketing of the radiator will be allowed. Once set, the mixture must not be altered throughout the whole test, including the test for acceleration.

Fuel Tank Arrangement

The division recommends a particular arrangement of fuel tanks for the test, consisting of two special tanks carried on the back of the windshield. Of these one is weighed before the start of each stage of the test and the other is used for intermediate running, an arrangement of two cocks, allowing the switch from one to another to be made instantly. It was decided to recommend weight measurement, as this is so much more simple and accurate than volume measurement. All tests are to be made with gravity feed on a definite head.

There are many other details, directed toward the prevention of evasion of the spirit of the test. The rules are so rigid, in fact, that no false results could be shown as long as the observation and checking were carried out properly.

Electric Units' Mounting

On March 30 the engine and transmission division met in Detroit and opened proceedings by appointing members to serve on a joint sub-committee with representatives already chosen by the electrical equipment division, to discuss the possibility of setting up standards for the mounting of ignition units, generators and starting motors. Next the subject of V-belt proportions was considered and it was reported by W. R. Strickland that, while British practice was already almost standard, there was no sort of agreement among American firms, either automobile manufacturers or belt makers. After a long discussion it was decided to take steps to have a number of tests made to decide the best angle for the pulley groove and the best proportions for belts. The chairman of the standards committee, A. Ludlow Clayden, undertook to try to arrange for a test to commence shortly. Practically every British user has adopted a 28-deg. angle for V-belting, but American types vary from 35 up to 60 deg.

W. T. Fishleigh, chairman of the division, then presented a number of blueprints of engine characteristics prepared, some by manufacturers and some by Professor Fishleigh himself in the laboratories of Michigan University. This division does not expect to make any report to the general meeting in Cleveland on April 21, but meets there April 22.

Curves for Groove Depth

March 31 was spent in active session by the miscellaneous division, which has a great number of subjects before it. The two principal items of the day were agreement upon a drive connection for speedometers, which will be submitted at Cleveland, and a further consideration of piston ring dimensions. The widths of rings for pistons of various diameters had already been decided, and there remained the determination of the proper depths for ring grooves in the piston.

The recorder to the Standards Committee had plotted some curves for groove depth in accordance with a suggested formula, and the latter was modified somewhat so as to increase the depth for small sizes while scarcely affecting that for the larger. On steering wheel sizes, the chairman, J. G. Utz, reported that the only part of a wheel suitable for standardization is the hub or center, where it is bored for attachment to the steering column. It is neither possible nor desirable to attempt to standardize the rim or spokes of the wheel. The following is the list of subjects now before the miscellaneous division in the order of importance:

1. Speedometer drive connections
2. Piston ring groove dimensions
3. Gearshift positions
4. Steering wheel hub dimensions
5. Taper sockets for fender supports
6. Heavy duty rod ends (wider than the existing standard)
7. Fillister, countersunk, round, French and carriage head bolts
8. Length of thread on S.A.E. standard bolts
9. A.S.M.E. pitches for small screws
10. Thread tolerance
11. Lock washer pressure.

Several other suggested subjects were

discussed and a recommendation to the Council passed that these other subjects be left alone for the present.

On April 4 the truck standards division met in New York with the purpose of clearing the slate of a number of small matters. A variety of subjects which had been suggested as suitable for the consideration of this division were discussed and most of them considered too unpromising for present treatment. The trailer hitch which seemed a good subject was found to be too complicated with patent devices. It was decided to postpone action on sections for solid tires in order to see how closely the standards for wheel diameter will be adhered to.

The most important matter now before the division, concerning which investigation is being made is that of control for trucks. European mobilization of motor trucks has shown that the military value of standardized control is incalculable. Gear lever positions ought always to correspond, brakes should have similar locations, throttle levers should always move in the same direction for opening, and so forth.

After several set-backs it now appears that there is hope for the establishment of a rating for solid and pneumatic tires which will help a truck manufacturer to choose the best size of the tire to give the lowest possible cost per mile. Some suggested tables were drawn up and are to be circulated among the tire makers for their consideration and amendment.

Ball Thrust Bearings

April 5 was taken by the ball and roller bearings division for a discussion on the standardization of thrust bearings, which follows naturally upon the work already done with the radial bearings. This work consists of a careful examination of practice and it is hoped to be able to complete it within a comparatively short space of time.

Wertman, of McGraw Tire, Promoted

NEW YORK CITY, April 1—C. E. Wertman, formerly assistant branch manager of the McGraw Tire & Rubber Co., this city, has been promoted to the position of resident manager, succeeding R. F. Hobron. E. E. Cowan has been appointed to the position of sales manager of the New York territory.

Tests on Sylphon Thermostat

WORCESTER, MASS., April 1—Tests made at the Worcester Polytechnic Institute on the Sylphon circulation regulator made by the Fulton Co., Knoxville, Tenn., and used on two prominent multi-cylinder cars have been completed. These tests from reports received would tend to show that the use of the regulator, which incorporates a thermostatic control of a by-pass valve, results in an increased fuel economy.

Variable Cutoff Is Suggested

Hoosier Engineers Discuss Higher Compression and Increased Thermal Efficiency

INDIANAPOLIS, IND., March 31—Increasing the compression and controlling power by variable intake cutoff were discussed as possible means of increasing the thermal efficiency of automobile engines at the meeting of the Indiana section of the Society of Automobile Engineers, held at the Claypool Hotel this evening. This discussion was the result of the statements made by C. E. Sargent, chief engineer Lyons-Atlas Co., in the paper of the evening, Increasing the Thermal Efficiency of Automobile Engines, which appeared in THE AUTOMOBILE for March 30. Mr. Sargent, who has had long experience with the Diesel type of high-compression engine and with gas engines of large sizes, is particularly fitted to discuss the advantages and disadvantages of higher compression than is used in motor car engines.

In his paper Mr. Sargent's remarks were based upon the fact that the average good internal combustion engine has been never much greater than 20 per cent efficient. This means that only one-fifth of the actual power possibilities in the fuel has been turned into useful work in this type of engine. His remarks were directed toward the development of engine design which would decrease some of the 80 per cent heat loss in friction, cooling water, radiation and exhaust. He offered for consideration the idea of varying the cutoff rather than the throttle to produce changes in engine speed and power. By this is meant changing the time at which the inlet valve closes instead of changing the amount of opening of the throttle.

Points Worth Study

It seemed to be the consensus of opinion of the engineers present that the points brought up by Mr. Sargent's paper were worth study from a theoretical standpoint, and embodied more a theory whose results might be worked toward rather than a practical basis for engine design at the present day. Among the engineers who took part in this phase of the discussion were, J. G. Vincent, Packard; Howard Marmon, Nordyke & Marmon; A. P. Brush, Brush Engineering Corp.; John O. Heinze, Heinze Electric Co.; Chester Ricker; Eugene Gruenewald, Moline; Mr. Grimes, National, and R. H. Combs, Prest-O-Lite.

Mr. Heinze stated that the engineers were aiming to maintain the same high compression and develop the same high efficiency of fuel economy at all speeds and at all power production. In other words the ideal is to permit flexibility and power without sacrificing thermal efficiency.

Mr. Sargent explained that the reason for closing the inlet valve late was in the attempt to get all possible fuel efficiency out of the motor, the effort being to make the motor as efficient under low loads as under high loads.

Mr. Heinze mentioned a motor which he developed two years ago arranged so that the time of closing of the intake valve—that is the cutoff—could be varied by having split cams. It was found that by varying the cutoff in this way it was possible to get as high as 19 per cent thermal efficiency, but not maximum power. In order to obtain the maximum power the thermal efficiency had to drop to about 16 per cent, that is, at 28 and 30 hp. the efficiency was 16 and at 25 it was 19.

Chairman F. E. Moscovics mentioned an English engine of several years ago which had a variable cutoff, and also stated that one of the old Wintons had a variable pressure maintained by using an air cylinder which operated in connection with the intake valve.

Chester Ricker explained that that valve was purely automatic, a light spring just sufficient to lift the valve was so connected with a piston in the air cylinder that it increased the air pressure on the intake.

A Cutoff Engine

Mr. Sargent stated the gist of his paper when he said "what we want to get is a cutoff engine."

Mr. Gruenewald stated his belief that any increases which could be obtained in this way in the thermal efficiency of an engine by changing the cutoff would not be sufficient in the minds of owners to make up for the increased complication.

Mr. Combs stated in a formal paper the point was made that 11,000 volts are necessary to overcome the pressure of 90 lb. per square inch. To this Heinze replied that not only the voltage is to be considered, it is also the current. It takes a pressure of 40,000 volts to puncture a glass plate ⅛-in. thick providing there is plenty of current behind it, but magneto current at 40,000 volts would not do it. He stated it was his belief that magnetos could be made which would spark in 200 or 300 lb. compression if needed.

Splitdorf-Apelco $10 Higher

NEWARK, N. J., April 3—An increase in price for the Splitdorf-Apelco electric starting and lighting system for Ford cars has been put into effect by the Splitdorf Electrical Co., the new price of $75 being an increase of $10. Higher cost of raw materials is solely responsible for the increase, according to the company.

Day-Elder to Build Trucks

$100,000 Concern Will Make 1-Ton and ½-Ton Models in Newark

NEWARK, N. J., April 1.—The Day-Elder Motors Co., this city, has been formed to manufacture motor trucks. The company is headed by Charles P. Day, for the last six years with the Universal Tobacco Machinery Co., Newark. G. A. Gemmer, the inventor of the Gemmer steering gear and who assisted in the organization of the Gemmer Mfg. Co., Detroit, is vice-president of the new company. F. G. Elder is treasurer. He has been an advertising man during most of his business career, having for the past nine years been treasurer of Sherman & Bryan, Inc., advertising agents in New York City. The new concern has been incorporated under the laws of New Jersey and is capitalized at $100,000.

The plant will be located at 161-167 Ogden Street, and will be occupied about April 15.

A 1-ton and a ½-ton model will be manufactured, the tonner selling around $1,400 and the other model at $850. These prices are at present only tentative, however, as no prices have as yet been definitely fixed.

The 1-ton truck will be equipped with a Continental four-cylinder motor developing 19½ hp. Other features are Bush radiator, Detroit Gear & Machine Co. transmission, and Sheldon front axle and springs.

The ½-tonner will use a Le Roi motor, developing 16 hp. Other features are a Grant-Lees transmission, Sheldon worm-drive rear axle, and Sheldon front axle and springs. This model will also be equipped with a starter.

Stroup Paige Purchasing Agent

DETROIT, MICH., March 29—P. E. Stroup has been appointed purchasing agent of the Paige-Detroit Motor Car Co. He held a similar position with Dodge Bros. during the last three years.

Sohlinger Flint Varnish Sales Manager

FLINT, MICH., March 30—W. J. Sohlinger, who during fourteen years was connected with the Sherwin-Williams Co., varnish maker in Cleveland, is now sales manager of the Flint Varnish & Color Works.

Von Rosen Is Saxon Sec.-Treas.

DETROIT, MICH., April 1—E. E. von Rosen, well known in the automobile industry, has been elected a director and also secretary-treasurer of the Saxon Motor Car Co., L. R. Scafe, formerly secretary-treasurer, having resigned. Mr. von Rosen was formerly comptroller of the United States Motor Co., and during the last three years was assistant comptroller, general auditor and assistant treasurer of the Maxwell Motor Co.

McCulla in Mexico Assisting Army

DETROIT, MICH., April 1—Wm. R. McCulla has left this city for Mexico to assist the government on mechanical and aerial transport. Mr. McCulla has had experience in the European war, having spent ten months in the war fronts on the other side.

Leonard Is Ferro Vice-President

CLEVELAND, OHIO, April 1—H. N. Leonard, who has been general sales manager of the Ferro Machine and Foundry Co., this city, was recently elected to the position of vice-president and general manager of the company.

Beane Is Mattson Representative

LODI, N. J., March 30—R. S. Beane, for many years associated with tire companies, has formed a connection with the Mattson Rubber Co., this city, Mr. Beane will be this company's special representative and will begin interviewing the larger dealers at once. The Mattson company reports a greatly increased activity, the plant now running three shifts.

Hopewell, of Chase & Co., Dies

BOSTON, MASS., March 31—John Hopewell, since 1870 a member of the firm of L. C. Chase & Co., manufacturers and commission merchants, this city, died this week in Washington, D. C. The Chase company manufactures, among other things, artificial leather for upholstery and other purposes. Mr. Hopewell was born in Greenfield, Mass., Feb. 2, 1845.

Corman Joins Elgin Co.

DETROIT, MICH., April 3—E. W. Corman, recently advertising manager of the Saxon Motor Car Corp., has joined the Elgin Motor Car Co., Chicago, in the capacity of director of sales and advertising.

Selden Is Scripps-Booth Asst. Mgr.

DETROIT, MICH., April 1—C. H. Booth, the president, has taken over the general managership of the Scripps-Booth Co., this city. C. G. Selden has been appointed assistant general manager. C. A. Erickson, who was formerly chief draftsman of the company, has been promoted to the office of chief engineer.

Chevrolet Plant for Ft. Worth

$600,000 Assembling Plant To Complete 15,000 Cars Per Year

FORT WORTH, TEX., April 1—The Chevrolet Motor Co. will build a $600,000 assembling plant in Fort Worth. The plant, which is to be chartered with a capitalization of $600,000, will cover approximately three acres of floorspace and will employ from 300 to 500 persons to begin with. The initial capacity will be 15,000 cars per year.

The building is to be constructed entirely of concrete and brick. The directors of the corporation will be Samuel Davidson, W. C. Stripling and N. H. Lassiter.

The Chevrolet company will also have assembling plants in Oakland, Cal.; Atlanta, Ga.; Minneapolis, Minn., and Kansas City, Kan. These are at present being established. The company now has plants in Flint, Mich.; Oshawa, Ont.; New York City, Tarrytown and St. Louis, Mo.

Packard's March Truck Business Amounts to $1,000,000

DETROIT, MICH., April 1—Orders calling for trucks to the value of $1,000,529.75 are on the books of the Packard Motor Car Co., showing the results of its domestic truck business for March. More than 99 per cent of the amount was for truck chassis; a majority of the buyers ordered bodies built by outside concerns. The company has delivered 4,308 Twin Six cars.

Hyatt Roller Bearing Co. to Equip New Process Steel Mill

LANCASTER, PA., April 1—An agreement has been filed in the courthouse at Lancaster, Pa., in which the Hyatt Roller Bearing Co. proposes to equip a mill there costing $50,000, for the New Process Steel Co., on the outskirts of the town. It is agreed that in return the Hyatt company will receive the products of the steel concern until the amount has been covered.

Sellon Chevrolet Supervisor

NEW YORK CITY, April 4—W. A. Sellon, for the past three years branch manager of the Brooklyn branch of the Chevrolet Motor Co., has been appointed retail store supervisor by that company. He will have charge of all the retail branches operated by the Chevrolet company and will be under the supervision of M. B. Leahy, factory sales manager.

Prest-O-Lite Completes Addition

New Building Will Increase Total Production to 1200 Batteries Per Day

INDIANAPOLIS, IND., April 1—An addition to the main factory of the Prest-O-Lite Co., 100 by 400 ft., which is the second largest building of the present factory group, is practically complete and will permit a total production of 1200 Prest-O-Lite storage batteries per day, three times the amount of the present output. The building is one story of reinforced concrete construction. Floors in one-half of the structure are of brick so as not to be affected by the action of acids. The roof is of reinforced concrete with a layer of cork under the roofing as an insulation against the sun's heat. Floor drains have been located at intervals of about 20 ft., and hose outlets provided at frequent intervals. Washing sinks will be placed at frequent intervals throughout the building and provided with mixing faucets so arranged that employees will wash in warm, running water.

Freight Hold-Up of Rubber Closes Knight Tire Plant

CANTON, OHIO, March 30—The Knight Tire & Rubber Co. has announced that it will be compelled to shut down, owing to the failure to obtain rubber from New York because of the freight congestion. About 125 cars are tied up in the East. About 500 men are affected.

Builds All-Steel Bodies

FREEPORT, ILL., April 1—The Stover Steel Tank Co., Freeport, has embarked upon a new side line, building all-steel bodies for commercial motor vehicles, no wood whatsoever being used in the construction. The Ford commercial all-steel body is made entirely from one piece of steel, with the exception of the hinged end-gate, and, under this form of construction, the makers entirely eliminate metallic sounds from riveted joints. In addition, the company is making all-steel express and stake bodies, ranging from the smallest to the five-ton trucks.

Streator Sale Brings $25,000

STREATOR, ILL., March 31—The real estate and buildings of the Streator Motor Car Co., now occupied by the Barley Mfg. Co., were sold at public auction by S. C. Eastman, referee in bankruptcy, for $25,000 to the Barley Mfg. Co. and the Streator Metal Stamping Co., the latter desiring to occupy a portion of the plant. The property consists of several modern buildings, has two switching tracks and 7 acres of land. The buildings and real estate have been used for several years by the Barley company, renting from the receiver. The stamping company has also been a tenant. The Barley company will continue to manufacture automobiles and supplies. The plant originally cost $75,000 and was installed by the defunct Streator Motor Car Co.

Overland Ships 47,465 Cars in Three Months

TOLEDO, OHIO, April 1—In the three months ended March 31, the Willys-Overland Co. manufactured and shipped a total of 47,465 cars, a new high record. This total comes within 1000 cars of equaling the entire yearly output of 1914. Output in March was 19,780, compared with 7005 in March, 1915, a gain of 12,775.

Jordan Plant for Cleveland

CLEVELAND, OHIO, March 31—A plant will be erected in this city for the Jordan Motor Car Co. A 5-acre site has been purchased on East 152nd Street, south of St. Clair Avenue. Ground will be broken at once. Cost will be $50,000.

Baltimore Tire Acquires Plant

BALTIMORE, MD., April 3—The Baltimore Rubber Tire Mfg. Co., this city, acquired a plant April 1 and will be ready to turn out its product on July 1. The plant will be located at Orangeville, the former home of the Maryland Mantel & Tile Co., and the group of buildings acquired is ideal for the manufacture of tires and inner tubes.

The capital stock of the new company is $200,000, all common. The company eventually expects to employ between 500 and 600 men, and the officers are G. W. Habbersatt, president; H. M. Rover, secretary-treasurer, and A. S. Mauk, vice-president and general manager. Mr. Mauk holds patents on several well-known tires. He has been identified with some of the leading rubber tire plants in the country.

Chevrolet Takes Cycle Co. Capacity

NEW YOPK CITY, April 1.—The Chevrolet Motor Co. has entered into an arrangement with the National Cycle & Mfg. Co., Bay City, Mich., to control its capacity for an indefinite period. The National Cycle & Mfg. Co. owns two plants, covering 5½ acres, is equipped to build motors and parts and employs from 1500 to 2000 men.

Wolverine Car and Tractor Organized

DETROIT, MICH., March 30—The Wolverine Car & Tractor Co. has been incorporated here with a capital stock of $300,000 by William J. and T. J. McNamara and William J. Wagenhals.

Night Work Lowers Efficiency

Study of Work and Output Shows Day Workers' Record Is 40% Better

SYRACUSE, N. Y., March 30—That workmen in factories on night shifts are 40 per cent less efficient than those working on day shifts is the conclusion of George D. Babcock, production manager of the H. H. Franklin Mfg. Co., this city. Mr. Babcock, after studying the efficiency of night factory forces, concludes that even with greatly increased supervision per man and with special incentives for night work, such as 10 cents extra per hour to the night men, it is impossible to get from the night forces more than 75 per cent of the efficiency obtained from the day shift. Mr. Babcock has further discovered that while the output efficiency of night work is much lower, the regularity of workmen is reduced and the amount of rejected work is much greater at night than in the day. This situation is not entirely due to artificial lighting or to less satisfactory shop conditions, but principally to the lack of willingness of first-class workmen to work nights, and to an increased fatigue on account of carelessness in the hours of rest and sleep. The daily hours of sleep are not so regular with a person on night work as with one on day work. Mr. Babcock believes that sleeping during the day develops nervousness which tends toward restlessness.

Tests at Other Plants

That the efficiency of a workman is not so great at night has been demonstrated at other factories. In one Cleveland factory the test made some years ago showed that the output of a day force dropped off materially when the electric lights were switched on at four o'clock on the winter afternoons. The electric current for the machinery and also for the lights was drawn from the same switch board and it was found that the consumption of current after the lights were turned on was actually a little less than before. This can only be explained by the fact that the men were not working at the same capacity and the different machines were considerably below their average output.

Chalmers to Assemble in Oakland

OAKLAND, CAL., April 3—The Chalmers Motor Co., Detroit, will erect an assembling plant in this city. It will employ from 300 to 400 men at the start and turn out twenty-five to thirty cars a day. The announcement was made before the Chamber of Commerce at a luncheon given for Hugh Chalmers.

No Packards for 1916 Races

Will Appear on Speedways But Not in Competition—Test Aeroplane Motors

DETROIT, MICH., April 3.—There have been a great many rumors concerning the probability of the appearance on the speedways this year of Packard racing cars. It is now finally settled that while such cars will undoubtedly appear no Packards will be entered for any competitive racing during 1916. For several months past the Packard engineers have been engaged upon the design of aeroplane engines, and J. G. Vincent proposed to follow the example of the Mercedes company, which tried out its aeroplane motor by fitting it in a racing chassis.

Recent European experience goes to show that no engine is better suited to aeroplane requirements than the twelve-cylinder and the Packard experiments will therefore be along the line of finding out the power and weight limitations of this type of engine. Experiments probably will be made with several different sizes ranging from about 300 cu. in. upward.

Preliminary tests on the block have been very encouraging, and there seems no doubt that the smallest experimental twelve will be capable of driving a chassis at a very high speed.

Want Rickenbacher on Coast

CHICAGO, ILL., March 27—Eddie Rickenbacher, manager of the Prest-O-Lite racing team, may be a contender in the Corona grand prize, April 8, and in the Ascot meet, April 16. Rickenbacher states he has been offered the Bentel Mercer for both events, and has been informed by George Bentel that the car is in perfect shape. He will accept the offer if his work at Indianapolis will permit it.

300-Cu.-In. Milac Building

LOS ANGELES, CAL., March 31—The Linthwaite-Hussy Motor Co., of this city, builder of the Milac car of 199 cu. in. piston displacement which Teddy Tetzlaff drove in the Ascot speedway event March 5, is building another Milac on the same lines which will just come under the 300-cu. in. regulations. This second car is to be driven in the Corona Grand Prix April 8, and then be shipped East to compete in the Indianapolis classic.

Anderson May Be Independent

INDIANAPOLIS, IND., March 27—Gil Anderson, champion speedway driver, probably will be the manager of the new Stutz team of racing cars for the 1916 season. It is reported that Anderson is negotiating with Harry Stutz for the use of the three white cars which he managed last year. Whether or not the withdrawal of Stutz from racing last year will prevent the use of the cars under independent management has not been determined.

Of the four Stutz cars in the team last year, one is now being raced in California by Earl Cooper. Anderson hopes to take the other three, in which case Tom Rooney will be a second driver. The third has not as yet been decided upon.

Sixteen Entries to Date for Corona Grand Prize

CORONA, CAL., April 2—Sixteen entries have been made so far for the Corona boulevard race on April 8. The first official practice on the course is to be held to-morrow afternoon. Two informal practices have been held in which some of the drivers entered in the Corona Grand Prize turned some fast laps.

During an informal practice spin, yesterday, Hughie Hughes on his first trial on the Sunbeam 12, turned a lap at 106 m.p.h. Earl Cooper on the Stutz made a lap at the rate of 97.7 m.p.h. O'Donnell on the Duesenberg showed 95 m.p.h. in his first try-out with the drivers.

Car	Driver	Car	Driver
Delage.	Oldfield	Sunbeam	Hughes
Peugeot.	Burman	Edwards.	Edwards
Milac.	Tetzlaff	Cyclone.	Durant
Onar.	Toft	Mercer.	Thomas
Apperson	Price	Gandy Sp.	Waterman
Mercer.	Pullen	Gandy	Lou Gandy
Stutz.	Cooper	Marmon.	Welsh
Duesenb'rg.	O'Donnell	Tahis	Teel

Seven Chicago Amateur Entries

CHICAGO, ILL., April 3—With the Chicago amateur driver's race over six weeks away there are twenty-five entries promised and seven actual entries for the event. Those who have actually signed the entry blanks and deposited the fee are as follows:

Driver	Car	Club
F. C. Sawyer	Mercer.	South Shore Country Club.
William Leet	Mercer.	Omaha Automobile Club.
Dr. R. R. Duff	Mercer.	Central District Mfg. Club.
H. W. Mershback	Packard.	Chicago Automobile Club.
C. H. Robbins	Mercer.	Speedway Park Association.
William Robbins	Mercer.	South Shore Country Club.
E. C. Church	Cadillao.	Chicago Automobile Club.
Frank Warner	Cadillac.	Chicago Automobile Club.
Bronsted.	Mercer.	Chicago Automobile Club.

Bourne Magnetic Truck Co. Formed

DOVER, DEL., March 30—The Bourne Magnetic Truck Co. has been formed in this State with a capital of $2,000,000 to manufacture and deal in motors, engines, wagons, etc. The incorporators are H. E. Latter, N. P. Coffin, C. M. Egner.

Christiaens to Race at Indianapolis

Will Drive Sunbeam—René Thomas Cannot Appear—Fiat Not to Enter

PARIS, April 3—*Special Cable*—Joseph Christiaens, the Belgian who drove the six-cylinder Excelsior into sixth place at Indianapolis two years ago, is an assured entrant with a six-cylinder Sunbeam in the 300-mile Indianapolis Speedway race, May 30. The report, however, that René Thomas, winner of the 500-mile race on the Indianapolis Speedway in 1914, will drive a Peugeot in that race, is incorrect. Though the Fiat company has been redesigning two 1914 Grand Prix models and it was almost certain the company would enter these in the coming Indianapolis race, it is now stated that this company has decided to the contrary.

To Convert Chicago Speedway Stock—Ben Hur Racers

CHICAGO, ILL., April 3—David F. Reid, president of the Speedway Park Association, has secured an option on all the common stock of the association, a move which will eventually release it from the hands of contractors who now hold all the outstanding shares. He states that the shares under option will be converted to membership certificates.

Attorneys for the association have recently incorporated a company with a capital of $100,000, headed by Mr. Reid, which will sponsor the Ben Hur special racing team to represent Chicago at all the big races. It is expected the new cars will be ready for the May races in New York and Indianapolis.

Patterson Heads C. A. C. Amateurs

CHICAGO, ILL., March 27—E. C. Patterson, former backer of Ralph De Palma, has been elected captain of the Chicago Automobile Club team for the invitation non-professional drivers' race at the Chicago Speedway, May 20. It is expected that there will be a large entry list from the local motoring organizations as well as from other clubs in the vicinity. The Rotary Club has named five entrants, and a number of the Chicago sportsmen were out for unofficial practice Saturday. Arrangements were made for official practice Sunday, but weather conditions did not permit it.

Master Drivers Run Annual Event

CHICAGO, ILL., April 4—The three-day reliability run for the master driver's medal, which was won last year by E. A. Turner, driving a Mercer, will be repeated this season, probably in October, and will be made an annual event.

New Financing Co. Formed

Guaranty Securities Corp. Plans to Finance Time Sales of 21 Makes

NEW YORK CITY, April 1—A new plan for financing time sales of automobiles which is not restricted to any one particular make, has been announced by the Guaranty Securities Corp., New York City, which is an outgrowth of the Guaranty Securities Co., Toledo, that was originally formed to finance time sales of Overland automobiles.

The plan as worked out by the new Guaranty Securities Corp. is very simple and consists simply in selling a man a car on a cash payment of from one-third to one-half the list price of the car and the balance in eight equal monthly payments or fewer installments if desired. To this is added in cash 2½ per cent of the list price to pay for necessary insurance and incidental expenses if the car lists at $600 or more, or 3 per cent if the selling price is under $600. The insurance is for full 80 per cent fire and theft coverage for one year.

At the present time the Guaranty plan has been extended so that the following cars may be sold by the dealer under its provisions: Ford, Hudson, Studebaker, Paige, Chevrolet, Reo, Oakland, Overland, Buick, Chandler, Maxwell, Kissel, Oldsmobile, Willys-Knight, Cadillac, Chalmers, Dodge, Jeffery, Hupmobile, Mitchell and Franklin. The credit concern intends to inaugurate a large national campaign to inform the general public of the plan, which will probably be widened in its scope as time goes on.

The customer gets the immediate use of his car and pays 6 per cent on the deferred payments. The schedule of payments for cars of different prices is given below:

SCHEDULE OF PAYMENTS

Price of Car	Cash Payment Required, % of List	Amt. Payable on Def. Payments, % of List
$ 750 or less	33⅓	66⅔
751 to $1,250	40	60
1,251 to 1,500	45	55
1,501 or more	50	50

The dealer pays no interest or premium, but when the customer has signed a contract in accordance with instructions given by the Guaranty concern, the dealer indorses it and sends it on to the credit house. The dealer keeps all the cash including the amount collected for insurance and incidental expenses. In addition to this the Guaranty Securities Corp. sends to the dealer immediately the amount of the deferred payments due from the customer, except the insurance and incidental collections and 20 per cent of the deferred payments. For this amount a deferred certificate is issued to the dealer, in which the Guaranty Securities concern agrees to pay the remaining 20 per cent as soon as the customer finishes paying for the car.

To show how this works out, the following is given:

Dealer sells a car listing at...	$1,000	
Dealer adds for insurance and incidental charges.......... (2½% of list over $600).	25	
Customer pays down on car (40%)		$400
Customer pays down for insurance, etc.		25
Customer gives contract note for deferred payments, $75 per month for 8 months.....		600
	$1,025	$1,025
Guaranty Securities Corp. buys contract note at face value..		$600
Guaranty Securities Corp. holds cash on deferred certificate till payments on contract note are completed (20%)...		120
		$480
Guaranty Securities Corp. deducts cash received for insurance, etc., and retained by dealer		$25
Guaranty Securities Corp. pays dealer cash immediately....		$455
Customer pays dealer cash on delivery (as above).........		$425
Dealer receives immediately in cash		$880
Guaranty Securities Corp. redeems deferred certificate in cash when payments on contract note are completed....		$120
Dealer receives full list price..		$1,000

Tentative Program for Salesmanship Congress

DETROIT, MICH., April 4—Though the program that will be taken up at the World's Salesmanship Congress here, July 9 to 13, has not been finally decided, a tentative program has been prepared. Who all the speakers will be has not yet been fully decided. A large number of well-known men in the different industries of the country are eligible.

Some of the subjects suggested to be taken up are: Are Salesmen Born? Can Psychology Make Salesmen? What Does It Cost To Make a Salesman? Ethics of Salesmanship; Comprehensiveness of Salesmanship; Selection of Salesmen; Education of Salesmen; Direction of Salesmen; Salesmanship in Public Schools; Salesmanship in Universities; Salesmanship's Health; Real Estate Salesmanship; Insurance Salesmanship; Sureties Salesmanship; the Price-Cutting Manufacturer; the Discounting Jobber; the Bargain Sale Retailer; Sales Letters; Magazine and Newspaper Advertising; Premiums and Souvenirs; Selling to South America; Selling to Germany; Selling to Great Britain; Debate on the Question, Is Advertising Salesmanship?

New Charging Station Booklet Out

NEW YORK CITY, April 4—The New York Electric Vehicle Assn. has issued a new booklet with maps showing the charging stations, routes and giving data over the entire metropolitan area, including all of New Jersey.

Dealer Loses Broken Wheel Suit

Canadian Court Holds Him Responsible as Maker's Representative

MONTREAL, QUEBEC, March 31—According to a judgment rendered in the Court of Review yesterday by Justices Fortin, Guerin and Archer, the vendor of an automobile, when he is acting as agent for the manufacturers, is bound to assure himself that the machine is well constructed and in perfect order, according to the guarantee, as he may be held responsible under the law for any damages which result from defects in the automobile.

It was proved that a defective wheel in the automobile which formed the basis of the action caused the death of the purchaser, J. Philippe Pothier. His widow sued P. A. D. Robert, from whom her husband bought the automobile, for damages, and Justice Hutchison, in the Superior Court at Sherbrooke, awarded her $2,500 on this stated ground:

Rotten Wood Used

"That the proof establishes beyond doubt that the accident was due to the rotten condition of some of the spokes of the left hind wheel of the said car, which collapsed or smashed and broke away from the hub of the wheel, and which caused the car to overturn." Robert appealed from this judgment, but yesterday it was unanimously confirmed by the Court of Review. "This may not be very popular with makers and sellers of automobiles," remarked Justice Fortin, "but it is according to the law."

Justice Guerin said: "Were I a judge sitting with the powers of a police magistrate, and application were made to me for a warrant for the arrest of the manufacturer who put such rotten wood in the wheel of this automobile, charging him with manslaughter, I would sign the warrant. In selling such an automobile he was selling a machine in a condition that endangered life. So far as the manufacturer is concerned it was criminal. So far as the vendor is concerned, it was not a crime, but it was a fault for which he is liable for damages."

Justice Archer held that the negligence on the part of the manufacturer was "gross if not criminal," and while the responsibility of the vendor of the machine was not the same, he said the man was nevertheless remiss and liable for damages.

Maker Is to Blame

"There can be no doubt that if the automobile had been sold directly by the manufacturing company to Pothier the company could have been held responsible in damages. I am also of the opinion that, as a general principle, an automobile merchant ought to be put on the same footing as the builder or manufacturer of the automobile. The vendor in the present action is something more than a salesman in the ordinarily accepted sense of that term. He said in his evidence that he was the agent of the company, and as such gave demonstrations in order to show to clients the superiority of the automobile he had for sale. He further told the court that he conducted tests before delivering the automobile in order to be assured that the machine was in good order, and the tests that he generally made were sufficient to establish if the wheels were in good condition. This enabled him to ascertain for himself the quality of the material used in construction and assure him in giving guarantees, as he did in the present case, that the automobile was in perfect order. Notwithstanding the fact that he gave such guarantee in this instance, he does not appear to have made such tests."

Gemmer Increases Capital $200,000

Detroit, Mich., March 30—The Gemmer Mfg. Co., manufacturer of steering gears, has increased its capital stock from $300,000 to $500,000. This concern's business has been increasing in such a way during the last few months that, notwithstanding enlargements of the plant which were made last year, the additions did not permit the increasing business to be taken care of as well as desired. For this reason further extensions will be made and the working force increased.

Lozier Capital Now $700,000

Cleveland, Ohio, April 1—The H. A. Lozier Co. has increased its capital from $10,000 $700,000.

Accessory Forgings Capital $50,000

Detroit, Mich., March 30—The Accessory Forgings Co. has increased its capital stock from $10,000 to $50,000.

Cleveland Machine Co. Reorganized

Ohio Corporation With $4,000,000 Capital Succeeds New Jersey Concern

Cleveland, Ohio, April 1—The Cleveland Automatic Machine Co., an Ohio corporation, has succeeded the company of the same name, which was a New Jersey corporation. The capital stock of the new company, which was originally placed at $1,000,000, has been increased to $4,000,000. The company has sold to William Solomon & Co. of New York and Secor & Bell of Toledo, Ohio, the $1,500,000 7 per cent preferred stock, par $100, and this will be offered to the public. The $2,500,000 common stock, it is stated, will not be publicly offered. The preferred stock is to be redeemed through a sinking fund which will be formed by the retention of 10 per cent of the net earnings, but this annual amount is to be not less than $50,000. The stock is callable at 115. The stock of the old company, all of one class, had always been closely held, but this marks the entrance of banking interests into the business.

The operation of the business remains in the hands of the old organization, whose officers are: President, A. L. Garford, Elyria, Ohio; vice-president and general manager, James Brophy; treasurer, H. M. Rich; secretary, George Cook Ford.

Rubber Goods Net Earnings Amount to $2,037,744

New York City, April 1—The Rubber Goods Mfg. Co. for the year ended Dec. 31, 1915, showed net earnings of $2,037,744 as against $2,084,626 in 1914. Net profits amounted to $1,330,166 as against $2,193,220 in 1914.

The reports says: "While the sales of the company both in quantity and value were larger in 1915 than in 1914, the net earnings were less on account of special conditions in the tire department. These adverse conditions made themselves felt throughout the entire heavy buying season, but from September on and continuing until Jan. 1 of this year up to date a marked improvement has occurred in the tire department."

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.65	.65	.65	.65	.65	.70	+ .05
Antimony	.44½	.44½	.44½	.44½	.44½	.44½	...
Beams & Channels, 100 lb	2.62	2.62	2.62	2.68	2.68	2.68	+ .06
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb	.28½	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb	.28½	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl	10.60	10.62	10.55	10.25	10.40	10.35	— .25
Fish Oil, Menhaden, Brown	.53	.53	.53	.53	.53	.53	...
Gasoline, Auto, bbl	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.95	.95	.95	.95	...
Lead, 100 lb	7.95	7.88	8.00	7.88	7.88	8.00	+ .05
Linseed Oil	.77	.77	.76	.76	.77	.77	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.75	.74½	.74½	.74½	.74	.74	— .01
Rubber, Ceylon, First Latex	.91	.90½	.89	.89	.88	.88	— .03
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	50.00	49.50	49.00	48.75	48.75	50.25	+ .25
Tire Scrap	.06¼	.06½	.06½	.06½	.06½	.06½	...

Market Prices Steady

New York City, April 5—Market prices last week were somewhat steady. Aluminum and lead with 5-cent rises and a decline in crude rubber were the features of the market activities. Aluminum rose to 70 cents a pound, a new high mark, while lead reached $8.00 per 100 lb. Para rubber declined 1 cent a pound to 74, while the Ceylon latex grade dropped 3 cents to 88 cents. Liberal arrivals of crude rubber were reported from Brazil yesterday. Despite the numerous reports of an active trade in rubber goods manufacturers show little disposition to purchase.

Steel prices remained constant last week. Both Bessemer and open-hearth steels are quoting at $45 per ton. Copper is firm at 28½ cents a pound. Beams and channels rose to $2.68 per 100 lb. at a gain of 6 cents.

Dividends Declared

Chicago Pneumatic Tool Co.; quarterly of 1 per cent on all stock at close of business April 15, payable April 25.

General Motors Co., regular quarterly of 5 per cent on common and 3½ per cent on preferred, payable May 1, to stock of record April 18.

Kelly-Springfield Tire Co.; quarterly of 4 per cent or $1 a share on common, payable May 1 to stock of record April 15.

Vacuum Oil Declares 3 per Cent Extra Dividend

New York City, April 1—The Vacuum Oil Co. has declared an extra dividend of 2 per cent as well as the usual semi-annual payment of 3 per cent, payable May 15, to stockholders of record May 1. The annual statement showed that net earnings in 1915 had been equal to more than 40 per cent on the $15,000,000 outstanding shares. The income account shows net profits of $6,861,913 against $2,075,644 in 1914.

6 Per Cent Dividend for Bowser Employees

South Bend, Ind., April 3—It has been announced by the management of the S. F. Bowser Oil Tank & Pump Co., Fort Wayne, Ind., that all employees of the plant will receive a dividend of 6 per cent on their wages for the month of February. It was stated by President Bowser that the company is planning to issue to each employe an insurance policy of $1,000 and an age pension.

Chevrolet Features Securities

Reaches 183 Compared with 85 in Oct.—Firestone Common Goes Up 20 Points

NEW YORK CITY, April 5—Chevrolet stock went up to 183 yesterday, compared with 85, at which the bankers offered the stock last October, representing an advance of over 100 per cent. This is the most rapid appreciation shown by any of the securities offered in recent years.

Maxwell and Goodrich Strong

Maxwell and Goodrich were very strong last week. Maxwell common, first and second preferred closed on Saturday with gains of 2¼, and 1¾ points, respectively. Maxwell and Studebaker have been the target of pool activities at various times during the past year, and it was rumored that a well-known speculator who has been absent from the floor of the exchange for some time and who returned on Monday was beginning a new campaign in these issues.

Goodrich, it is stated, will earn not less than 25 per cent on its common during 1916. It is understood that the February net of that company was 85 per cent ahead of the same months of last year.

Gasoline Not a Factor

So far the widely heralded crisis existing in the gasoline situation has not hurt the securities prices. Automobile stocks are being purchased on the theory that the Mexican affair is going to lead the American army far into the wilderness, where numerous automobiles and especially trucks will be needed. It is also believed that should real intervention follow and Mexico be occupied by a large American army, thousands of American business men will follow the army into the choice business sections of the country. They will need automobiles of all types because the railroads are not adequately developed.

$3,000,000 Orders from Russia—Not War Sales

NEW YORK CITY, March 31—That the market for American-made automobiles in foreign countries was never better is shown in reports of orders now on hand by the large exporting houses in this city. One house, Gaston, Williams & Wigmore, alone has on its books orders for $3,000,000 worth of touring cars and trucks from dealers and merchants in Russia. None of this business is with the Russian Government, but represents the foreign demand for American automobiles by automobile users in Russia.

Bock Bearing to Be Reorganized

TOLEDO, OHIO, April 1—Incorporation of the Bock Taper Roller Bearing Co. this week is the beginning of the reorganization of the Bock Bearing Co., West Toledo. The initial capital stock is $10,000, but this is preliminary to increasing the capital stock of the present company. C. E. B. Lamson, J. E. Dunipace and C. H. Clements are the principal incorporators.

King Holds Annual Speedfest

Host to Parts Manufacturers and Their Representatives—Business Talk Barred

DETROIT, MICH., April 1—A large number of parts makers and their representatives were the guests to-night of the King Motor Car Co., at the third annual King Speedfest, at Hotel Statler.

The purpose of this annual gathering is to get better acquainted. The unusual conditions prevailing in the automobile industry owing to the great war, the shortage of materials, the freight car situation, and the many other things which make the situation entirely abnormal this year, brought about many an interchange of views among the many men representative of the industry in general, although business talks were barred.

Some Materials Less Scarce

From what the parts makers had to say it appears that, while the general condition of the materials situation is still as bad as it has been for many months, the scarcity of certain raw products is not quite so pronounced. The parts makers are in the same situation as the car makers, inasmuch as they are able to get certain supplies of raw materials without too much trouble, while other needed supplies are very difficult to secure, even at the greatly increased prices which are quoted at present.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	69¼	70¼	+ ¼
Aluminum Castings pfd	98	..	..	..	..
J. I. Case pfd	76	85	85	87½	+10
Chalmers Motor Co. com	83	85	155	160	—3
Chalmers Motor Co. pfd	90	93	98	101	—1
Chevrolet Motor Co.	..	..	170	175	—6
Electric Storage Battery Co.	47¼	48½	62	64	+2
Firestone Tire & Rubber Co. com	400	405	765	..	+20
Firestone Tire & Rubber Co. pfd	110	112	113	115	..
General Motors Co. com	124	126	460	480	—20
General Motors Co. pfd	102½	103	114	117	+1
B. F. Goodrich Co. com	42⅜	42⅝	76⅛	76½	+3⅞
B. F. Goodrich Co. pfd	99	100½	114½	115½	+ ½
Goodyear Tire & Rubber Co. com	200	205	337	340	—3
Goodyear Tire & Rubber Co. pfd	103½	105	115	117	+3
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	5	8	18	20	—2
International Motor Co. pfd	18	22	35	40	..
Kelly-Springfield Tir[illegible] com	129	131	75⅛	75½	+ ⅞
Kelly-Springfield Tir[illegible] 1st pfd	83¾	84½	96	98	..
Kelly-Springfield Tu[illegible] 2d pfd	130	132	..	..	..
Maxwell Motor [illegible]	44¼	44½	72¼	72½	+2¼
Maxwell Moto[illegible]	81	82	86	87	+1
Max[illegible] Mot[illegible]	[illegible]	[illegible]	55¾	56¼	+1¾
Mi[illegible]	[illegible]	[illegible]	235	240	..
[illegible]	[illegible]	[illegible]	112	116	..
[illegible]	[illegible]	[illegible]	175	178	..
[illegible]	[illegible]	[illegible]	111	..	..
[illegible]	[illegible]	[illegible]	163	170	+3
[illegible]	[illegible]	[illegible]	100	104	..
[illegible]	[illegible]	[illegible]	690	..	..
[illegible]	[illegible]	[illegible]	25½	26½	— ½
[illegible]	[illegible]	[illegible]	70	72	..
[illegible]	[illegible]	[illegible]	[illegible]	108	..
[illegible]	[illegible]	[illegible]	[illegible]	16	..
[illegible]	[illegible]	[illegible]	[illegible]	27½	+ ½
[illegible]	[illegible]	[illegible]	[illegible]	34¼	+ ¼
[illegible]	[illegible]	[illegible]	[illegible]	..	..
[illegible] com	[illegible]	[illegible]	[illegible]	88	—1
[illegible] pfd	[illegible]	[illegible]	[illegible]	..	..
[illegible]	[illegible]	[illegible]	[illegible]	142½	+ ½
Studebaker Corp. pfd	98½	99½	111	113	..
Swinehart Tire & Rubber Co.	74½	76½	88	90	..
Texas Co.	138	139	195	197	..
U. S. Rubber Co. com	65	65¼	50⅝	50⅞	—1⅝
U. S. Rubber Co. pfd	105¼	105¾	109½	110½	+ ½
Vacuum Oil Co.	199	201	230	240	+7
White Motor Co. (new)	..	..	49½	50	—1½
Willys-Overland Co. com	123¾	124	224	226	—5
Willys-Overland Co. pfd	100½	101½	102	104	—2

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co.	..	..	31	32½	..
Chalmers Motor Co. com	..	80	..	162	— 4
Chalmers Motor Co. pref	90	92½	97	100	..
Continental Motor Co. com	..	185	37¾	39	+ 3¾
Continental Motor Co. pfd	80	85	9½	10¼	— ¼
Ford Motor Co. of Canada	550	..	..	415	+ 20
General Motors Co. com	117	..	440	480	— 25
General Motors Co. pfd	99	100	113½	116	— ½
Maxwell Motor Co. com	33	34½	70½	73½	+ 2
Maxwell Motor Co. 1st pfd	75	77	83½	86½	— 1
Maxwell Motor Co. 2d pfd	30½	32	53	56	..
Packard Motor Car Co. com	80	92	165	173	— 1½
Packard Motor Car Co. pfd	93¾	97½	..	104	..
Paige-Detroit Motor Car Co.	..	..	810	..	+110
*Reo Motor Car Co.	28¼	29	34	35	+ ¼
*Reo Motor Truck Co.	11	12	26¾	..	..
Studebaker Corp. com	48	50	139	142	— 2¾
Studebaker Corp. pfd	93	95	111	..	..
INACTIVE STOCKS				¼	
*Atlas Drop Forge Co.	25	..	..	40	..
Kelsey Wheel Co.	195	..	320	365	—152½
*W. K. Prudden Co.	18¾	20½	29	33	..
Regal Motor Car Co. pfd	..	25	13	..	..

*Par value $10. †Ex-dividend.

Balk Gasoline Probe Resolution

Senate Holds Up Vote Till Trade Commission Report Is Made

WASHINGTON, D. C., April 1—After a hot debate the Senate this week failed to put the Martine resolution, directing an investigation of the high price of gasoline by the Attorney General, through its final parliamentary stage, and therefore the resolution is expected to come up again. The Senate adopted the resolution, but the preamble, asserting that the Standard Oil Co. was a trust and was responsible as such for the price of gasoline, was not voted upon finally. Until the preamble is acted on or amended and adopted the resolution is not complete, especially as the body of the resolution does not mention "gasoline" at all but merely refers to it as an article.

Senator Martine has announced that he will call up his resolution again at the earliest opportunity, but the impression prevails that he will not be able to get any action before the report of the Federal Trade Commission on the gasoline and oil subject is sent to Congress. The report is rapidly nearing completion, and probably will be sent to Congress on or about April 5.

40 Cents in Two Months?

The gasoline subject was also up in the House this week, when Congressman Howard of Georgia, in introducing a resolution authorizing the President to declare an embargo on the exportation of gasoline, startled the House with the prediction that gasoline for the use of the Government itself in huge quantities will reach a wholesale price of 40 cents in the next two months. The Howard resolution was written after the author had a talk with Secretary of Commerce Redfield, who presented some startling facts. At the same time Congressman Steenerson of Minnesota introduced a bill to give the Federal Trade Commission the power to fix prices on gasoline and allied products. It is doubtful if any action will be taken on the Steenerson bill.

"I was told by Secretary Redfield," said Congressman Howard, "that the contract price for gasoline for Government consumption last year was 11 cents. Now the producers are coming here for contracts and will not listen to any suggestion less than 40 cents."

"Government investigators report that the high price of gasoline prevailing is due to artificial rather than economic means," said Congressman Steenerson, "and yet the Department of Justice says it can find no sufficient evidence to warrant prosecution under the anti-trust laws. Here, therefore, is an instance where the competitive system has failed to secure to the people reasonable prices of one of the prime necessities of life, and we must either submit to exploitation by monopoly prices or have prices fixed by authority of Congress. That Congress has the power cannot be questioned.

"In the Federal Trade Commission we have already an instrument suited to the work. Its members have already investigated the subject, and say they can determine to a fraction of a cent per gallon just what it costs to produce and deliver this commodity in any part of the country where it is now dealt in."

Rittman Resigns—To Head New Gasoline Concern

PITTSBURGH, PA., April 1.—Dr. Walter F. Rittman, chemical engineer of the Bureau of Mines and inventor of the new process for obtaining a much greater yield of gasoline from crude oil, has resigned his position with the Bureau to become head of a company being organized for the purpose of manufacturing gasoline. It is stated that the local automobile dealers' association has been negotiating with Dr. Rittman in regard to a plan to reduce present gasoline prices. It is thought that Dr. Rittman and his company will figure in the plan.

$4,000,000 Fuel Co. Formed

DOVER, DEL., April 5—The People's Engine Products Co., with a capital of $4,000,000, was formed here yesterday to manufacture, produce and refine, buy, sell and handle petroleum, gasoline, gas and lubricating oils. The incorporators are H. E. Footh of Pittsburgh, H. C. Swann of Bellevue, Pa., and R. Robbins of Crafton, Pa.

Thielens a Studebaker Director

NEW YORK CITY, April 5—Sales of the Studebaker Corp. for the quarter ended March showed an increase of 100 per cent over those for the corresponding period of a year ago. The production is being maintained.

At the annual meeting of the stockholders the retiring directors were reelected. At the directors' meeting for organization, following the annual meeting of the stockholders, A. B. Thielens was elected a director, succeeding D. M. F. Weeks, resigned.

Hale Joins Haynes Stellite

ELKHART, IND., April 1—P. P. Hale has resigned his position as chief draftsman of the Sun Motor Car Co., this city, to accept a position in the sales organization of the Haynes Stellite Co., Kokomo, Ind.

Boycott Standard Oil Co.

Pittsburgh and Minneapolis Dealers Make New Move for Cheaper Gasoline

NEW YORK CITY, April 1—Agitation from different sections of the country for a Federal investigation of the inflated prices of gasoline is becoming more acute as each day passes.

The Pittsburgh Automobile Dealers' Assn. has agreed to buy no more gasoline from the Standard Oil Co. until its prices are justified. The association is overlooking nothing in its campaign for a substantial reduction in gasoline prices. Every buyer of a car in that city will be asked to refrain from buying from the Standard Oil Co. until prices come down to normal basis.

Federal investigation has been asked of Congress by the Minneapolis city council. The council asks for a consideration of the alleged control by the Standard Oil Co. of crude oil production and for an embargo on shipments of oil to warring nations. The situation in fact has become so acute in that city, that the Standard Oil Co. has practically been asked not to open any more filling stations in that city until it has cleared itself of all insinuations and charges as to monopoly and price manipulation.

A similar investigation has been asked by the Ohio State Automobile Assn. in Akron. This faction too believes that an embargo on exportation would relieve the situation.

In Detroit, a sort of provisional organization to discuss ways and means of combating the present gasoline situation has been formed by six representatives of automobile factories in that city, six dealers selling cars, and six garagemen. A resolution was passed asking the National Automobile Chamber of Commerce to push whatever measures are deemed necessary to relieve the situation by congressional action, embargo or other means.

Cleveland S. A. E. Meetings

CLEVELAND, OHIO, April 3—Secretary C. S. Pelton of the Cleveland Section of the S. A. E. has called the attention of members of the engineers' organization to the dates of meetings arranged by the Cleveland Section. Meetings will be held April 21, May 19, and a field day some time during June.

Motor Fuels Co. Formed

ST. JOSEPH, MO., March 31—Motor Fuels Co., capital stock $100,000; to exploit refining patents held by S. M. Herber; incorporators, S. M. Herber, J. C. Sanders, J. L. McQueen, William Taylor and Mabel Morgan.

Tire Cos. Winners In Monopoly Suit

Automobile Co-Operative Assn. of America Loses—Asks for New Trial

CLEVELAND, OHIO, April 1—The jury in the Federal District Court returned a verdict for the defendants yesterday in the case of the Automobile Co-Operative Association of America against the B. F. Goodrich Co. of Akron, B. F. Goodrich Co. of New York, the Diamond Rubber Co. of Akron and the Republic Rubber Co. of Youngstown, Ohio. The original petition included the Firestone Tire & Rubber Co. and the United States Rubber Co., but they were dismissed before the trial began.

In each case the petition was directed against the officers of the companies personally, as well as the companies themselves.

Defendants were charged in the petition with having formed and operated a combination in restraint of interstate and foreign trade and plaintiff claims that through this alleged combination its own business was destroyed and it lost the $75,000 capital with which it began business.

These companies, it was alleged, sold tires and other rubber goods and allowed a discount, usually from the retail price, which went as a profit to the dealer, but shortly after the plaintiff began business, it was charged, this combination was formed and prices were fixed arbitrarily, thus excluding the plaintiff and others from buying and selling freely and obtaining automobile accessories.

The petition charged that dealers were sent communications which frightened them and prevented them from buying goods of other companies and that defendants refused to sell to any one who furnished goods to plaintiff at wholesale prices. It was also alleged that blacklists, containing plaintiff's name, were distributed and that an agreement existed between defendants and an association of retail dealers in New York City by which the dealers were prevented from selling anything to plaintiff.

In addition to the alleged loss of its capital, plaintiff alleged that its profits, estimated at $50,000 annually, had also been lost. It asked judgment threefold the damages adjudged, and other sums that would have brought the entire amount up to $450,000.

The Automobile Co-operative Association has filed a motion for a new trial.

Receivers for Mason-Seaman Taxicab

NEW YORK CITY, April 1—The Mason-Seaman Transportation Co., one of the largest taxicab companies in this city, was placed in the hands of receivers yesterday. Lower taxicab rates and the present high cost of gasoline figured prominently in the reasons given for the failure of the company.

The company is capitalized at $10,000,000 and was organized in 1914 to take over the Mason-Seaman Transportation Co. and the Yellow Taxicab Co.

The company has 1000 touring cars and taxicabs on hand. The value of the assets is not given, but the liabilities are set down as $400,000.

Metric System Bill Provides $500 Fine or Jail

WASHINGTON, D. C., April 1—A bill for the compulsory use of the metric system has been introduced in Congress. According to the bill, after July 1, 1924, all Americans may have the choice of breaking the law or of using the metric system; any person, corporation, company, society, or association who shall use, or offer and attempt to use, in any industrial or commercial transaction in the sale or purchase of any commodity any other weights and measures than those of the metric system shall be guilty of a misdemeanor, and upon conviction thereof in any court shall be punished by a fine of not more than $500 or by imprisonment for not more than three months, or by both such fine and imprisonment. Frederick A. Halsey, who led the fight against the metric system a decade ago, is again leading the opposition to the measure, which is known as the Dillon bill.

58,502 Cars Bought in Ohio in 1915

COLUMBUS, OHIO, April 1—Statistics prepared by Fred H. Caley, secretary of the Cleveland Automobile Club, and submitted at the annual meeting of the Ohio Automobile Association showed that the State of Ohio purchased 58,502 cars during 1915, which was the largest number sold in any State in the union. According to the statistics New York was second with 56,671 cars; Illinois third, with 51,150 cars; Pennsylvania fourth, with 43,588 cars, and California next, with 40,700 cars. Basing the figures on the 1916 U. S. census estimate, there is now one car to each twenty-eight people in the Buckeye State.

According to a report made by W. H. Walker, Ohio registrar of automobiles, covering the present year up to and including March 28, the department has issued 121,000 sets of licenses to gasoline automobile owners in the State since the first of the year. It was late in May last year when that number was reached. Up to date the department has issued 2361 licenses to dealers and 7981 licenses to owners of electric cars.

Bay State Regulates Lighting

All Vehicles Must Light Lamps at Same Time—Other Measures

BOSTON, MASS., April 3—Governor McCall has signed two of the bills of interest to automobilists that have reached him. One of these provides that all vehicles shall display their lights half an hour after sunset and half an hour before sunrise. The law compelled the motorists to light up at those times, but the owners of other vehicles did not have to light their vehicles until one hour after sunset, so the new law makes the time uniform for all vehicles.

Another measure signed allows an automobilist in an adjoining State who lives within 15 miles of the border to register his car in the Bay State for a fee of $2. This is the law in New Hampshire and Maine, and allows business men to run back and forth without having to pay a yearly registration in both States.

The bill to allow the sale of gasoline and to make repairs on Sunday went through all the branches. Then it was killed in the Senate, but reconsideration was granted, and it is still in abeyance. A bill to compel all motorists to take out a $2,000 bond before driving their cars was killed, and the bills to compel all owners to pass a physical and mental test, and the other to take the discretionary powers from the Highways Commission were also killed, but not until they had reached close to the enactment stage.

Wisconsin Registrations Gain 70 per Cent

MILWAUKEE, WIS., April 1—A total registration of 51,000 cars by private owners at the close of business March 31 is the unprecedented record of the State of Wisconsin. A year ago the total registry for the first quarter of 1915 was slightly under 30,000, showing a gain of 21,000, or 70 per cent. Although the Department of State planned only on a registration of 100,000 for 1916, predictions are freely made that the number will run up to 115,000 before the end of the year.

Must Stop, Look and Listen at R. R. Crossing

LANSING, MICH., March 30—That an automobile driver when about to cross a railroad must stop, look and listen in such a way and at such a distance from the crossing that it really can be shown that he took all necessary precautions, is a decision of the Supreme Court of Michigan, in the case of J. S. Sanford of

Battle Creek against the Grand Trunk Railroad.

In his opinion, Judge Brooke states, "The duty of an automobile driver approaching tracks where there is restricted vision, to stop, look and listen, and to do so at a time and place where stopping, and where looking and listening will be effective, is a positive duty and the safeguarding steps the plaintiff failed to take. He stopped where stopping served no purpose, and failed to stop where stopping would have disclosed danger. He made chance and not sight, the guarantee of his safety."

Collins Curtain Maker Wins in Patent Suit Appeal

DETROIT, MICH., March 31—The award of $20,000 damages to W. A. Paul as a result of his suit against J. N. Collins, J. A. Bennett and the Novelty Leather Works, maker of Collins Curtains, claiming invention on a curtain holder for inside curtains on automobiles, has been set aside by the Supreme Court of Michigan, which has reversed the decision of the Wayne County circuit court on Jan. 22, 1915.

The patent involved was No. 1,066,448, filed by Collins July 22, 1912, and granted to him July 1, 1913. The attorneys for Collins, Bennett and the Novelty Leather Works appealed the case, claiming that the circuit court had no jurisdiction in the matter and that the case should have been heard in the Federal courts.

Troy Trailers for U. S. Army

TROY, N. Y., April 1—The United States Government bought eleven 2½-ton Troy trailers for use in the punitive expedition against Villa in Mexico on March 21. These trailers were shipped by a special train which made passenger train time on the trip to El Paso, Tex.

There was not time enough to give the finishing touches in the factory and a squad of painters was sent along to give the trailers the second coat and striping on the run.

Garagemen Liable for Employees

COLUMBUS, OHIO, March 31—In a decision handed down by Judge Ruth in the Municipal Court owners of garages are held responsible for the acts of their employees, for automobiles left in their care. William K. Krauss sued Albert B. Brightman for damages done to his car while stored in Brightman's garage when an employee drove it and sustained an accident.

No Cars—No Show

ATLANTA, GA., March 28—There was to be an automobile show here, but the dealers have sold all their cars and have none to exhibit.

Prosperity in Northwest

$40,000,000 in Deposits—Brisk Spring Trade Expected—Crop Conditions Good

NEW YORK CITY, April 3—Prosperity is shown in the reports from the Federal Reserve banks in the twelve regional districts. Business is flourishing despite the freight embargo and the growing cost of production. There is much activity in all retail lines and orders are overwhelming the manufacturers.

Excellent business conditions are reported from the Northwest. The public there seems to be guided by a spirit of common sense in its purchasing. Money is not being spent to an unwarranted degree for luxuries, although the better classes of goods are in demand. To a large degree the individual buyer is trying to get his money's worth—he has good purchasing power and is willing to spend his money.

Savings deposits in banks in the Northwest continue to increase and the spirit of thrift is becoming more evident. A new high record for deposits in Minneapolis is shown in the last comptroller's call for a statement from national banks. Present figures are slightly in excess of those of December, 1915, and illustrate a growth in deposits of nearly $40,000,000 since the March call of 1915. Loans and discounts for Minneapolis banks show a substantial increase over the December figures and a still greater increase over those of March a year ago.

Horses Slow Up Business

Roads in the country have been, in many cases, almost impassable for the last three weeks. In these days a very large percentage of country travel is by automobile, and when the breaking up of winter makes the roads bad for heavy motor transportation and the farmers have to depend upon horse-drawn vehicles, there is a very marked slowing up of business.

Every prospect is for brisk spring trade as soon as the roads are passable.

Reports from the territory to the south and west of that territory indicate good prospects for the coming crop. In the winter wheat belt the fields are apparently in good condition with plenty of moisture, although a recent storm will probably delay spring operations to some extent. Reports come from Iowa of general optimism and to some extent increased value for farm land, with some activity in the land market.

Large Sales Predicted for Norway

NEW YORK CITY, March 31—Prosperous conditions as a result of the European war will create a new outlet for American automobiles in Norway. V. E. Lindzen, of Lindzen & Robsahm, Christiania Hupmobile distributors, upon arriving in Detroit, stated that business in that country is better than ever before. Up to the start of the war most of the cars sold in that country were of German makes with a few Minervas from Belgium, Renaults from France and Daimlers from England. As these machines cannot now be secured, the dealers will naturally turn to the United States for their cars.

There are probably 2000 cars in Norway at present, and a large increase is expected in the near future.

Automobile Service Managers Want N. A. C. C. Help

DETROIT, MICH., April 4—Thirty members of the Automobile Service Managers' Assn. of Mich. were present at a smoker given by the organization at Hotel Statler on April 1. General service matters were discussed and it was the feeling that the service men must have the co-operation and help of the National Automobile Chamber of Commerce in promoting a standard service policy such as has been suggested by the association. Another meeting of the service men will be held on April 11 at the same place/ at which a standard repair parts policy will be discussed and acted upon. This will then be referred to the National Chamber with the hope that the latter organization will get behind it and seek to have it generally adopted. It is the general feeling that the meetings should be better attended and that all manufacturers should co-operate and take an interest in the work.

Edison Sales Organizations Meet

ORANGE, N. J., April 5—Salesmen and branch managers of the Edison Storage Battery Co. gathered at the factory and main office, Orange, recently for the annual sales meeting. H. G. Thompson, vice-president and general sales manager, presided. Those in attendance included: John Kelly, New York; W. F. Bauer, L. F. Meissner, H. J. Butler, Chicago; Bertram Smith, G. F. Simon, Detroit; E. M. Cutting, San Francisco; George W. Holden, Boston; C. H. Clare, New York; Geo. Drake Smith, E. J. Ross, Jr., H. H. Smith, F. V. McGinness, H. M. Roberts, H. W. Stortz, John Pulster, J. B. Renwick, Jr., R. C. Veale, A. Mudd, Geo. J. Glaser and Paul Sutcliffe, Orange.

Tire Shortage in Sweden

NEW YORK CITY, March 31—The automobile business at Sweden has been brought to a standstill by the war, according to Willy Schroeder, a representative of a Swedish tire company. Owners of cars stuff old tires with rags.

Factory Miscellany

Champion Ignition Adds—The Champion Ignition Co., Flint, Mich., has announced that work will be begun soon on a modern fireproof addition to its factory, which will add 12,500 ft. of floor space to the plant.

To Make Non-Skid Devices—T. O. Nelson of Fort Wayne, Ind., has gone to Goshen, Va., where he will make arrangements for the opening of a factory for the manufacture of automobile non-skidding devices and a new type of farm implement. The Virginia town has offered unusual inducements to obtain the factory.

Making Hearse Bodies—J. W. Henney, Jr., Freeport, has leased the Bloom Bldg., Hancock Avenue, East Freeport, and commenced the manufacture of hearse bodies for automobiles. He has for his associates several Chicago men who are well versed in body making for motors. Mr. Henney recently resigned his position with the Staver Auto Mfg. Co., Chicago, to take charge of the Freeport plant. He was for many years superintendent of the Henney branch of the Moline Plow Co. The new plant opened for business April 1.

Gardner Machine to Add—The Gardner Machine Co., Beloit, Wis., has awarded contracts for the erection of a 100 by 100 ft. machine shop addition and a new power house, 40 by 60 ft. The capacity will practically be doubled. The company has been working night and day for many months, and the addition will be rushed to give much-needed relief. The Berlin Machine Works, also of Beloit, which recently changed its name to P. B. Yates Machine Co., has awarded contracts for a new shop, 285 by 263 ft. The Yates company specializes in machinery for woodworking.

Inglis Succeeds Wallman—The Wallman Manufacturing Co., manufacturer of gasoline and oil storage systems, tanks and pumps, 283 Fifth Avenue, Milwaukee, Wis., has been succeeded by the Inglis Mfg. Co., a newly organized concern of which C. W. Inglis of the Milwaukee Steel Foundry Company is president and treasurer, and Charles Inglis, for 28 years past with the International Harvester Co., Milwaukee branch, is secretary and manager. It is the intention of the new concern to improve and largely increase the production of garage systems.

Gillette Safety Tire to Build—The Gillette Safety Tire Co., Eau Claire, Wis., has awarded contracts for the erection of its new factory, foundations for which were laid during the winter. The company was organized last fall by R. B. Gillette, an Eastern tire expert, and is spending about $75,000 in factory building and equipment. The main factory will be 60 by 250 ft. Work will begin at once and it is hoped to be able to start actual production by July 1.

To Invade Automobile Field—The Pulley-Grip Co., 405 Broadway, Milwaukee, Wis., which has been marketing a chemical compound for application to pulleys in factories and workshops to minimize belt slippage, is now putting out the preparation in a small size for use on fan and motor pulleys on pleasure and commercial cars. It is claimed that the use of Pulley-Grip will not only keep the fanbelt from slipping, but preserves the belt and saves bearings. The article is being used widely in all parts of the country by the largest manufacturers. It is stated that several truck and motor builders are equipping all belt-driven mechanisms with Pulley-Grip as standard equipment as a preventive of overheating on heavy-duty motors especially.

The Automobile Calendar

April 1-8	Butte, Mont., Home Industry Electric & Auto Show, Holland Arena, H. W. West, Mgr.
April 3-8	Twin Falls, Idaho, Show, Oliver Tabernacle, B. H. Fuller, Mgr.
April 8	Corona, Cal., 300-Mile Boulevard Race, Citrus Belt Racing Assn.
April 10-15	Seattle, Wash., Show, Arena.
April 10-15	Danville, Ill., Eastern Ill. Automobile and Electric Show; Chambers Bldg.
April 11-13	Milwaukee, Wis., Spring Show; Dealers' Show Room Automobile Display; Milwaukee Automobile Dealers.
April 12-15	Champaign, Ill., Show, Gymnasium Bldg., University, Ill.
April 14-16	Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
April 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn.
May 6	Sioux City, Ia., Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 14-20	Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Des Moines, Ia., Iowa Derby, 20 Miles; Des Moines Special, 10 Miles.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway 300-Mile Race.
May 30	Minneapolis, Minn., Speedway Race.
June 10	Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 12-16	S. A. E. Summer Trip on Great Lakes.
June 20	Galesburg, Ill., Track Race, 100 miles.
June 28	Des Moines, Iowa, Speedway Free-for-all, 300-mile race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet. Hilles-Riegel.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 11-12	Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 18-19	Elgin Road Race.
Sept. 4	Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City, Sheepshead Bay Speedway Race.
Oct. 7	Philadelphia Speedway Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Nov.	Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in the Industry

Boston Trade News—A. F. Chandler has been placed in charge of the retail sales for the Jackson Motor Co. of New England. He was formerly with the Willys-Overland and Paige-Detroit factories as traveling salesman, and later with the Becker Stutz Co. at Boston.

A. H. McIntyre, formerly with the Jackson company, is now with the wholesale department of the Saxon Motor Co.

Williamson Joins F. W. D.—G. H. Williamson of Cincinnati, formerly associated with the Maxwell Motor Co., Detroit, as district manager, has accepted a position in the sales department of the Four Wheel Drive Auto Co., Clintonville, Wis.

Milwaukee Items—The Wait Automobile Co., Fourth and Prairie Streets, Milwaukee, Wis., State distributer of Moline-Knight cars, has moved to new and larger quarters at 789-791 Thirty-second Street, and is occupying a modern, fireproof garage building, with ample repair-shop facilities.

John Wisniewski & Son, 904 Kinnickinnic Avenue, Milwaukee, have been appointed district agents for the Farmack Motor Co., Chicago, for Milwaukee and vicinity.

F. J. Siekert & Co., 326 Wells Street, Milwaukee, have been appointed agents for the Olsen wheel for Ford trucks and representatives of two large builders of delivery bodies for Ford chassis.

Washington Items—G. W. Miller, automobile dealer in Seattle, will shortly close out his stock of used cars at 715 East Pine Street, and following the trend of the times, will engage in the used parts business on East Pike Street.

Sharp and Leader of the Puget Sound Auto Co., Seattle, are now distributors of the Cole car in western Washington, which they will handle in addition to the Reo.

Another tire has made its appearance in Seattle, the Mohawk, distributed in Washington and Oregon by the Pacific Auto Supply Co. C. E. Barteau is president of the company in Seattle.

R. V. Barnett, field manager of the service department of the Mitchell-Lewis Motor Co., paid his annual visit to the Pacific Coast during the past month, visiting the Mitchell branches in California, Oregon and Washington. Reviewing the business, he said: "Conditions on the Pacific Coast, especially in the Northwest, were never better. Our sales to date are more than 100 per cent greater than last year."

Trade Happenings

Hartford Trade Changes—The A. C. Hine Co., Hartford, Conn., distributor in this State for Oakland, has put in an accessory department, giving up one-half of the salesroom at 314-316 Pearl Street for the purpose. W. J. Rabbitt, formerly with the Post & Lester Co., has been placed in charge. The Hine company has taken on the Knight tire for the State.

A deal is now in the works for the acquisition by the Willys-Overland Co. of a plot of ground at the corner of Asylum and Hurlburt Streets, Hartford, 90 by 140 ft., approximately. It is understood in automobile circles that the site will be used for a three-story service station and salesroom for Overland cars.

Andrew Caskey, at 26 Mechanic Street, Hartford, has taken on the Rayfield carburetor, formerly handled by the Palace Auto Service Co.

R. R. Ashwell, in the Ashwell service building, 341 Trumbull Street, has taken on the Norma ball-bearing and the Atwater Kent system of ignition.

Baltimore Trade Items—The Rawlings Implement Co., 11 West Pratt Street, Baltimore, Md., has taken over the distribution of the Federal tire.

The Mohawk Tire Sales Co., 1201 North Charles Street, Baltimore, has succeeded the Motor Car Accessory Co., and has taken over the stock, fixtures and good-will of the company. Mohawk tires will be a feature of the company's business. C. M. Ness of the firm of Charles M. Ness & Co., horse saddlery dealers, is president of the company, and G. T. Ness, vice-president. Frank Rowe is in charge of the sales and general management of the new company. Lerch Bros., Inc., 110 Hanover Street, Baltimore, has taken over the agency of the McGraw tires, a new line to Baltimore, and the firm will also distribute the McGraw product throughout the State.

H. C. Clark, 1014 Morton Street, Baltimore, has located at that address following the dissolution of the Motor Car Accessory Co. Several accessories, including Master Carburetor and Safety Vulcanizer, will be distributed throughout the State.

The United Auto Sales Co., a concern backed by several of Baltimore's leading men, has taken over the business of F. B. Donovan, Inc., and will handle the Studebaker line. The company will continue to maintain its office and showrooms in the Colonial Motor Car Bldg., 10 to 20 East North Avenue, and the service station will remain under their charge on Biddle Street, near Eutaw. Besides looking after Baltimore City, the new company will cover the territory in Baltimore, Harford, Howard, Anne Arundel and St. Mary's counties. Officers are: T. E. Straus, president; H. A. Mayer, vice-president and general manager, and W. E. Straus, secretary-treasurer.

Illinois News Items—A. Eisele, Rock Island, Ill., has purchased the stock of J. H. Bolte in the Union Motor Co., and will add a repair shop to the plant. He will be distributor of the Chevrolet car in Rock Island and adjoining counties.

The Modern Power Appliance Co., Rockford, Ill., was incorporated this week; capital stock, $5,000; incorporators, S. G. Smith, H. H. Rogers and W. D. Knight. Object, to manufacture and deal in automobiles, storage batteries and other supplies. A plant has been opened on North Main Street.

The Auto Starter Co., 168-172 North Halstead Street, Chicago, has been incorporated; capital stock, $2,500; incorporators, W. F. Millar, J. W. Diephouse and R. B. McKinney, to manufacture and deal in starters and other supplies for motor vehicles.

D. A. Heald and R. A. Snider, for a number of years mechanics with the Fisher & Raker garage, Canton, Ill., have decided to engage in business for themselves and have opened a new garage at 244 Van Buren Street, that city. They will carry a line of supplies and accessories in addition to a general repair business and battery and generator work.

Spokane, Wash., and Vicinity—The Foster-Larson Co., distributor for the Paige line in eastern Washington, has enjoyed an active business month during March. Jones and Smith closed for the agency for the Paige at Coulee City, Wash.; L. C. Densow took over the Paige agency at Krupp, Wash., and to the Enterprise Garage at Wilbur, Wash., went another Paige agency. The Ephrata Garage contracted for the same line at Ephrata, Wash.

Quaker tires have been introduced in Spokane by the McGowan Hardware Co., who have taken the agency for this line of tires for Spokane and the Inland Empire.

R. L. Strickle has been appointed secretary and treasurer of the Spokane Oldsmobile agency. Mr. Strickle was formerly of Winnipeg.

The AUTOMOBILE

Vol. XXXIV,
No. 15

NEW YORK, APRIL 13, 1916

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Vol. XXXIV New York—Thursday, April 13, 1916—Chicago No. 15

The AUTOMOBILE

Industry's Elevator Service

Standardization Means Greater Efficiency at Lower Cost—Scientific Research Work Required More Urgently—Dimensional Standards Still Most Important—Many Standards Used Universally

By A. Ludlow Clayden

Chairman S. A. E. Standards Committee

THE why and wherefore of standardization; the enormous value of standardization to industry and to individual has been explained many times. No engineering body has ever done so much standardizing work in so short a space of time as the Society of Automobile Engineers, and this is all the more remarkable because automobile standards have been particularly hard to create.

This is because the sort of standardization which has been necessary in the automobile field apparently comes much closer to the individual engineer and to the ultimate user of the machine than does almost any other sort. *Apparently* only, because we have become so accustomed to the simpler standards that we cease to recognize them as such. The world would find life difficult indeed without the standards of measurement, without pounds, feet and gallons. If every merchant had his own standards for these things, so that a pound was sometimes six ounces and sometimes sixty, a foot anything from three inches to a yard, it is easy to see the awful confusion that would ensue. So it is with many other things, and we are floundering in all kinds of confusion to-day simply because we do not realize that it *is* confusion.

Dipping into history it is shown that it was the presence of confusion and the realization of its existence that caused governments throughout the world to step in and establish standards of weight and measurement by enactment. The realization of the confusion led to its elimination. The process began far earlier than we have any record; there are traces of it in the dimly distant past of Egypt; the Phoenicians spread their system over wide tracts of the earth. Thus we have no record as to whether the first man who suggested standards was, or was not, regarded as insane.

Most Standards Are Modern

It is a surprisingly short time since the weight, measure and money standards used in Europe were really well applied, and the engineering standards that exist are quite modern. The U. S. standard screw thread and the British Whitworth standard thread are examples of early engineering standardization by legislation, but we still see three or four different wire gages in use, and it is only the world of science that has shown itself advanced enough to adopt a universal standard of weight and measure. The advance of democracy must eventually break down the absurdity of national boundaries to such things as this. That Continental Europe, Great Britain and America should employ three different systems is almost as ridiculous as though New York and Pennsylvania were each to set up standards of their own invention.

Governments move slowly and they are only just commencing to take engineering standardization seriously in hand. Meanwhile engineers are developing standards which they use by agreement, some, but not all of which, will become subjects for enactment in the course of time. It is not all standards that are suitable for legislation like weights and measures.

Essentials of a Standard

Standards divide into two main classes, scientific or fundamental standards and standards of custom or convenience, which are usually "dimensional" in nature. Thus weights and measures are standards of custom; there is no reason for the choice of any special unit; a convenient unit is taken and all the scheme of weight or measure erected upon it. Standard screw threads are a different matter. Here the desire is to choose a thread such that the strength of the thread and of the bolt will be equal quantities, which means that there is a fundamental reason for choosing definite dimensions.

Coming to automobile standardization we find that most of it existing is dimensional; the S. A. E. standards are mainly standards of custom and convenience. The S. A. E. standards:

1. Facilitate production.
2. Increase efficiency.
3. Decrease price.

These are the three essentials of a standard; if it does not do one or more of these three then it is a poor standard and of no value whatever.

Detail Requirements

Let us examine these three requirements in detail. To facilitate production, increase efficiency and decrease price is to increase the ease of buying, or, in the ultimate, to increase the ease of manufacture. A typical example of this sort of standard requirement is the case of carbureter flanges.

Originally each automobile engine designer when producing a new engine laid out what seemed to him

S. A. E. STANDARDS USED BY SEVENTY DIFFERENT FIRMS IN THE AUTOMOBILE INDUSTRY	Abbott-Detroit	Allen	Apperson	Autocar	Avery	Buick	Cadillac	Case	Chalmers	Chandler	Cole	Commerce	C-T-Co.	Denby	Dodge	Dort	Driggs-Seabury	Empire	Franklin	General Motors	General Vehicle	Gramm	Grant	Haynes	Hudson
Adjustable Yoke Rod Ends	X	X	X				X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
Plain Yoke Rod Ends		X	X					X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X
Eye Yoke Rod Ends		X	X				X	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X	X
Rod End Pins			X	X			X		X	X	X	X			X	X	X	X	X	X	X			X	
Spark Plugs	X	X	X	X	X		X	X	X	X	X	X		X	X	X			X	X	X	X	X	X	X
Screw Sizes to 1½ inches	X	X	X		X		X	X	X	X	X	X	X	X	X	X			X	X	X	X		X	X
Screw Tolerances	X	X			X					X	X	X	X	X	X				X	X		X		X	X
Screw Threads Above 1½ inches				X						X				X					X	X					X
Lock Washers	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Square Broached Fittings		X		X			X	X				X	X	X	X								X	X	X
Taper Fittings	X	X					X			X	X			X	X		X	X				X	X	X	
6-Spline Fittings		X								X	X	X	X						X				X	X	
10-Spline Fittings				X			X				X		X					X							
4-Spline Fittings	X									X				X					X			X	X	X	
Taper Fitting with Castle Nuts		X		X			X			X		X		X	X	X	X			X		X	X		
Solid Tires				X	X								X	X			X			X	X	X			
Truck Wheel Diameter					X								X	X			X			X	X	X			
Test of Rims															X										
Pneumatic Tire Sizes	X					X			X	X				X	X			X	X				X		X
Carbon Steels	X	X		X			X			X			X			X	X		X		X		X	X	
Screw Stock				X						X		X		X	X								X	X	X
Steel Castings		X							X	X			X			X					X				X
Nickel Steels		X		X	X		X			X			X	X							X			X	
Nickel Chrome Steels		X		X			X			X			X	X		X					X				
Chrome & Chrome Vanadium Steels	X						X			X									X						
Silico Manganese Steels							X						X	X											
Heat Treatments		X		X			X			X			X	X	X		X				X		X	X	
Babbitt Metal	X				X			X		X				X				X							
Bearing Metal, W. B		X								X			X	X				X							X
Phosphor Bronze		X												X	X						X			X	X
Brass Cast. Metals		X					X						X	X						X	X			X	X
Cast Manganese Bronze	X	X					X							X					X					X	
Manganese Bronze Sheets and Rods															X										
Hard Cast Bronze														X											

a good flange on the side of the cylinder block or the end of the manifold for the attachment of the carbureter. Without doubt all the hundreds of flanges thus designed were perfectly satisfactory; they all gave enough area for proper compression of the gasket; they all had provision for studs or bolts large enough to enable a tight joint to be made. Carbureter makers, however, had to make their instruments with a flange to suit every engine. Often when three or four engine makers wanted the same size of carbureter they also asked for each a different flange, slightly different only, as a rule, but different enough to force the carbureter maker to have special tools, special jigs and even special carbureter body castings for each customer. Nobody obtained any benefit from this state of affairs except the tool maker, and every carbureter produced cost just a few cents more because of the greater amount of money tied up in tool equipment.

So was it with the sizes of steel tubes, so with lock washers, so with the specifications for steel and many other things. The S. A. E. took the ideas of all the engineers, made comparison between them, and rearranged them in a proper series which would satisfy all requirements.

An Elevator Service

The difference between the situation before and after S. A. E. standardization may be visualized as the difference between a flight of steps and an elevator. In a building of twenty floors somebody wants to get to each floor, but nobody wants to stand halfway between two stories. The S. A. E. put in an elevator which would stop twenty times and cut out the necessity for 500 stairs, and nobody had any use for the stairs from that time on. Thus in creat-

Jeffery	Kelly-Springfield	Kissel	Knox	Koehler	Lexington-Howard	Locomobile	Marmon	Maxwell	Mercer	Modern	Moline	Mutual	National	Olds	Overland	Owen	Packard	Paige-Detroit	Peerless	Reo	Saxon	Service Motor Truck	Stearns	Stegeman	Velie	Vim	Ward	Wilcox	Winton	Anderson Electric	Milburn	Waverley	Beaver Mfg. Co.	Brown-Lipe Gear Co.	Ferro. Mach. & Fdry. Co.	Grant Lees Gear Co.	Herschell-Spillman Co.	Mechanics Mach. Co.	Northway Motor & Mfg. Co.	Peru Auto Parts Co.	Ward-Leonard Elec. Co.	Waukesha Motor Co.
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ing standards all that is necessary is to make sure that the elevator misses no floor and does not stop between any of them.

Now, the carbureter flange standard, the steel specification standards, the lock washer standards and many others were found by examining what was being done and then finding a series which would give the same results with fewer detail variations. These are standards based on practice or empirical standards.

Heavy Work Ahead

There are other matters which the S. A. E. has to consider which are more closely allied to the screw thread standard, in that they have but small reference to practice and are principally dependent upon fundamental principles. As time goes on the dimensional standards will become matter of course. It was necessary for the originators of the idea to prove that there was advantage in having a standard series of carbureter flanges, but there is no need to argue about the advantages of a standard speedometer drive connection or about the desirability of standard mountings for electric generators or starting motors.

Leads to the Laboratory

Thus the development of standardization work by the S. A. E., or any other engineering society, for that matter, leads inevitably to the laboratory, to the setting up of fundamental standards based upon scientific first principles.

Of such subjects the most important at present in hand is the question of lamp design. It is known that some headlights give good light with little glare, some give good light with much glare, some give little light with too much glare. To take all the lamps on the market and strike an average of their

S. A. E. STANDARDS USED BY SEVENTY DIFFERENT FIRMS IN THE AUTOMOBILE INDUSTRY	Abbott-Detroit	Allen	Apperson	Autocar	Avery	Buick	Cadillac	Case	Chalmers	Chandler	Cole	Commerce	C-T-Co.	Denby	Dodge	Dort	Driggs-Seabury	Empire	Franklin	General Motors	General Vehicle	Gramm	Grant	Haynes	Hudson	Inter-State
Gear Bronze														X							X					
Aluminnm Alloys	X	X					X			X				X	X						X			X	X	
Brass Sheets and Strips							X						X	X												
Brass and Tobin Bronze Rods															X											
Non-Ferrous Metal Tubes	X						X																			
Steel Tubes		X	X	X		X	X		X	X		X	X	X	X			X			X		X	X	X	X
Bands and Strips	X			X						X				X	X							X			X	
Pleasure Car Frames		X									X				X											
Ball Bearings	X	X		X		X	X		X	X		X	X	X	X			X		X	X		X	X		
Carbureter Flanges	X	X		X	X	X		X	X	X	X			X			X	X		X			X			X
Flared Tnbe Unions	X	X	X	X	X			X	X	X	X	X		X			X			X		X	X	X	X	X
Gasoline Pipe Sizes	X		X	X	X		X	X	X	X	X			X	X	X	X	X				X	X	X	X	X
Flared Tube Ells and Tees	X	X	X		X				X	X	X	X		X	X		X			X		X	X	X	X	X
Throttle Levers	X			X										X	X										X	X
Magneto Dimensions		X	X	X	X				X	X		X		X	X			X		X				X		X
Electric Bnlb and Base Dimensions	X	X				X	X			X	X		X		X			X	X		X	X	X	X	X	
Bulb Voltage Size and Refl. Labels	X	X					X			X	X				X			X	X					X	X	X
Three-Speed Gearshift	X	X					X		X	X	X			X			X							X	X	X
Four-speed three-slot shift																										
Four-speed two-slot sbift																										X
Oversize Cylinders		X								X	X			X									X	X		
Storage Battery Directions	X	X					X		X	X	X			X	X				X					X	X	
Insulation Requirements	X						X			X	X				X				X							
Dimensions of Lead Batteries		X									X			X	X								X		X	
Ratings of Lead Batteries							X		X		X				X								X			
Additional of Elec. Appliances	X						X				X			X					X				X			
Ground Return	X						X		X		X			X	X								X		X	
Test of Insulation Materials							X				X				X										X	
Fuse Dimensions									X	X													X			
Leaf Spring Nomenclature		X		X		X	X		X	X			X	X	X				X		X	X	X		X	
Center Bolts	X					X		X		X										X						
Spring Leaf Points	X						X		X	X		X			X										X	
Engine Test Forms Vol. III		X												X											X	

optical dimensions would be useless. It would result in the production of a series of lamps of indifferent lighting quality and would certainly not increase efficiency, even if it decreased cost a little and facilitated production. Thus empirical standardization in this matter of lighting would not fill all three requirements and would not be of much value.

Accuracy Most Important

To get a standard that will be of use, necessitates careful laboratory work to decide, in exact terms, the effect of varying proportions in the filament of the bulb, in the curvature of the reflector, in the relation between the two, and so on. It is a far more difficult proposition than the empirical standard. First the tests must determine the ideals, and then investigation must show how close to those ideals we can get.

Another question now being considered which is of a similar nature is that of standard sizes for the drills to be used previous to tapping. Science calls for a perfect standard thread and practice cannot give it. Careful experiment is needed to determine the size of drill that will give the best thread in different materials so, though this is not theoretical work, it is work where the average of practice as it exists may have little relation to what that practice ought to be.

There are very many other things of a similar sort and, as the society grows in strength and in wealth, more and more of them will be taken up. In passing it may be remarked that the British Institution of Automobile Engineers has just commenced an investigation of steel standards for British use which will absorb a $10,000 grant from the British manufacturers' association.

The dimensional standards, however, remain the most important at present before the Standards

Jeffery	Kelly-Springfield	Kissel	Knox	Koehler	Lexington-Howard	Locomobile	Marmon	Maxwell	Mercer	Modern	Moline	Mutual	National	Olds	Overland	Owen	Packard	Paige-Detroit	Peerless	Reo	Saxon	Service Motor Truck	Stearns	Stegeman	Velie	Vim	Ward	Wilcox	Winton	Anderson Electric	Milburn	Waverley	Beaver Mfg. Co.	Brown-Lipe Gear Co.	Ferro. Mach. & Fdry. Co.	Grant Lees Gear Co.	Herschell-Spillman Co.	Mechanics Mach. Co.	Northway Motor & Mfg. Co.	Peru Auto Parts Co.	Ward-Leonard Elec. Co.	Waukesha Motor Co.
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Committee, for dimensional work based on existing practice is well advanced, while the scientific procedure is but beginning. There are now in hand fifty different things on which work is being done actively, and another fifty concerning which information is being collected. Outside this formidable list there are many other subjects that have been suggested and are not yet taken up; in fact, each day almost brings some new standardization proposal to the S. A. E. office.

24,000 Hours of Work

To-day the Standards Committee has 120 members and thirteen divisions; each member puts in an average of well over 50 hr. a year in division meetings, added to which are the general meetings of the Standards Committee and of the society as a whole. Thus the total of time given per year by each member of the committee is not less than 100 hr. The division chairmen and members entrusted with research work give much more time than this. Multiplying 100 by 120 gives a grand total of 12,000 hr. of work, and allowing for the special work done outside the meetings, for the work of the honorary officials and that of the staff of the society, this total will certainly not be less than doubled. Eight into 24,000 goes 3000 times, which means that the Standards Committee members do as many hours of work in a year as one man could do in 10 years working in a regular way.

The S. A. E. has lately been collecting information from the industry as to the actual application of the S. A. E. standards. A request was made to a number of manufacturers that they would state which of the long list of standards were employed in their products. The first results of the canvass appear on pages 666 to 669 and are worthy of special study. One or two points, however, must not be overlooked in reading this tabulation properly. First, it must be remembered that all of the standards cannot apply to one product; a passenger car does not use solid rubber tires, for example, nor does a transmission manufacturer require spark plugs. Secondly, it has been shown that several of the firms who appear to be making less extensive usage of the standards do not really know how many standards they employ. Some of the car assemblers, for example, are not fully informed as to the standards employed in making the transmissions or motors which are fitted to their chassis.

Wide Use of Standards Encouraging

On the other hand, the very wide use of standards by firms making complete vehicles is very striking. In some ways standardization is likely to be more valuable to the assembler than to the manufacturer of complete cars, or would seem so to be, but a glance at these records shows that this view is a wrong one. Another interesting thing is to follow the horizontal lines and see thereby the universality of many standards. There is no need to specify them here; the table itself gives sufficient conspicuousness to each.

Standardization began in a small way with the S. A. E. and ever since it has been the aim of every man who came into direct contact with the work to do his best to help speed up. The more that is done the more there remains to do.

Standards Committee of the S. A. E. for 1916

A. Ludlow Clayden, Chairman

Ball and Roller Bearings Division

Chairman, F. G. Hughes, New Departure Mfg. Co.
George R. Bott, Norma Co. of America.
C. H. Clement, Bock Bearing Co.
David Fergusson, Pierce-Arrow Motor Car Co.
F. M. Germane, Standard Roller Bearing Co.
B. D. Gray, Hess-Bright Mfg. Co.
F. J. Jarosch, Bearings Co. of America
R. S. Lane, Hyatt Roller Bearing Co.
C. W. McKinley, Willys-Overland Co.
W. R. Strickland, Peerless Motor Car Co.
M. W. H. Wilson, Cadillac Motor Car Co.

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C. P. Grimes, National Motor Vehicle Co.
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R. H. Combs, Prest-O-Lite Co.
W. H. Conant, Gould Storage Battery Co.
Frank Conrad, Westinghouse Elec. & Mfg. Co.
Russell Huff, Dodge Bros.
Leonard Kebler, Ward Leonard Elec. Co.
T. L. Lee, North East Electric Co.
A. D. T. Libby, Splitdorf Elec. Co.
W. E. McKechnie, Cadillac Motor Car Co.
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R. J. Nightingale, Willard Storage Bat. Co.
H. G. Osburn, National Metal Molding Co
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Electric Vehicle Division

Chairman, Arthur J. Slade, Consulting Engineer
J. R. C. Armstrong, General Vehicle Co.
H. S. Baldwin, General Electric Co.
Alex. Churchward
W. H. Conant, Gould Storage Battery Co.
R. S. Fend, Woods Motor Vehicle Co.
Bruce Ford, Elec. Storage Battery Co.
John H. Hertner, Rauch & Lang Carriage Co.
Wm. P. Kennedy
Robert McA. Lloyd
E. J. Ross, Jr., Edison Storage Bat. Co.
F. A. Whitten, General Motors Truck Co.
E. R. Whitney, Com. Truck Co. of America
E. P. Chalfant, Elec. Auto. Mfrs. Assn.

Iron and Steel Division

Chairman, K. W. Zimmerschied, General Motors Co.
A. W. Copland, Detroit Gear & Machine Co.
Radclyffe Furness, Midvale Steel Co.
H. L. Greene, J. H. Williams & Co.
Rex Johnson, Studebaker Corp.
Z. B. Leonard, Perfection Spring Co.
J. A. Mathews, Halcomb Steel Co.
Geo. L. Norris, American Vanadium Co.
J. H. Parker, Carpenter Steel Co.
C. F. W. Rys, Carnegie Steel Co.
H. G. Stoddard, Wyman & Gordon Co.
Henry Souther, Ferro Mach. & Fdry. Co.

Miscellaneous Division

Chairman, John G. Utz, Perfection Spring Co.
Clarence Carson, H. W. Johns-Manville Co.
James E. Dismond, Aluminum Castings Co.
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W. A. Frederick, Continental Motor Mfg. Co.
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C. B. Veal, Purdue University

Springs Division

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Geo. C. Brainard, Hydraulic Pressed Steel Co.
C. E. Clemens, Perfection Spring Co.
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Chairman, Wm. P. Kennedy, Consulting Engineer
W. H. Allen, B. F. Goodrich Co.
B. B. Bachman, The Autocar Co.
Geo. D. Carpenter, The White Co.
H. D. Church, Packard Motor Car Co.
C. E. Clemens, Perfection Spring Co.
J. E. Hale, Goodyear Tire & Rubber Co.
John Younger, Pierce-Arrow Motor Car Co.
Russell Hoopes, Hoopes Bros. & Darlington, Inc.
Robert McA. Lloyd, Consulting Engineer
C. T. Myers, Timken-David Brown Co.
A. C. Schulz, Locomobile Co. of America
Harlow W. Waite, Revere Rubber Co.
E. R. Whitney, Commercial Truck Co. of America

Chain Division

Chairman, F. L. Morse, Morse Chain Co.
Warren J. Belcher, Whitney Mfg. Co.
John R. Cautley, Peter A. Frasse & Co.
Herbert F. Funke, H. F. Funke & Co.
J. C. Howe, American High Speed Chain Co.
H. Shipper Pierce, Link Belt Co.

Engine and Transmission Division

Chairman, W. T. Fishleigh, Univ. of Michigan
A. W. Copland, Detroit Gear & Mach. Co.
L. C. Fuller, Fuller & Sons Mfg. Co.
W. A. Frederick, Continental Motor Mfg. Co.
E. G. Gunn, Northway Motor & Mfg. Co.
H. L. Horning, Waukesha Motor Co.
A. F. Milbrath, Wisconsin Motor Mfg. Co.
W. T. Norton, Jr., Selden Motor Vehicle Co.
W. R. Strickland, Peerless Motor Car Co.
Herbert C. Snow, Winton Motor Car Co.
F. A. Whitten, General Motors Truck Co.

Foreign Co-Operation Division

Chairman, A. Ludlow Clayden, Class Journal Co.
W. H. Allen, B. F. Goodrich Co.
C. C. Carlton, Firestone Tire & Rubber Co.
J. E. Hale, Goodyear Tire & Rubber Co.
B. Martini, Fiat Co.
John Pugh, Rudge-Whitworth, Ltd.
Harlow W. Waite, Revere Rubber Co.

Nomenclature Division

Chairman, K. W. Zimmerschied, General Motors Co.
H. E. Coffin Hudson Motor Car Co.
A. Ludlow Clayden, Class Journal Co.

Automobile Electricity

Locating and Curing Troubles

Part II

Tracing Trouble in the Starting and Lighting System by Symptoms—Short Cuts in the Process of Elimination by Noting Superficial Indications

By J. Edward Schipper

TO detect electrical troubles the infallible rule is:
First—Study the symptoms.
Second—Make the diagnosis.

Since the starting and lighting systems can each be regarded as independent two main divisions are immediately suggested. They are:

A—Troubles in the lighting system.
B—Troubles in the starting system.

Improper Lighting Operation

Improper lighting operation is indicated in three ways:
Case 1—Engine stopped—lights out or dim.
Case 2—Engine running—lights out or dim.
Case 3—Some lamps bright—others dim or out.

CASE 1—Taking up Case 1 with engine stopped and lights out or dim there are two possibilities: A—Battery discharge due to some failure in the battery circuit or in the battery itself or, B—Open circuits in the wiring system.

A-Battery Discharge

Battery discharge as a symptom immediately suggests short circuit. This may be in the wiring of the lamps and their fittings, in the battery, in the circuit breaking or regulating mechanism or in a grounded generator. In fact, almost any part of this circuit is susceptible.

Lamp Shorts—The connections at the lamps sometimes give short-circuits due to poor taping causing bare wires to touch each other. Other things to look for in the lamp connections are loose strands of multi-strand wire bridging across the lamp terminals, grounding of the lamp sockets on the reflector or other lamp parts, defective sockets or other bare wires touching parts of the lamps due to chafing against the lamp or bad insulation.

Switch Shorts—At the lighting and starting switches grounds may be due to bad connections at the switch or a defective switch. Short-circuits at connections in the switch come from bare wires which touch each other, loose strands in multi-strand wires bridging across the terminals, or bare wires touching parts of the switch. Defective switches may have short-circuits in the working parts or through some condition of construction or mounting may be grounded.

Connector Shorts—Short-circuits in the connectors can be traced to either faulty wiring connection or defective connectors. The faulty wiring may have allowed bare wires of opposite sign (*i.e.* plus or minus) in contact, loose strands of wire across terminals or wire connections in contact with metal frame or body giving either a short or ground. Defective connectors have an internal short-circuit which can be readily detected by substituting a perfect connector.

Wire Shorts—Defects in the wire itself are due to bare wire caused by rotted insulation, worn insulation or poor connections. Where wire passes through metal parts the chafing must be noted. A ground to metal parts of the car may be due to worn or rotted insulation or by some metallic connection cutting through the wire insulation.

Battery Shorts—Battery short-circuits may be internal or external. If they are internal the battery itself may be worn out, the plates warped or buckled or a collection of sediment at the bottom of cells due to disintegrating plates although the latter is rare because of the height of the plates above bottom of jar.

External battery short-circuits may be due to acid on the top of the battery forming an electrolyte between terminals; battery terminals sulphated or in contact with top of metal battery box or battery wire connections acid soaked.

Circuit-Breaker Shorts—Circuit-breaker short-circuits may be due to the contacts being held closed by reason of being dirty or worn by a reversal of generator or battery wire connections or by a kick-back of the engine. The circuit-breaker might be grounded also due to defective insulation. A circuit-breaker short allows current to discharge battery through generator at less than charging speeds. After a long run at high speed lights would operate.

Synopsis

Part I—Last Week

¶ *Three fundamental thoughts were established in the first part of this electrical series.*

¶ *First: Continuity of which the circle is the symbol. Electricity flows in a circle or circuit. The circle must be complete.*

¶ *Second: The basic law of current flow. In order that this should exist there must be sufficient voltage.*

¶ *Third: Trouble testing by elimination. The electric circles are divided into a number of arcs by bridging across and these arcs are gone over one by one. These three principles are applied to the lighting, starting and ignition circles.*

Part II—This Week

¶ *Finding trouble by symptoms in starting and lighting systems. Classifying these and indicating the possible troubles for each set of symptoms.*

Part III—Next Week

¶ *Locating troubles by units in starting and lighting. Knowing the unit in which the trouble exists, the possible locations and causes are given in detail.*

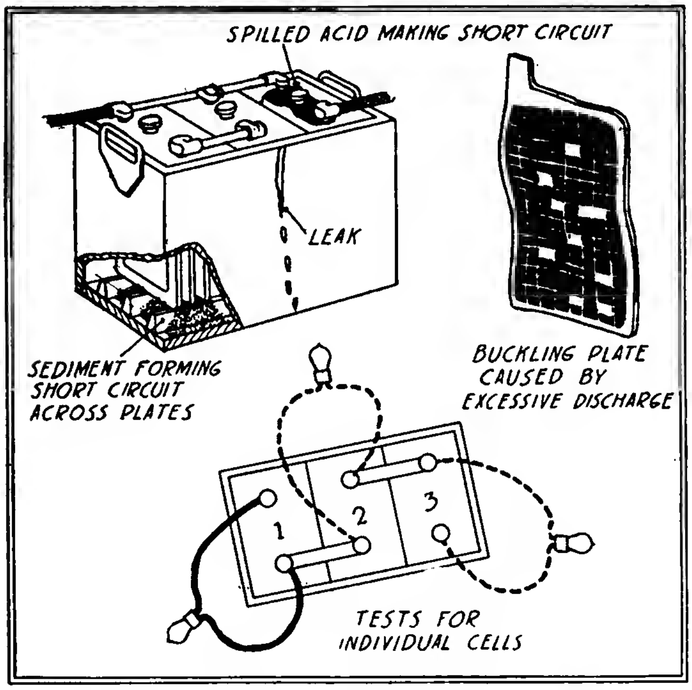


Fig. 1—Some common battery troubles and a simple battery test

A grounded generator can be caused by an accumulation of dust worn from the brushes or a defective insulation of the armature or field coils, located by examination.

A discharged battery can also be due to an overload on the starting or lighting system which may be caused by the leakage of current from short-circuits or grounds as described, by increasing the lamp load through the adding of higher candlepower or lower efficiency lamps, by adding additional apparatus to the lighting system, by the improper operation of the starting motor or by burning the lamps much longer than normal. A discharged battery can also be due to mishandling in winter storage or injured plates or cracked cells.

B—Open Circuits

Open circuits are caused by some breakage of wire or contact throughout the current path. They form a break in the electric circle. Loose connections or sulphated battery terminals should be looked for first. Points especially to be noted are switch terminals, lamp connector terminals and lamp sockets. Burned-out unscrewed bulbs are the most common open-circuit troubles. In connectors look for dirty contact points or no tension in the plunger springs. Bulb bases may not make good contact in lamp sockets or in the switch poor contact may be made. Broken wire at points subject to vibration or where joints have been made is a common open circuit trouble. When the points separate in a contact breaker a wilful open circuit is made. When they will not close at charging speed it should be remedied.

Engine Running, Lights Out or Dim

CASE 2—With the engine running a common ground of trouble with the conditions that obtain when the engine is stopped is in short-circuits. These should be traced in the same manner as outlined above.

Troubles in the Generator

Generator troubles fall under this general head and for this reason it is created. They may be classified under the following heads. Mechanical, field magnets weak, armature winding, commutator brushes and holders, governor, circuit-breaker and regulator.

Mechanical—Under the mechanical head the commutator may be omitted as it is discussed separately. The first cause of trouble is in faulty lubrication which has caused worn bearings allowing, frequently, the armature to strike against the pole pieces. The other cause of trouble is over-lubrication which generally results in rotted brush lead insulation causing a short-circuit or ground at the commutator. Other troubles are electrical, broadly speaking, as well as mechanical.

Fields—Weak field magnets will vary in cause according to whether the magnets are permanent or wound. In permanent magnets the cause is generally due to exhaustion through long use, no keeper used when removing them or magnets reversed when re-assembled. In wound magnets shunt field coil or coils may be grounded due to a water-soaked generator or short-circuited through burning out by running the generator with the battery disconnected. They may also be water-soaked or oil-soaked.

Armature—Armature windings may be burned out or grounded. When burnt out the trouble may be due to a current overload due to improper regulation, a soaked winding or a steady and prolonged return flow from the battery due to failure of the circuit breaker contact points in opening. A grounded armature winding is due to defective insulation.

Commutator—Commutator troubles can be divided into two heads. First, those due to defective manufacture and those due to surface wear or deterioration in service. Defective commutators may be grounded, have a short-circuit between their segments or have loose segments and are generally denoted by sparking at the brushes. Those that have deteriorated in service show a rough or blackened surface due to the following causes: Sparking from worn or short brushes, sparking on account of high mica, cheap brushes, oil collection on commutator surface, loose copper segments, poor contact between brushes and commutator generally due to sticking holders, or poor contact due to weak brush spring pressure.

Brushes—Faults in brushes and brush holders can be classified into five divisions, namely, grounded, poor spring tension, sticking in holder, poor fit to commutator surface and over-heating holders. When grounded it is due to de-

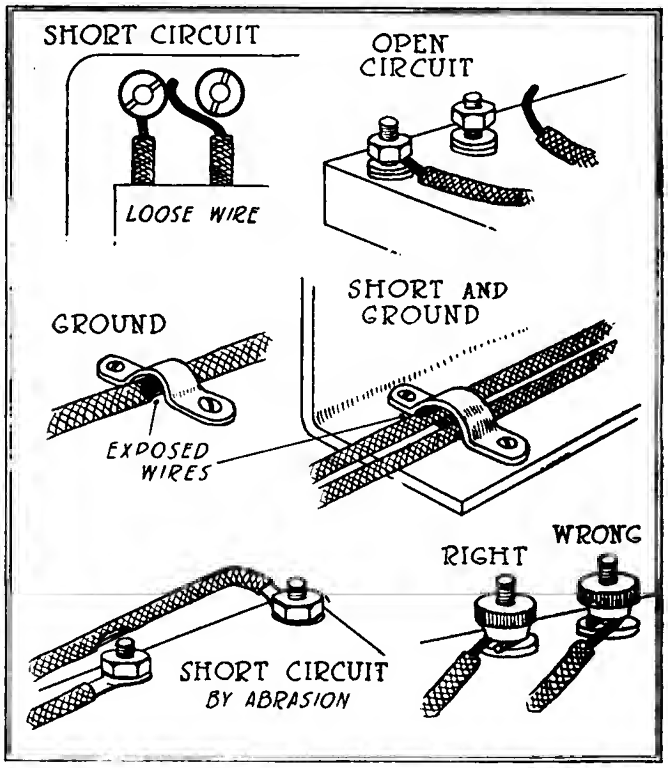


Fig. 2—Typical examples of short and open circuits and grounds

fective insulation or dust deposit. When spring tension fails the brushes are worn too short, the tension is not adjusted or has been thrown out due to heat, or the springs themselves may be broken. When the brushes stick it may be due to binding or from dirt and grease. When the brushes do not fit the commutator surface it is a matter of manufacture. Over-heating brush holders are caused by the sparking of poor brushes or no brush lead connection.

Governor—Generators which have a slipping clutch or governor form of regulation may have troubles in the governor due to a mechanical break, disintegration of weights where lead or other soft metal is used, or a defect between the brake shoes and drum due to a collection of grease or a worn shoe.

Circuit-Breaker—In the circuit-breaker or main contact, as it is often called, there may be a direct mechanical break, a burned-out coil due to current overload or a ground due to defective insulation, a bad adjustment which does not allow the generator to cut in at all or if so at an improper speed or the contact points may be sticking. The latter is due to a mechanical break, disintegration of weights where worn out or dirty contact points, reversed wires at the generator terminal or a backfire of the engine.

Open Circuits with Motor Running

Again under the main head of no lights or dim lights, with the engine running, there is a group of troubles which can be classified under the general head of open circuits. There are eleven of these which are prominent: 1—The generator terminal connections may be loose or making poor contact; 2—The wire connections to the switch may be defective; 3—Defective wire connections to connector terminals; 4—Lamp socket terminals disconnected or loose; 5—Burned-out bulbs; 6—Halves of connectors do not make contact; 7—Bulb bases out of contact with lamp sockets; 8—No connection between lighting switch terminals; 9—Broken wires especially at taps; 10—Joints or places subject to abrasion and 11—Defective connections at the lamp sockets.

Some Lamps Bright Others Out or Dim

CASE 3—Local troubles under the general head of lights dim or out when engine not running, should be first sought for in a partly-discharged battery. When the engine is running, in addition to the partly-discharged battery the circuit-breaker or generator troubles above outlined should be drawn over. If one or more lamps are unsteady and flicker the circuit-breaker troubles should be gone through, the lamp filament may be broken making and breaking contact or a poor contact in the lighting switch, connectors or lamp sockets. With some of the lamps bright and others dim, the circuit on the dim lamps may have a partial short or the troubles explained above for switches, connectors and lamp sockets should be gone through. In single wire installations a ground should be searched for; the bulbs showing dim may be intended for higher voltage, or the bulb may be blackened due to being nearly burned out.

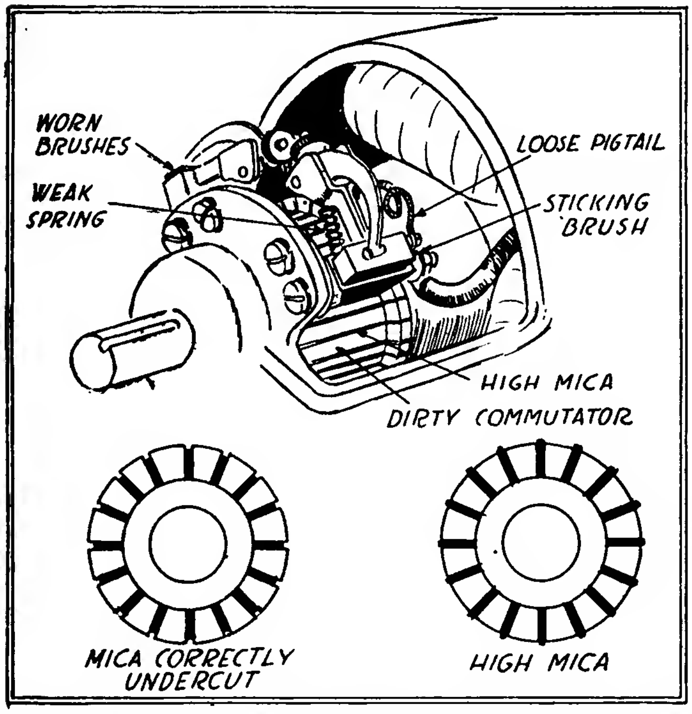


Fig. 3—The commutator assembly and some of its common troubles

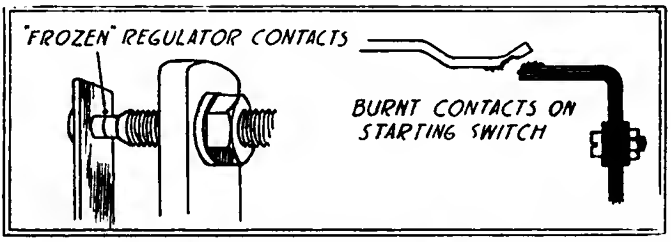


Fig. 4—Two troubles which are not infrequent in lighting and starting systems

Starting Troubles

TROUBLES in the starting system are indicated in two ways: First, the starter will not crank the engine at all, or second, it cranks it so slowly that proper starting is not given. The first thought in either of these cases is that the battery may be partly or completely discharged or it may be operating at very low efficiency due to very cold weather or some other cause.

Coming back to the general head of when the starting motor will not crank the engine at all there are two causes, open circuits and short-circuits or grounds.

Open Starting Circuits

Open circuits on the cranking motor will be found at the brushes, in loose connections at the commutator starting switch or in the wiring. If at the brushes they may be worn too short or improperly adjusted. They may also stick in the holders due to binding or dirt. Loose connections are obvious, the commutator troubles are the same as those described for generators, the starting switch trouble is nearly always a failure of switch blades to make contact. Sometimes the switches are fused owing to arcing.

Shorts in Starting Circle

Under the head of short-circuits and grounds, these can be divided under the general heads of those in the armature, those in the wiring and those at the starting switch. In the armature or field winding of the motor these may be either burned out or grounded. In the wiring a short-circuit may exist due to rotted or worn insulation or a ground from rotted or worn insulation or from metal screw or cleat connections which cut through the insulation making a ground to one of the metal parts of the car. In the starting switch either a ground or short-circuit may be found due to water soaking or otherwise defective insulation.

Starting Motor Cranks Too Slowly

After the battery condition has been looked after and the starting switch examined for poor contact, the remaining source of trouble is due to a drop in potential caused by a high resistance in the starting circuit. The brushes may not fit the commutator or have proper spring tension or may be poor, giving high resistance. The brush leads may also give poor contact. The same commutator troubles applying to the generator may exist or there may be loose connections in the starting motor wiring which can be sub-divided under the same general heads as the generator troubles.

Shall the Differential Be Abandoned?

Experiments on Trucks and Passenger Cars Show That Eliminating the Balance Gear Is Beneficial in Several Respects—Comparative Tests To Prove the Case

By A. Ludlow Clayden

THE necessity for a differential to allow a corner to be turned without slipping either of the driving wheels has only recently been questioned with respect to automobiles, although street cars and locomotives have always been made with plain, solid driving axles. To-day it seems possible that we have for years been laboring under a delusion, in so far that experiments are showing vehicles without differentials to possess certain distinct advantages.

In 1913 automobile engineers were much interested by the elimination of the differential from the Sunbeam racing cars, and in the races of that year in Europe these machines showed a good tire economy, while the drivers commented upon the remarkably steady steering at high speeds. In 1914 the Sunbeam company abandoned the scheme, giving as the reason the fact that a blowout at high speed on a rear wheel made the steering hard, was actually dangerous in fact.

Meanwhile several small cars appeared on the European market without differentials, notably the Mathis designed partly by E. Bugatti, and the baby Charron. These little cars proved just about the same from the viewpoint of tire wear as though they had the differential, they exhibited slightly less tendency to skid when driving, and much less when braking, while they were exceptionally easy to steer at speeds of 50 m.p.h. Moreover, a blowout did not seem to disturb the steering within the speed range of which the little cars were capable. The most prominent disadvantages were that care had to be taken to use identical tires on both rear wheels, since if one were a trifle larger than the other the tread soon became rough and chafed on the larger casing; and that the cars were difficult to push by hand except in a straight direction. With little cars usually kept in cramped quarters this was a real disadvantage to many owners.

At the outbreak of war this no-differential experiment in the light car world was being watched with great interest, but, of course, nothing has been done since August, 1914.

Truck Tests Made in America

During the past year in America experiments have been made beginning at the other end of the scale, on a series of large motor trucks instead of on light cars. Also there are on the market several substitutes for the differential gear designed to limit the extreme freedom of action which is the differential's worst fault. The most instructive of the tests are those now being made by the Fifth Avenue Coach Co. on several of the buses which are running on routes in New York City, these tests having been commenced at the instigation of A. M. Laycock, chief engineer of the Sheldon Axle & Spring Co.

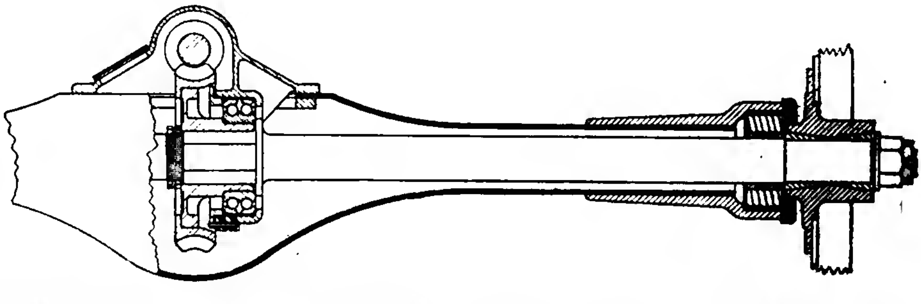
Last fall the differential gear was taken out of one of the buses, the two halves of the casing being locked together, and care was taken to preserve this as a strict secret, none of the drivers being informed.

Concerning the performance of the bus the chief engineer of the company, G. A. Green, reports two things of special importance. The first is that the bus was not troubled in any way by the winter snows, though these caused considerable delay and difficulty with many others, and the second is that the wear on the tires appears to be less than normal. Since the differential was removed the distance run is well over 31,000 miles and the original rear tires lasted 15,495 and 16,000 miles respectively. At the time of their removal they were still a little over half an inch larger in diameter than the limit, there being 1¼ in. of rubber left instead of ⅞ in. This mileage compares well with the average for the buses, as that is about 11,000 miles, but Mr. Green points out that the results are inconclusive because such large variations are noticed in tire durability. He considers it will be necessary to wear out six or seven sets of tires before the tire wear can be estimated properly. It is, however, some small confirmation of the durability shown in the first set, to learn that the second pair of tires are still in operation and are approaching the mileage given by the first pair.

As regards liability to skid this seems to be about the same, except when braking, when it is less, and the only comment the driver had to make of an adverse nature was that the bus seems sluggish on making sharp turns, requiring more throttle opening than usual. Several other buses are now being converted and will be run throughout the present year, Mr. Green hoping to decide the matter completely by next winter.

The most attractive feature of a differentialless axle from the engineer's viewpoint is the opportunity it affords for saving weight. In the experiments made thus far, ordinary axles have been used with the differentials filled with lead, or with the drive shafts taken out and a single shaft, solid from end to end, inserted in their place. If designing an axle to operate without a differential, however, it would be possible to use a shaft strong enough to carry the weight as well as taking the drive, which would mean that the casing for the worm gear would only need to be strong enough to support the driving stresses and would have no weight-carrying function.

In addition to the bus experiments, the Sheldon company has sent out a number of axles without differentials to different parts of the country, and is getting most encourag-



Sheldon worm driven axle with single solid drive shaft replacing the original differential ing reports from the Middle West and parts where trucks are used largely on sand roads. In loose gravel the absence of the differential may easily make all the difference between ability to proceed and complete stalling. The results of these experiments are also being watched with care, so that much valuable data should be available in a few months.

At first thought the idea of removing the differential sounds absurd, and the first anticipation is that the chafing action on the tires would be very bad, but when the matter is examined in detail the question of tire wear is easily explained.

Slip on Sharpest Turn

For example: The sharpest turn made by an automobile in service is of about 20 ft. radius, and very few turns are made as sharp as this, the majority of deviations from the straight line being of 100 ft. or more in radius. Taking the extreme case, imagine a vehicle with 34-in. tires making a turn at 20 ft. radius. Turning through a right angle the inner wheel will be 20 ft. from the center of turning and the outer wheel 24 ft. 8 in., so the distance traveled by the inner wheel in making the turn will be 15.7 ft. and that covered by the outer wheel 19.3 ft. Now the 34-in. wheel covering these distances will, if rolling freely, make 1.76 and 2.16 revolutions, the difference being 0.4 revolution. It is still a moot point as to which wheel does most of the slipping, under these circumstances, but it is safe to assume that it will be mainly the inner wheel. This slipping, of course, causes some wear.

Action When Braking

Turning to the other case, where a differential is fitted, it is not possible to calculate the slip, but every time a rear wheel passes over a bump and so leaves the road for an instant it is slightly accelerated and is slowed down again by friction when it returns to the road. The amount of acceleration is very small, but what makes the big difference is that the slipping caused in this way is going on during the whole time the vehicle is running, whether straight or on turns, whereas the solid axle causes slipping on turns only and prevents the acceleration effect. If one wheel is off the ground, the other being in contact with it maintains the speed of revolution of both wheels constant.

The reason that the solid axle reduces the tendency to skid when braking is that either rear wheel must continue revolving if the other is turning. If one wheel rests on a wet patch and the other is on dry road, that on the wet can be made to lock by a light application of the brake. Directly a wheel ceases to revolve and begins to slide it is useless for controlling the direction of the vehicle, it merely takes the path along the road which offers the least resistance, and variations in the condition of the surface cause the locked wheel to try to follow a tortuous path. If the other wheel is locked also the rear end of the vehicle will have no sense of direction, whether the axle has a differential or whether it has not. When one wheel is locked and the other, being on dry road, is not locked, then the latter is liable to be pulled out of its path by the gyrations of the former, but when both turn together, at the same speed, as they must do with the solid axle, then both keep their sense of direction and maintain the straight course. It is easy to see why the solid axle enables snow or sand to be taken without trouble, and the braking question is merely a reversal of the same argument.

The ideal, of course, all other things being equal, is to have a differential for making sharp turns and not to have one for 99 per cent of normal running. Thus there is a great deal to be said for a modified mechanism which will strike a mean between the two extremes. Whether the solid axle, or a modified differential comes to be accepted practice, or whether the old differential will emerge from the time of trial in unaltered form is a matter for speculation, but it appears that 1916 will stand out in automobile engineering as the year when the differential question was settled.

Improving on the Cotter Pin

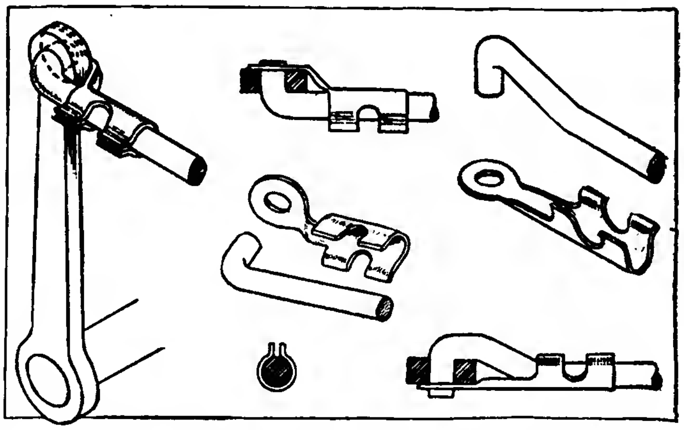
New Device for Securing Rod Ends Simpler and More Effective Than Old Method

It is seldom that any new invention affects the simpler mechanical devices. Only at rare intervals does anyone discover a better way of doing some very simple thing than the way that has been used for years. A novelty which will replace the cotter pin for many of its applications; which is more effective and no more costly is thus an invention of no small importance, as it cannot fail to find a scope of application far exceeding the automobile industry.

Such a device patented by C. S. Pelton of the Perfection Spring Co., Cleveland, Ohio, is now being put on the market by the Burns & Bassick Co., Bridgeport, Conn. Primarily the "Pelton clip" was designed to connect the throttle-operating rod to the throttle lever. The usual method is to bend over the end of the rod, drill it and place it through the lever hole, afterward putting in a cotter pin. The Pelton clip dispenses with the drilling, guards against rattle, is equally cheap and is easier of application.

The illustrations render the idea perfectly clear. The clip is made from sheet steel, punched from strip and with the tongues bent up into a nearly parallel position. To apply it, it is simply put in place and the ends of the tongues brought together with a pair of pliers. The end of the clip can be set to take a bearing against the throttle lever, so preventing rattle, and the clip is easily detached by opening the tongues with a screwdriver. As shown, there are two patterns, one with the clip bent out to clear the lever end, and the other, a straight clip for cases where the end of the rod is cranked.

Of course, the throttle application is far from being the only one. Throughout a chassis there are many other places where the Pelton clip is greatly the superior of a cotter pin, and in agricultural machinery there is an enormous field.



Pelton clip in straight and cranked form. Note the end view which shows lips which are closed by pliers or separated by screwdriver for detaching the clip.

Motor Trucks and Trailers Aid Mexican Expedition

The above illustrations give some idea of the thoroughness with which the army authorities have gone about securing sufficient motor transport for men and supplies on the punitive expedition of American troops pursuing the Mexican bandit Villa.

1—Enlisting men for the chauffeurs' division. Applicants are always more numerous than the positions to be filled. All are eager for a trial.

2—One of the heavier types of Troy trailer used for the more weighty supplies.

3—A Jeffery quad loaded with general supplies for the army at the front, rations, tents, ammunition, etc.

4—A new Jeffery quad stocking up with gasoline directly from the tank car.

5—Ford ambulance with two stretchers, one placed above the other on the side opposite the driver. This car also draws a trailer carrying two stretchers.

6—Twenty-three of twenty-eight Packard light service trucks ready for shipment fourteen hours after the second order was received from Washington for trucks for army service in Mexico.

Burman Killed in Corona Grand Prize

Car Overturns at 100 M.P.H.—Mechanic Killed—Others Injured

The late Robert Burman

CORONA, CAL., April 8—Robert Burman, celebrated as Wild Bob throughout the world as an automobile racing driver, was mortally injured and his mechanician, Eric Schrader, and a track policeman were killed here to-day when Burman's Peugeot blew out a tire at 100 m.p.h. in the ninety-seventh lap of the Corona Grand Prize. The car skidded upon a culvert and crashed past two telephone poles into a group of spectators, several of whom were seriously injured. Burman died at the Riverside Hospital at 5:55 this evening. His skull was fractured, several ribs were crushed and both legs broken in several places. Mrs. Burman was with her husband when he died, having rushed to the emergency hospital ahead of the ambulance that took him to the operating room.

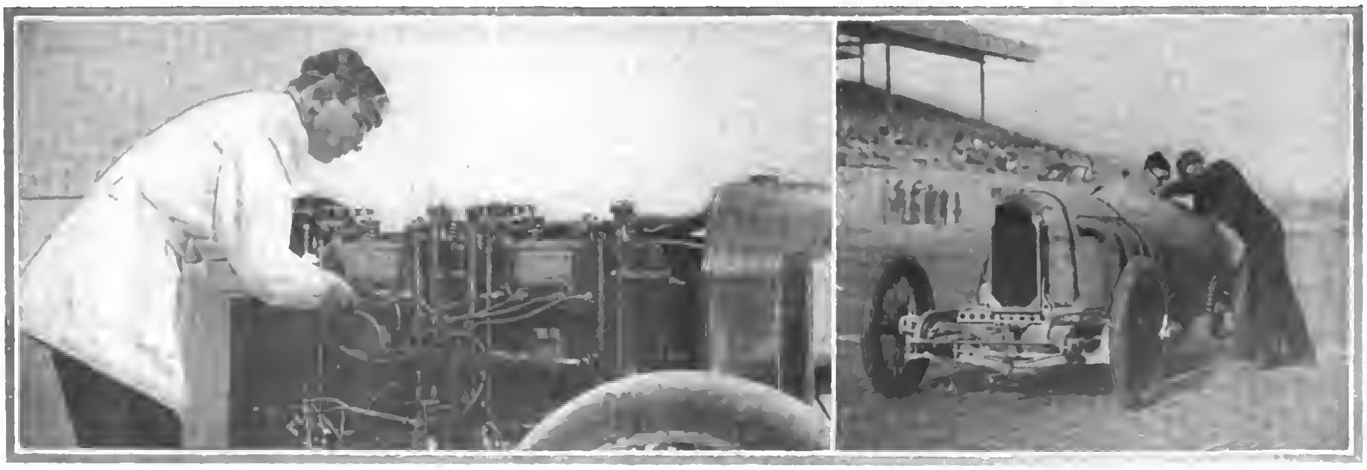
When the accident occurred Burman was six laps behind O'Donnell, who was leading, and was driving at top speed to make up some of the time he lost at the pits during his frequent stops for tire changes and mechanical troubles. Struggling under these handicaps, Burman drove with his characteristic fearless abandon now in first place, now in last and then back in the lead again, drawing frantic plaudits from the crowd as he forced his mount on, lap after lap, ever striving against adversity in his fight for first place and the $5,000 purse.

On March 25 Burman won the Exposition cup race at San Diego, Cal., sending his Peugeot over the 50-mile course at 52:14 m.p.h.

Burman, frequently characterized as the world's speed king, was born in Imlay City, Mich., April 22, 1884. Burman tested the first automobile ever manufactured by the Buick Motor Car Co. and then entered the employ of the Jackson Automobile Co., becoming head tester. While thus employed, a resident of Jackson, Mich., built a freak racing car and invited Burman to enter into a contest with him. This Burman did and won his race by more than a mile. This early success decided him to enter the racing field and he induced the Jackson company to allow him to enter one of their cars in a 50-mile race at Detroit in 1906. He won against a field comprising practically all of the leading racing drivers in the country. This was the beginning of his fame as a racing driver. His next experience was at St. Louis, where he drove twenty-two and one-half hours of a twenty-four-hour race, winning by 82 miles. With the Buick cars, which he drove later, Burman won so many races that he attracted attention all over the world. His most notable victory in 1910 was the winning of third place in the Grand Prize at Savannah, his car being the first American-built machine to cross the tape.

Burman held five records on the straightaway regardless of class. They are: 1 kilometer, 0:15.88; 1 mile, 0:25.40, and 2 miles, 0:51.28 made in his Blitzen Benz at Daytona, Fla.; the other two, made in the Buick Bug at Jacksonville, are: 20 miles, 13:11.92, and 50 miles, 35:52.31.

Burman also held the class B speedway record for stock cars of 301 to 450 cu. in. for 250 miles, 4:38:57.40. He held the quarter-mile speedway record made in his Benz at Indianapolis in 0:8.16; 1 kilometer in 0:21.40; ½ mile, 16.80; and 1 mile, 35.35. He also held six circular dirt track records, 10 miles, 8:16.40; 15 miles, 12:47; 20 miles, 16:25.60; 25 miles, 20:28.80; 50 miles, 40:57.80; and 75 miles, 1:08.56.



Two views of Burman. At the left he is tuning up his Blitzen Benz prior to breaking the world's record for the mile, and at the right as he was starting in the match race between his Benz and De Palma in the twelve-cylinder Sunbeam at the Sheepshead Bay Speedway on Nov. 2, 1915 in two heats, the average speed in one being 111.97 and in the other 113.86 m.p.h.

Essentials of Racing Engines

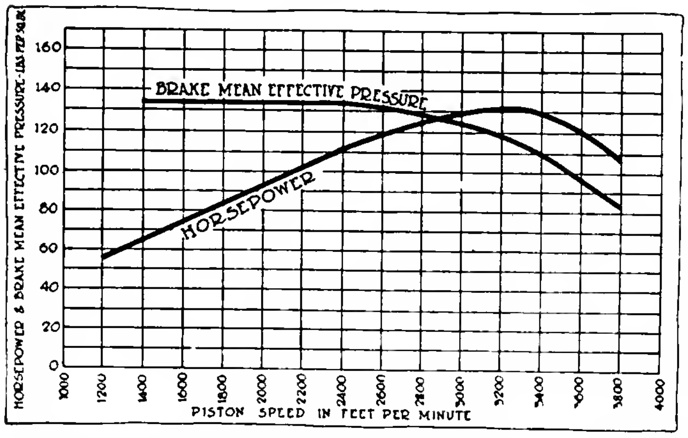
Intimate Engineering Details of Wisconsin Racing Motors Described and Discussed by Mid-West Section S. A. E at First Professional Session of Section

CHICAGO, ILL., April 8—Last night the first professional session of the Mid-West section of the S. A. E. took place, the paper of the evening being given by Charles H. John, president and general manager of the Wisconsin Motor Co., Milwaukee, Wis. Mr. John gave a general talk on the racing work done by his company, including the fullest details of the engines with which the Stutz cars were so remarkably successful last year. The paper is reprinted almost in full below. Some of the details mentioned by Mr. John were given in THE AUTOMOBILE for Oct. 14, 1915, but there is a good deal of additional information particularly as regards lubrication and valve gear.

Model Aeroplanes Make Flights

Another feature of the meeting which aroused equal enthusiasm was the exhibition of model aeroplanes by the Model Aeroplane Club of Illinois. Preliminary to the exhibition, Arthur Elton Nealy of the Model Aeroplane Club presented a short paper in which he brought out the value of the model aeroplanes in the development of aviation with particular reference to what the models were doing in the development of automatic stability in full size machines. He stated that at the present time the full size machine so far as its stability and guidance was concerned is 90 per cent operator, and 10 per cent machine, but that in the models which carry no operators, automatic stability and guidance must be inherent in order to make successful flights inasmuch as no operators, of course, can be carried in the midget aeroplanes.

In the demonstrations of the flying ability of the models which followed, Mr. Nealy succeeded in proving that model aeroplanes can be made to have a great degree of inherent stability and guiding power. About a dozen different types of models were flown within the confines of the assembly hall and the young men who manipulated seemed able to make them guide themselves with almost human intelligence. The models looped-the-loop and did similar stunts which have been featured by aviators. The most striking exhibition was that of a model hydroaeroplane which arose from a pan of water 2 ft. by 3 ft. in size, flew out over the audience, looped-the-loop and returned to rest in the pan.



Horsepower and brake mean effective pressure curves plotted against piston speed for Wisconsin racing engine.

Mr. John's paper follows:

In the high speed motor the underlying principle is to reduce the weight of the reciprocating parts to a minimum for safety. By reducing the weight of these parts the inertia forces are reduced, which are the causes of excessive vibration at high speeds and which waste much power by reason of the extra friction. This is accomplished by using better materials for the connecting rod and piston. Chrome vanadium connecting rods, heat treated, of exceedingly light weight, and pistons of special aluminum alloy, reduced the inertia forces to a minimum and greatly relieved the stresses upon the connecting rod as well as on the bearings. Alloy steels were also employed for the crankshafts, bolts, gears and other parts subjected to excessive strains. The microscope is used to determine the proper heat treatment and the scleroscope to get the proper hardness. Valve springs had to be made of vanadium steel and tungsten steel was developed for valves. Bearing metals are given special study, as under the great pressure and high speeds ordinary metal would burn out in a short time. The law of bearings, however, would prove inadequate without an efficient oiling system.

Racing, and naturally, also, high speed engines, have compelled the engineers to give the question of correct lubrication their minute attention. The result of their labors was the introduction of high grade motor oil, and this, to some extent, has eliminated a great many motor troubles. In these high speed motor tests it was also discovered that oils, when exposed to very high temperatures, would deposit a sediment in the oil chamber. This was largely eliminated by cooling fins in the piston, also cooling fins on the crank base. In a test made with one of the large Wisconsin six-cylinder tractor motors, we found that running the oil through cool water, which was made possible on account of our forced feed oiling system, increased the efficiency nearly 10 per cent. This taught us a valuable lesson, and we now are cooling the oil on our tractor motors by means of a jacketed inlet manifold. This manifold has double duties, to-wit: cools the oils and at the same time heats the incoming gases.

Lubrication Most Important

I attribute a great deal of the success of Wisconsin motors in racing annals to their perfect oiling system, which in all of our motors is the forced feed type. The oil is contained in a separate oil sump and is forced by a gear pump through ducts to the main bearings and then through holes bored in the crankshaft to the connecting rod bearings. The oil under pressure is forced from each side of the connecting rod bearings and is thrown in all directions. In this way oil is splashed against the cylinder walls, pistons, push rods and into pockets over the camshaft bearings. Oil is also fed directly over the timing gears by means of a copper tube leading from the main duct. The oil then drains back into the sump through a strainer and is there ready for another journey. This, in the opinion of many engineers, is the most efficient and economical oiling system yet introduced. In a 10-hr. continuous test recently made at our plant on a high-speed motor, the consumption of oil was slightly over 1/100 pint per hp. per hour.

Long Stroke Is Advantage

As the amount of power available from an engine depends upon the volume of gas consumed in a given time, it was evident that by using smaller cylinders and allowing the crankshaft to revolve faster, the same amount of power could be obtained as from a larger engine revolving at slower speeds. Extensive trials also proved that the long-stroke motor was capable of greater speed and increased power over the short-stroke motors. This lead to the development of the present 300 cu. in. racing motors which I will endeavor to describe more fully.

Selecting the Steel

It is hardly necessary for me to repeat the success of Harry Stutz on the speedway, in the road races and in the transcontinental runs. I wish to add, however, that all of the races up to the year 1915 were run with practically our stock T-head motors. Directly after the Indianapolis speedway races of 1914, we concluded that the foreign invaders had carried off enough of our good gold, and we agreed to build four motors for Mr. Stutz that could successfully compete with the foreign racing machines. Our engineer, A. F. Milbrath, had sketched out one of his ideas which met with Mr. Stutz's approval, and we immediately started to work on these motors. We had heard wonderful tales of a new steel made in Belgium, called B. N. D., with a wonderful tensile strength, and we concluded that we had to get this steel. Orders for crankshaft and connecting rod materials were placed at once, but alas, war was suddenly declared, and we were compelled to look for other channels of supply. We decided to use chrome-vanadium steel, which had given us such excellent service. This was of American make, and the greatest care was exercised in the selection of all materials. The scleroscope and the Brinell tests were resorted to, and in addition, to make sure that the material was correct, physical tests and chemical analyses were made. After heat treatment, specimens were taken from the various parts and examined micro-photographically to insure the granular structure being right. With these precautions, we were able to demonstrate that America can produce steel equal in strength and stability to anything produced abroad, and to-day American products are at a par with any of European extraction. Our tests convinced us that we had the proper material, so we rushed through a single motor in order to give it a thorough test.

Gives 131 B.H.P. at 2950 R.P.M.

When the first motor was completed and put on the test stands the results were quite satisfactory, but no extraordinary power or speed were developed. A careful study of lubrication and principally ignition was necessary before we were able to get results. When all of these difficulties had been satisfactorily solved, we obtained some very astonishing figures, in fact, they were far above our expectations. This motor of 296.81 cu. in. capacity developed 131 b.hp. at 2950 r.p.m., and was at once shipped to Mr. Stutz, whose chassis was ready for the motor, and trials were at once started. It was shown by these trials that this engine was developing extraordinary power, and Mr. Stutz at once notified us to proceed with the other motors. Three cars were built and the performance of these three cars has been among the most remarkable in automobile racing. In the 500-mile Decoration Day races at Indianapolis, these three cars started, and all three finished well up in the running, a record never equalled before.

I do not have to enumerate all the victories which Harry Stutz won, as they are matters of history. Foreign engineers have as a rule taken their defeat manfully, and are giving America due credit for designing and building a motor capable of such wonderful achievements.

American engineers have shown that they are equal to their European cousins, American car builders can build just as good a chassis and American steel makers can produce just as good materials, and perhaps better, than the famous steels of Belgium.

I-Head Is Efficient

It is well known that a gasoline poppet valve engine follows certain lines, and these lines are fixed and cannot be altered. The valve-in-the-head type has been recognized as the most efficient construction, and it is only a few years since the four-valve superseded the two-valve type. It is not necessary for me to argue the merits of the four-valve type, and neither do I wish to enter into a dispute as to the authorship of this type. I have read of an English engineer claiming he orginated this idea, and then again the French claim it, and so do the Italians. We also find that very nearly all of the European racing cars are using four valves, and I will just mention the Sunbeam, Humber, Straker-Squire, Vauxhall, Peugeot, Delage, Schneider, Mercedes, Isotta-Fraschini and Fiat.

Dispensed with Valve Cages

In all of these there is a certain similarity, especially in the combustion chamber, as it is necessary to employ the semi-spherical shape if one wants to obtain large valve area. It was also found necessary to dispense with valve cages, and so we find valves fitted directly in the cylinder head with ample waterjackets surrounding them. These essentials in motor construction were established, and it was now the ambition and aim of the automobile engineer to get the greatest amount of power out of a given cylinder volume for the greatest length of time. The fact is established that we took their own weapons and defeated them squarely, and we are proud of our record.

Aluminum Barrel Crankcase

It may be of interest to members of the section to hear the details of construction of this motor. The aluminum crankcase of the Wisconsin racing motor is of the barrel type, with rather a large opening on the bottom, but built extremely rigid. The bottom cover is provided with cooling ribs. The main bearings are ball-bearing, with 1-in. diameter balls, and held in place by means of cast steel retainers. The motor is three-point suspension, the forward end supported by a trunnion bearing on the steel front cover plate and the rear carried by a cast-steel arm firmly bolted to the crankcase.

Dimensional Details

The crankshaft is 2¼ in. in diameter and the material employed is chrome-vanadium steel, double heat treated. It is made in two pieces, the two halves being held together by a large bolt. The cylinders are block cast with ample water-jackets around the barrels, as well as around the valves. There are two inlet ports, as well as two exhaust ports, and the valves, which are 1¾ in. in diameter, are seated directly in the cylinder head. The valve guides are of cast iron, but the valves are of high tungsten steel. Two valve springs are used, one inside of the other. This eliminates the danger of the valve dropping in on the piston should a valve spring break.

One Rocker for Two Valves

A single camshaft is used, which operates the valves by means of short fork-shaped rockers, one rocker operating two valves. The camshaft is built up and stepped spacers are employed between the cams and bearings, which are ball-bearing. The camshaft is driven by means of spur gears

½-in. wide. These gears are also of chrome-vanadium steel, heat treated and run on ball bearings. The gears are inclosed in an oil-tight aluminum housing. A single gear drives the water pump, oil pump and magneto. The front cover plate is of steel as is also the flywheel. The connecting-rods are tubular, made from a solid forging of chrome-vanadium steel. A 1-in. diameter hole is bored through the entire length, making a very light, but at the same time very rigid rod. The bearing end has four bolts, and is bushed with bronze, Fahrig metal lined bearings. The upper end is bushed with a solid bronze bushing with a ⅞-in. hole for the piston pin. This pin is bored taper, the thicker part remaining in the center of the pin and gradually tapering towards the outside.

Pistons of Magnalium

The pistons are made of magnalium and weigh 12 oz. each. Only one groove is cut into the piston, and this is cut wide enough to hold four rings 1/16-in. wide. The piston pin is neither fastened to the rod nor to the piston, but is free to float, and is held in place by means of a wide steel clip, liberally perforated with holes. The head of the piston is supported by ribs radiating from the center and uniting with a lug which extends through a slot cut into the connecting-rod at the top of the piston pin. Two sets of spark plugs were provided for each cylinder, and a two-spark Bosch magneto was used. The weight of this motor is 600 lb.

Pressure Feed Lubrication

The oiling system is of the pressure type, our standard gear pump being used. The oil is carried in the sump and drawn from here through a strainer, after which it is forced through the oil leads to oil rings carried on the crankshaft. These oil rings carried the oil through holes drilled in the crankshaft to the connecting-rod bearings, the overflow from the bearings forming a spray which lubricates the pistons, wristpins and main ball bearings. Oil troughs are also provided under the rods and the rods are fitted with scoops so that a double system is employed for the lubrication of the big ends. The excess oil is drained back into the sump. A separate oil lead was taken from the pump to lubricate the overhead camshaft, a small stream of oil being directed onto each cam. The ball bearings carrying the camshaft are lubricated by splash from the cams. The excess oil from the camshaft housing returned to the oil sump through the gear housing at the front end of the motor, also through a return tube at the rear end.

Maximum Power at 2950 R.P.M.

The motors developed their maximum power at about 2950 r.p.m., or 3200 ft. piston speed per minute. At this speed the brake horsepower was 131. During the races the average speed of the motors was slightly less than above, or between 2600 and 2700 r.p.m., at which speed the horsepower was 124 to 128. On the test stand the motors were run up to 3500 r.p.m., at which speed the horsepower dropped slightly. The maximum pressure on connecting bearings, due to the pressure on pistons, was about 600 lb. per square inch.

The mean velocity of gas through inlet manifold was 2950 r.p.m., the speed of maximum power was 175 ft. per second, and through the valves 215 ft. per second.

The maximum mean effective pressure in the engine, figured back from the brake horsepower, was 132 lb. per square inch. This pressure was maintained from about 1400 r.p.m., to about 2200 r.p.m. At 2950 r.p.m. it was 118 lb. per square inch.

Discussion Obtains Timing of Engine

In opening the discussion on the paper on American racing engines, Chairman F. E. Place, vice-president of the Buda company, congratulated the section on having the opportunity to learn the construction and design of an engine which has made such wonderful records on speedways and in road races and has shown that America can produce engines and cars which can show their heels to the fleetest productions of Europe. He felt that the paper was particularly timely in that it was presented just before the beginning of a new racing season and in a center where racing interest is most acute.

Use 40-Lb. Valve Springs

George W. Smith, engineer of the Thos. B. Jeffery Co., inquired as to the weight of the valve springs employed and as to the method of holding the wristpin in place. In reply Mr. Milbrath stated that the valve springs were capable of 40 lb., and that the wristpins were fastened neither to the connecting-rod nor to the piston, simply floating within the piston and being held in place by a steel ring around the piston, which, however, acted in no sense as a piston ring. In illustrating this, Mr. John exhibited a connecting-rod, wristpin, and piston from one of the racing motors.

Features of Two-Cycle Racers

Mr. Marr, formerly engineer of the Amplex, mentioned some features of the two-cycle racing car with particular reference to the Amplex which competed in the first 500-mile race at Indianapolis. He stated that the engine was almost the stock motor, but was lightened as to its reciprocating parts as far as possible. The weight of the connecting-rod was cut down but the lightening of the piston was limited by the extreme pressure over the piston head. He said that the motor developed 86 hp. at 1650 r.p.m. for 4 hr., and showed its maximum torque at 1100 r.p.m., and its maximum crankshaft speed was 1800.

Temperature of the Oil

Robert J. Broege, engineer of the Buda company, asked as to the temperature of the oil in the Wisconsin racing engines, to which Mr. Milbrath replied that the temperature ran to 150 deg. on the test stand, but was not so high when running on the track on account of the cooling effect of the air, and that the running pressure decreased slightly with the speed and the power that the motor was developing.

Asked by E. A. Turner, vice-president of the Northwestern Expanded Metal Co., as to the valve timing of the racing engines, Mr. Milbrath stated that the timing was no different from that of the stock Wisconsin motor. He said that the timing was as follows:

Inlet opens 10 deg. after upper dead center.
Inlet closes 50 deg. after lower dead center.
Exhaust opens 50 deg. before lower dead center.
Exhaust closes 10 deg. after upper dead center.

Asked by F. C. Mock, research Engineer Stromberg Motor Devices Co., as to what cylinder volume the 75 ft. per minute velocity of gas was assumed, Mr. Millbrath answered that this assumption was at full cylinder volume. He stated that the oil temperature, he believed, was lower in the force-feed system employed in the engine described than it is in the splash systems on account of the cooling ribs, but no comparative tests have been made by him.

Fuel Economy Possibilities

Asked as to the economy of the engine, Mr. Milbrath stated that while no tests were run to determine the economy at moderate touring speeds, he believed that it would prove very efficient on account of the almost complete opening of the top of the cylinder by the valves, and also the hemispherical shape of the combustion space.

He stated that the compression space was figured at 20 per cent of the total cylinder volume, and when turned over by hand, a compression of 95 lb. per square inch was shown. The weight of the flywheel was 70 lb. The spark advance at maximum power was about 30 deg.

The History of the American Automobile Industry—25

Four-Cycle and Two-Cycle Engines on a Commercial Basis—Development of the Modern Motor Vehicle Fostered and Made Possible by Gasoline

By David Beecroft

WITH the epoch-making development of the Otto four-cycle engine of 1876, and the development of the Clerk two-cycle engine in 1878, the great principles of explosion engines were laid down, and both type of engines, the four-cycle and the two-cycle, were placed on a commercial basis. Since then the development has been that of improvements, but the basic principles as laid down by Otto and Clerk have been continued. This thus brings us to a dividing line in the history of the combustion engine. Up to this time it was the solution of the great problem of making the explosion engine a commercial success. It was a constant working in the dark. It was because of the efforts of many inventors that the final results were accomplished. Otto worked thirty-seven years, and others were working an equally long time. The solution was started by de Rochas in 1862 and was completed by Otto.

Gasoline of Prime Importance

Before carrying on the practical development of the automobile from the days of Otto and Clerk up to to-day it is necessary to digress here and introduce a few chapters on the development of the petroleum industry. Without the lighter fuel now known as gasoline, it is questionable if the motor vehicle would have developed as successfully as it has. Fortunately a copious supply of gasoline has kept pace with the development of the industry, and it is impossible to estimate the influence the fuel situation has had on the development of the motor.

It is an interesting coincidence that while the first oil well was drilled near Titusville, Ohio, by E. L. Drake in 1859, the principles of the four-cycle gas engine were laid down by de Rochas in 1862, just three years later. As previously stated, de Rochas had correctly conceived the necessity of four-cycles of operation in a gas engine as we know it to-day. It is particularly fortunate that practically at the same time the great gasoline industry should have been started.

Formerly a Waste

At the beginning of the automobile industry as a commercial business, this fuel was a waste because there was not sufficient use for it. Kerosenes of several different grades were on the market, and some of the lighter grades were practically what is known as gasoline to-day. They were regarded as extra hazardous, and were prohibited in some States lest they be used in kerosene lamps and cause damage. Gasoline was then used quite a little for private gas plants, and the early experimenters could hardly help obtaining a fluid that evaporated easily and burned cleanly. Its hydrogen content was proportionately quite high as compared with the carbon content, and the flame rather resembled an alcohol flame than a kerosene one. These facts explain how early American inventors succeeded by simply dropping the liquid on the inlet valve.

The History of Petroleum

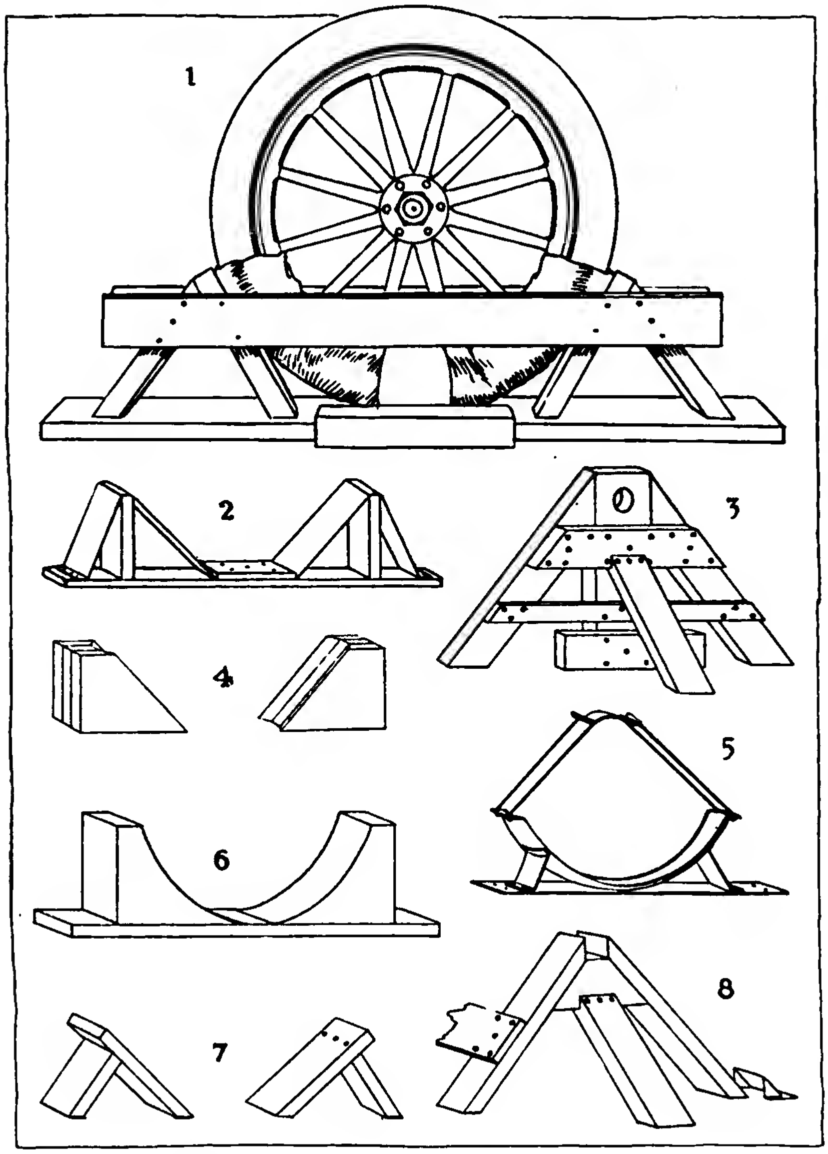
While the practical development of the gasoline industry dates from 1859, it will be appropriate here to show that petroleum in its varied forms has been in constant use for at least 3000 years and perhaps longer.

The production of petroleum runs back beyond the beginning of writing, and its story reads like a tale from Fairyland. Few things have had such a wide use during so long a time as has petroleum and its allied products. As a cosmetic for beautifying, a medicine for internal or external use to lessen pains and rheumatisms and embalming preservative, its use reaches from ancient Egypt to the present. Equally long is its use as a cement for bricks and stones or a slime for rendering crudely-built boats water-proof. The walls and buildings of Nineveh and Babylon, the tower of Babel and Solomon's temple, just as modern roads and building foundations, made use of petroleum products. Josephus tells us that the tower of Babel was constructed of burned brick and bitumen that it might not admit water. Herodotus says of the building of Babylon that large bricks were burned in furnaces and closely laid "using for lime or mortar hot asphaltas or bitumen." He also describes it as being obtained from the valley of a small river Is, a tributary of the Euphrates. That valley of pitch is still supplying its products to the surrounding country, and more recent writers describe it as containing many noisy springs and the pitch as used for "the staunching of boats."

Securing Shipping Security

Methods for Blocking Automobiles in Freight Cars Vary Widely—Evolution is Toward Simple and Cheap Types—V-Blocks Were Source of Many Damage Claims

THE question of blocking automobiles for freight shipment is a very important one for both shipper and railroad, for improper blocking may cause serious damage and pecuniary loss. For twenty years, manufacturers have been trying to solve the problem of proper loading, and in the early beginnings, there were many makeshifts, such as beams of wood spiked across the car floor, one touching the front wheels and the other supporting the back wheels of the automobile. Later, solid pieces of wood cut on an angle were used on both front and rear of each tire, being fixed to the floor with large spikes, and side strips made from boards 1 in. by 2 in. in thickness, and from 6 in. to 12 in. in width were nailed along each side. Boards were placed beneath these blocks as base boards, and the whole formed what was known as a cradle. There were many variations of this method, some of which still exist to-day, and all being rather crude and expensive. Some of these blocks were made from solid wood, and others were constructed from two pieces of wood, the latter being known as "V" blocks. Some manufacturers using solid blocks endeavored to have them curved so that they would conform to some extent with the curved face of the tire.



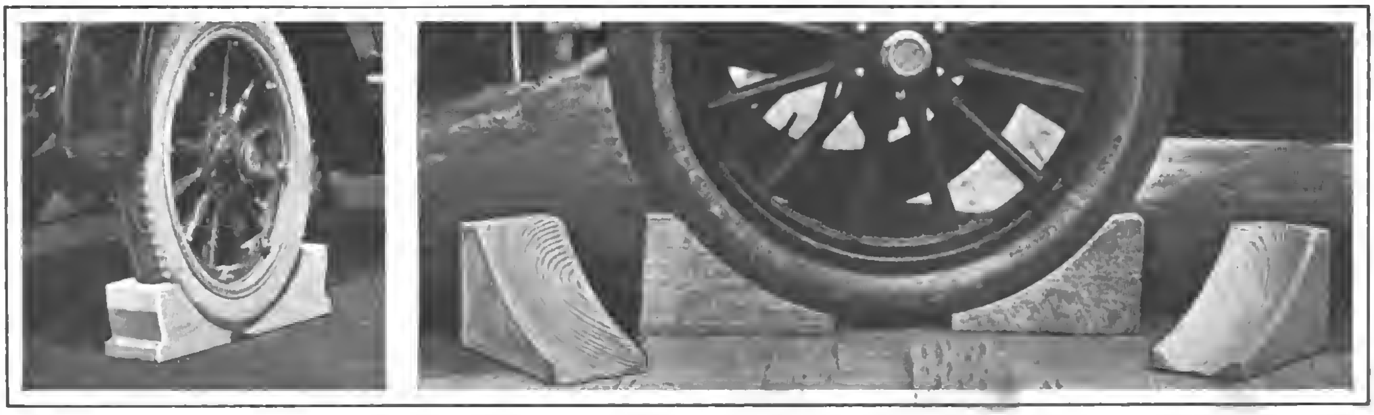
1. *Application of the two-piece V block.* 2. *Block of sheet steel stretched over wood blocks.* 3. *Hub horse used by Franklin.* 4. *Grooved block made from three pieces.* 5. *A costly metal blocking system.* 6. *Solid curved blocks mounted on board.* 7. *Two piece A block.* 8. *Studebaker axle horse used on front axle only*

It was believed by some of the railroads, and quite a number of shippers, that the obvious difficulties and objections to the "V" block and other straight faced blocks then in use could be overcome by using a metal block. The idea was that a metal block could be returned to the factory and used over and over again. Several were invented and tried out. The most popular principles employed were those of the stamped block, which was grooved to keep the tire from moving sideways, and to do away with the necessity for side strips. This metal block conformed in shape to the wooden blocks then in use. The stamped block, however, proved impractical. It was found that, in drawing the metal, it would crystallize, and the weight of the motor car with the constant jolting to which it was subjected, would crack the blocks and cause them to sag and fall.

The Hub Horse

About ten years ago, the H. H. Franklin Mfg. Co. developed a type of loading arrangement known as a hub horse. This horse was so constructed that the hub of the automobile could be rested in a hole made for the purpose, the four horses suspending the car from the floor. Studebaker, about two years ago, adopted a similar device. The effect of the horse, however, is to bring the entire weight on the axle. The automobile must be fastened so rigidly that there can be no play, and it becomes practically a part of the freight car. Thus, any blow received by the freight car becomes a direct blow to the machine. The wheels being suspended, the car does not receive the cushion of its tires.

Most of the blocking systems mentioned above cause chafed tires, and the claims from this source of damage alone aggregate thousands of dollars. The railroads from time to time have made an effort to overcome this trouble, and about 1911, the Santa Fé published a booklet entitled "Suggestions for Loading Automobiles," the main suggestion being that all tires be wrapped with a double thickness of burlap around the lower third of the circumference, and that the front wheels be tied down with two tie straps instead of one.



Left—Evans block curved to fit tire and with "heel" to receive nails. Right—Grimm block which is similar but without heels

This booklet concludes with the statement that the Santa Fé has adopted as a standard a straight faced grooved block which prevents the front wheel from turning on the steering knuckle, and therefore, eliminates tire chafing to a considerable extent.

V-Blocks Wrong in Principle

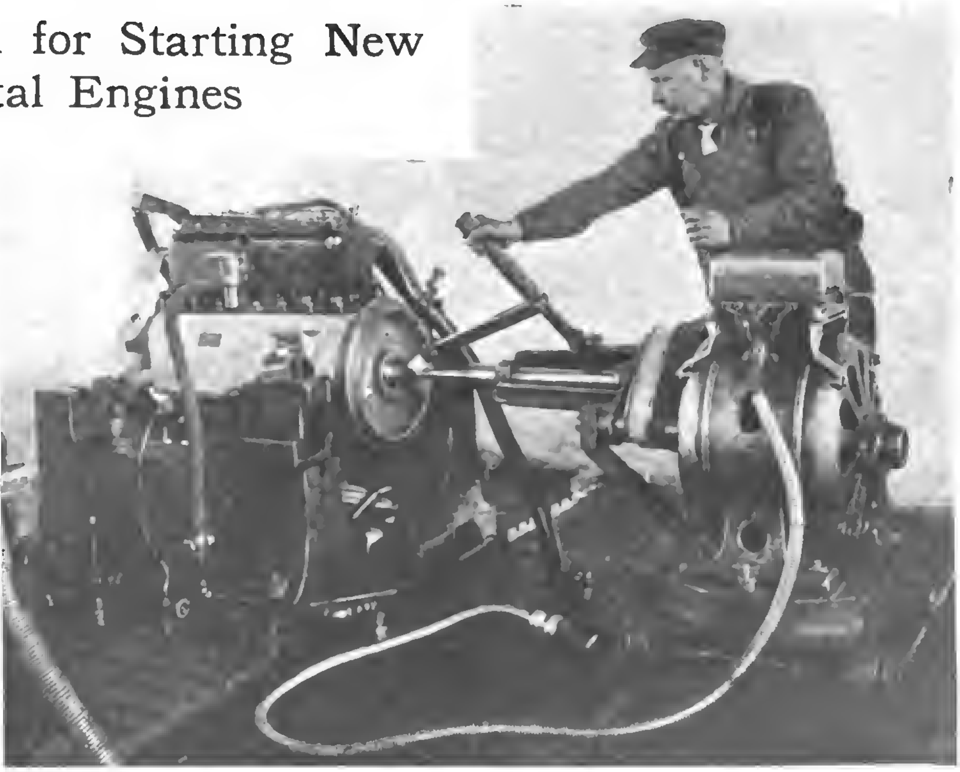
In the light of present achievement, this old Santa Fé block seems very crude indeed. The Santa Fé grooved block was so expensive that it never came into general use and, whereas there was a great variety of different methods used, the most popular up to 1913 was the V-block made from either two pieces or three pieces of lumber. These V-blocks were wrong in principle, crude, and were the source of constant claims for damage, but they were cheap, and a number of companies used them for this reason.

In 1913, Charles G. Grimm, an experienced wood worker of Palatka, Fla., conceived the idea of combining the curve and the groove in the same block. After months of experimenting, he applied for patents in the United States and Canada for the Grimm automobile shipping block, which was so constructed that it fitted exactly the contour of the tire, the wheel resting easily and evenly along the whole length of the groove. The groove of this block holds the wheel perfectly straight, and the shoulder or freeboard on the block prevents any chafing against the burlap blocks or sideboards. The smooth surface of the groove prevents any chafing of the tread, and makes it unnecessary to wrap the tires with burlap, or to face the blocks with burlap or carpet, as recommended by the Santa Fé for use with the old fashioned block. The Grimm block which is manufactured in Palatka, Fla., by the Florida Woodenware Co., from long leaf pine and cypress, was first used by the Cadillac company, and then it gradually superseded the other methods of loading, until in the latter part of 1915, thirty of the larger automobile manufacturers were using it exclusively.

In December, 1915, Edward S. Evans, associated with the Florida Woodenware Co., Detroit, applied for a patent on a similar block which is now being used extensively.

The chief difference between the Grimm and the Evans blocks is the "heel." The Grimm block is the more simple as the back of the block is a plain, perpendicular surface, but the Evans block uses a heel, which is incut in the back of the block, so giving a surface through which the nails can always be driven at a uniform angle and proper depth into the car floor.

Cranking System for Starting New Continental Engines



THE Continental Motor Co. has succeeded in effecting a considerable economy of time and labor by the installation of a powerful cranking motor for use in their large engine test shop. The electric motor is mounted on a carriage that runs on a track behind the rows of engines on the test blocks. At proper intervals there are floor plugs to supply the necessary current.

To permit the ready engagement of the starter, the shaft can be swung into any position till the clutch comes opposite the end of the crankshaft; the operators right hand controls this jaw clutch and the left hand the motor controller. It is stated that this starter can have 250 new engines running in less time than in starting twelve engines by hand.

The FORVM

PUBLIC MUST BE PERSUADED TO ACCEPT KEROSENE AS A FUEL BEFORE IT CAN BE ADOPTED—AIR COOLED AND TWO-CYCLE MOTOR ADVANTAGES

Advantages and Disadvantages of Kerosene as a Fuel

By B. H. Pomeroy, M. E.

I HAVE been following the various writings upon the question of kerosene for a fuel for combustion motors and am more than amused at the way some go about telling how to get the required results.

It is not the booming of kerosene in a combustion motor that is important, but getting the public to accept and use it as a fuel, as it has its advantages and again its disadvantages.

Arguments Pro and Con

Advantages are: high explosive force, freedom from carbon on plugs and cylinders and greater mileage, gallon for gallon and less oil required for lubricating of cylinders.

Disadvantages are: for persons who fill tanks on cars and slop it on the cushions and floor mats, leaving a stain that soils the clothes; but this could be overcome if the general public would adopt kerosene as a fuel. The mere fact of converting it into a perfect explosive gas is no great task, as the writer is a firm advocate of kerosene as a fuel and has been using it for four years as such with perfect success and finds no trouble whatever, and when you say kerosene burners to people, they simply say, "Gasoline is good enough for me," and this is one reason why the kerosene motor is no further ahead. There have been several firms which have branched out on kerosene and advertised to some extent, but they seem to have abandoned the proposition. But why have they abandoned it? Simply because the public has not taken kindly to it.

The carbureter of to-day is not adapted for kerosene, but a very simple device can be made. The one which I have on my own car to-day—and have used for the past four years—has given entire satisfaction with no more bad odor or smoke than the present grade of gasoline gives. I am using a model L Schebler 1¼-in. carbureter with my attachment, using the regular throttle, but with changes in the air valve and venturi. I can idle from 60 to 1200 r.p.m. without the least sign of loading up and can see no waste or overflow from carbureter when I stop the motor after running for an hour on forced suction or closed throttle.

Kerosene a Logical Fuel

My motor is easily started, almost always on a quarter turn of the crank, but cold weather makes some difference, not enough to speak of. I use my car 365 days per year and I am at a loss to understand why others do not adopt kerosene as a fuel. The kerosene proposition is probably like a great many good inventions—held up on account of insufficient confidence of men with capital to help out the inventor. In my case, I have worked with kerosene and experimented with it since 1900, when I made the first worm-drive rear axle and had it on exhibition in New York. Then I was discouraged by the majority of automobile men, who said the device was out of the question because of friction; but to-day, what about it? The same thing applies to my kerosene-burning motor. There are several good kerosene motors not of the hot bulb type. Secore, for one, gives perfect combustion, and why not others? Simply because the inventors are afraid to come to the front with them, on account of having their inventions swept from them.

When the automobilist gets to using kerosene for fuel as a regular thing then we will see the price go up, the same as gasoline. As long as oil is controlled by a few firms this will invariably be the case.

I am not finding fault with any particular firm, but think and know that this proud and ingenious nation of ours should find a way to corral this everlasting increase in price of fuel. I do not cherish the idea that I as one should be classed as a traitor for keeping my invention as others of my class are doing, but when the time is ripe and the general public is willing to accept, I am ready to unfold my invention. Of course I desire to benefit my brother man as much as I can, but when one has spent several years at perfecting a thing of this kind, he desires to see something done with it, and not have it shelved and the public go on in the same old way.

Air Cooling and Two Cycles for Higher Efficiency

By Chas. E. Duryea

THE several articles and editorials on conservation and increased efficiency in your recent issues are most interesting. The public badly needs more of this education. Mr. Sargent's plea for a higher compression with low throttle instead of lower compression is certainly along the right lines. His suggestion to vary the closing of the inlets and thus secure a cutoff action is good, but it is not clear how we can prevent the driver from using the most powerful mixture and the latest cutoff possible in order to get maximum power and thus get compressions too high for the mixture, resulting in pre-ignition with its pounding and disadvantages. The automobile does not go into the hands of trained engineers, but is driven by everybody and must be so simple and foolproof that it cannot well give trouble, or be tampered with in any way.

Two-Cycle Fuel Economy

One of the reasons why I look forward to a perfected two-cycle is the fact that it employs constant compression and so may make better and more efficient use of its fuel when throttled than can the usual four-cycle. Mr. Sargent's figures showing the disposal of the fuel energy are very interesting but hardly correct for the average automobile engine. The energy expended in work is probably under 20 per cent, as shown in next column, the engine friction is probably nearer 10 than 5 per cent. The radiation and exhaust are probably somewhat higher than 25 per cent and the jacket loss probably lower than 45 per cent.

Why Not Compound?

The best way to increase the work energy would seem to be by compounding. Nowadays buyers seem to like more cylinders and by using one-third of them as second expansion affairs we could save the need for mufflers and add 20 per cent or more to the work figures. Steam engine practice indicates that it is more economical to use low-pressure cylinders rather than attempt to expand to the limit in the high-pressure cylinder. Compounds heretofore made have been water-cooled, whereas if they had been air-cooled the efficiency would have been much higher because the heat would have been more largely retained for work instead of foolishly used to boil water.

The big loss being out through the jacket and radiator it would seem apparent that air cooling needs adoption. It is perfectly easy and safe to run an air cooler with its walls at 360 to 500 per cent, which is two to three times the usual waterjacket temperature. This means that very much less heat escapes to the cooling system and accounts for the superior showing made in efficiency contests by the air-cooled cars. The first look for the man looking for low fuel costs should be toward the cars which use their fuel for propulsion rather than for water boiling. Two and three times the mileage per gallon is equivalent to cutting the fuel price in two and three with the added advantage that some fuel is left for the other fellow.

Car Weight Important

Car weight is another consideration in the line of conservation. Comfortable riding is a matter of design and springing and not of weight. While it is true that with a given unsprung weight the heavy body rides more easily than the light one, it is also true that the light body does not need the heavy wheels and axles to carry it and so is not affected by the same unsprung weight. Buggies and cycles went through this improvement from heavy to light with great gain. The automobile will do so just as soon as buyers refuse to take heavy cars. Motorcycles and buggies weigh very little more than their maximum loads. When will we get automobiles approximating this ratio? A 4000-lb. car is three times as heavy as needed to carry seven people and costs twice as much to run, not to mention added tire and other expenses.

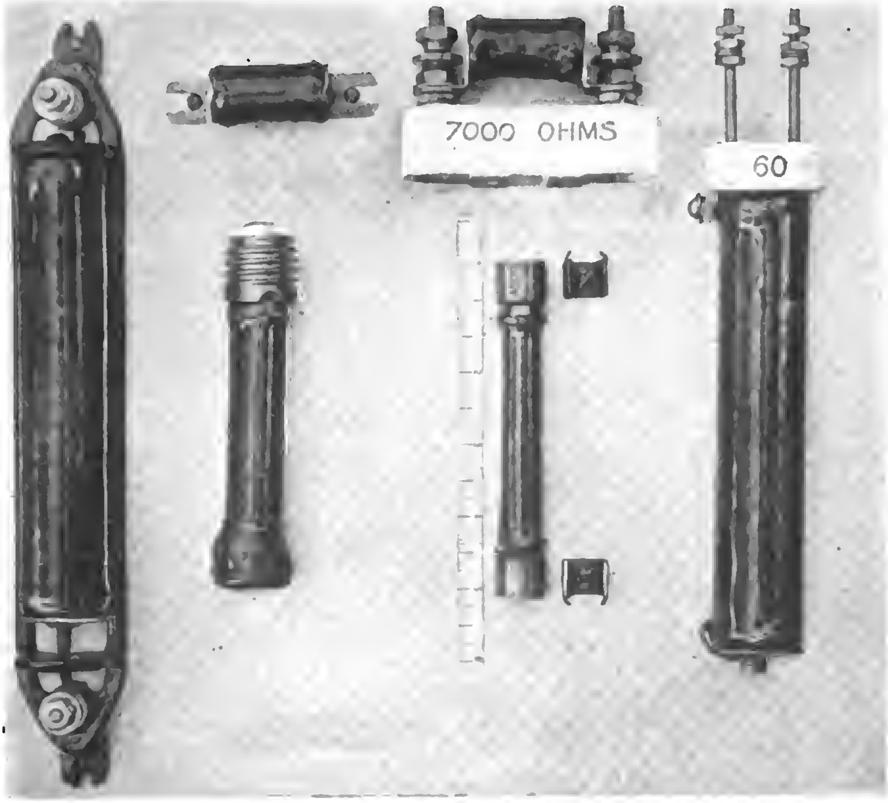
Compact Ward Leonard Resistance Unit

Adaptable to a Wide Variety of Circuits and Can Be Furnished Up to 10,000 Ohms on One Layer of Wire for Standard Conditions

A COMPACT unit of high resistance and of moderate current carrying capacity has been brought out by the Ward Leonard Electric Co., Bronxville, N. Y. The resistance material, which is illustrated herewith, is made up of units of wire of practically zero temperature co-efficient, wound on porcelain tubes and covered with a vitreous enamel. The resistance wire is embedded in a substance which expands and contracts at the same rate as the wire does itself within the limits of ordinary electrical usage.

This harmonious expansion and contraction prevents adjacent turns of wire from closing together and short-circuiting, which would in turn cause a change in the resistance of the unit and might cause burn-outs in the circuit.

The vitreous enamel in which the wires are embedded and by which they are entirely covered, protects them from the atmosphere. As the entire wire is hermetically sealed in this way it cannot deteriorate owing to the action of the atmospheric moisture or other corrosive elements. The coating of enamel over the wire is thin and is a good conductor of heat, thus keeping the temperature low by dissipating the heat.



Compact Ward Leonard resistance units which are rust-, water-, fire- and dust-proof

By the practically zero co-efficient of the resistance wire is meant that its resistance does not alter with changes of temperature and this is an important factor in practical installations of all sorts.

Units Are Strong

Mechanically the resistance units are strong, being compact, non-abrasive, rust-proof, water-proof, fire-proof and dust-proof. The terminals are sturdy and the connection between the resistance wire and the terminal leads is embedded in the vitreous enamel which preserves the joint against depreciation. The shapes of the units are shown in the illustrations. These illustrate units arranged to be screwed into lamp sockets, fitted with ferrules for fuse clips equipped with angle ends, or for wall mounting. Any of the units shown can be furnished with resistances as high as 10,000 ohms on one layer of wire.

Automobiles and Trucks Big Assets To German Army

Enable Rapid Transference of Reinforcements Between Various Battle Fronts—Constructional Points Brought Out By War Service—Coping with Tire and Fuel Situations

By E. A. Langdon

ACCORDING to enthusiastic Germans, three factors have been responsible for the successes of the Kaiser's armies in Poland: Von Hindenburg, the big guns and the automobile. It would be difficult to choose any one of these as the supreme factor, for without the wonderful mechanical equipment, even Germans admit, the field marshal could not have achieved what he did. This applies not only to the later campaign and the struggle for Warsaw, but even more to the early stages of the eastern fighting, when East Prussia and West Prussia were considered to be seriously endangered by the millions of Russian soldiers.

It is claimed that the plans for the battle of Tannenberg, for instance, were largely of a makeshift nature, in that the Russians moved into Germany along somewhat different lines than was expected of them, and that millions of German troops had to be rapidly transferred from more southerly points of the frontier to the north. This could never have been done without thousands of automobiles, in spite of the fact that several lines of railroads, very efficient in a military sense, run parallel with the line of forts Koenigsberg-Thorn-Marienburg. Likewise, it was due to the automobiles that every kind and quantity of artillery required could be brought to the battlefield in time to defeat the Russians. Of course, the automobile operations were by no means restricted to the preliminary work of the battle, but as positions shifted, the motor equipment was always kept working hard.

The First Big Demonstration

This was the first demonstration on a large scale of the tremendous military value of the automobile to Germany. The work, consisting of wholesale movements of troops and cannon and ammunition, was repeated with relatively small modifications in the several battles of the campaign of the fall of 1914. At the same time, cars enabled the Austro-Hungarian troops to make the best of their strategic retreat through Galicia, in the face of Russian armies which were in vast numerical superiority. It was the unfailing supply of enormous quantities of munitions which made it possible to hold the Carpathian passes against the Russians thrown into them regardless of losses. Finally, automobiles constituted, to a large degree, the driving force which turned the Russians from the Carpathians and Galicia into Poland, ending the first and opening the second great stage of the eastern campaign.

An Automobile Railroad System

The second stage consisted largely of the advance, sometimes rapid and sometimes slow, of the united Teutons toward Warsaw, and after the conquest of that city, to the Brest-Litowsk line. Most of this advance was made in a country of soft soil, very poor in the way of roads, while most of the railroads were destroyed by the retreating Russians wherever they had time to do it. Fortunately for the invaders, the solid railroad beds could not be destroyed in the short time given to the retreating enemy, and this made possible the creation of an "automobile railroad system," in which the cars followed the lines of the railroads. The latter radiate from Warsaw toward the Russo-German frontier, being also constructed, largely, from a military point of view. Hence, concentration along these radius lines toward Warsaw was relatively easy and automobiles were able to do their best. Of course, a very great amount of their work was done over roadless ground, and here, too, the value of the cars was tested and proved. But, in a general way, the hardest work for automobiles in the east was done during the Carpathian campaign, when the machines had to plug through snow and mud several feet deep and often had to be raised and got under way.

Unique Car Uses

It stands to reason that cars served all kinds of work for which they had never been intended. The writer remembers, as specially striking, the instance of a car jacked up with its rear axle geared to the generator of a wireless telegraphy outfit, and another case, where the motor actuated the dynamo of a huge searchlight. One of the most interesting emergency uses to which a car was put was when the motor of one of the large siege guns bombarding one of the Russian fortresses became inoperative. In a very short time the crankshaft of a nearby automobile had been geared up to the shaft driving by the electric motor of the gun and controlling the position of the latter, so that the gun could continue to operate until a thorough repair could be made.

On the western front, automobiles also found plenty of work. This applies especially to the fighting in the Champagne and Vosges, where the net of railroads is more sparse than in Northern France and Flanders, and where at times most violent fighting went on. Several hills commanding the surrounding ground, such as the well-known Hartmannsweilerkopf, changed hands as often as a score of times during the war, and the party on the offensive of course had to bring up troops and fighting machines under better cover than that of the strategic emergency railroads serving a position which is securely held. In more than one case, all the fighting against the forces on such a hill was in vain, until the supply of heavy ammunition was cut off from them, when the position was carried by storm. In some of these storms, armored cars with small-calibre guns participated, and in spite of the obvious difficulties of such a hill climb made surprisingly good showings.

One might even say that Germany succeeded where motor cars could operate and did not succeed where they failed. Wherever there was a possibility of quickly attaining a position required and suitable for effective attack, this possibility was realized through the work of the automobile. It was *the alliance with the automobile* which made the 30.5 and 42 cm. guns as effective as they proved in scores of siege operations, including Liege, Antwerp, Maubeuge, etc.

Field Repair Depots

Mention has already been made of Factories Behind the Front, as the repair shops are called. In the east these shops, of which there are a number, are from 150 to 200 kilometers behind the front, while in the west they are much closer to it and in better communication therewith. The chief reason for this different situation is that the positions in France and Belgium are considered by the invaders to be absolutely impregnable; to support this argument they point to several gigantic attacks which left the German front almost unchanged and which were stayed by an army of much smaller number than those attacking the lines of the Teutons. Needless to say that automobiles played their part in these very efficient defense acts, transferring reserves and materials from one point to the other, according to local requirements.

Steering Gears Weak

As to the technical information which the war work of the motor car brought to the light, one of the most striking facts discovered was the general weakness, relatively speaking, of the steering gear. The steering equipment seemed most apt to give way under the terrible stress of operation. From 10 to 20 per cent of the repairs necessitated by work, not military or fighting damage, had to be made on steering equipment. The simple explanation of this fact is that under the strenuous conditions of military service crystallization of this hard-working part sets in much more rapidly than in ordinary work, where a car may be kept on fairly decent roadways most of the time.

Radiators Protected

One trouble much complained of is the lack of protection of the radiator. The slightest injury of the honeycomb developed very quickly into serious trouble since motors are always working at top capacity. Whenever possible, radiators are being protected by cheap but strong devices, such as wide-mesh, heavy-wire hoods. It is said that German trucks, constructed with a view to getting government subsidies for their purchasers, were better protected from the start than American trucks, which latter proved excellent in a great many respects. The Germans frequently praise the relatively low weight of American machines which permits greater fuel economy, a most important factor in Germany to-day. In this respect, American cars average much better than European makes.

Clearance a Factor

Another point which had not been foreseen sufficiently was ground clearance. Automobiles had of course to make their way over the most unimaginable ground and many a car was delayed for hours or, worse yet, disabled for weeks. Here, too, light and cheap American products gained laurels.

With the natural irregularity of supplies that accompanies war operations no matter how well managed, maximum carrying capacity for fuel and oil of paramount importance. The tanks, however, proved almost invariably to be hardly sufficient. Hence, whenever automobiles go to repair shops, small tanks are replaced by large ones, which latter are generally of aluminum, iron and copper being too costly for this kind of equipment at the present time.

Aluminum in Demand

Apropos of the increasing use of aluminum, there is a very noticeable tendency toward a reduction of dead weight in German automobile construction. Alloys of the nature of magnalium, a combination of aluminum and magnesium, which is both light and strong, are becoming very common, and German engineers and metallurgists do not tire of emphasizing the great help which the war rendered to their work by forcing the rapid development of many questions of this kind. There exist a great many new articles which enter into the manufacture of automobile parts, and several developments of paramount importance are said to be in the status nascendi. One of these, it is rumored, is an alloy composed mainly of aluminum to which has been added a metalloid element, and the mixture is said to closely resemble steel in its elastic possibilities.

Another novelty, or rather a series of innovations, exists in the fuel line. Let no one be surprised if after the war Germany will use almost no gasoline for her automobile motors. Not only has the use of benzol increased tremendously, but alcohol has become at least as common for motor service, and the very design of automobile motors has been adapted to the character of these novel fuels.

Synthetic Rubber Used

It has been mentioned in a former article that synthetic rubber is now a practical article in Germany. Seeing that Germany's imports in this very valuable and important substance, namely, para rubber, became practically nil with the outbreak of the war, the plans for making the material in a synthetic way were rapidly put on a commercial basis, and almost all new tires are now made of this material. Germans have no doubt that after the war they will soon increase their output of synthetic rubber and that they will be able to do so at such a low price as to introduce in a short time huge quantities of the material in the world. German technologists in particular are very optimistic regarding this development and more than one has been heard by the writer to predict for the rubber industry the same fate as that befell the indigo industry decades ago, when synthetic indigo was first brought out by the Germans and in a short time destroyed completely the trade in the natural East Indian product.

The Patent Situation

This incident, of which there are a considerable number of parallels, points to an important evolution in German industry. Until a short time ago, the Empire recognized what was known as secret patents, claims and specifications to inventions, which were filed by the government, but not published, yet protected the inventors' rights. Only the growing power of liberal business interests disposed in time of this rather undemocratic institution; but Germans now believe that the war will be followed by commercial competition so keen as to almost amount to a trade war against Great Britain and possibly America, and they will do their utmost to protect national business interests, even at the expense of some free institutions. It is to be supposed that, if these plans realize, the Germans will offer to the world after the war numerous new chemical products the compositions of which will of course be determinable by analyses, while the process of manufacture will be kept utterly secret. The Germans argue that such a course will be more beneficial to them than to patent their inventions abroad and run the risk of losing their title thereto, either temporarily or permanently, through war or other extraordinary event, as was the case with German patents in England. The advantage of secret, over the open patent method, German engineers claim, is well demonstrated by the thermit welding system, which requires aluminum in powder form for doing the welding work; but the method of producing the powder is not patented, yet kept strictly secret. Such a system of business, involving secrets of manufacture and trade, can, according to the Germans, be successful in Germany, though perhaps not everywhere else; since, as the Germans never tire to state, the German businessman, engineer and workman are ruled by a Berufsethik (ethics of vocation) which forms as essential and important a part of their morals as the decalogue.

Germany Adopts Production

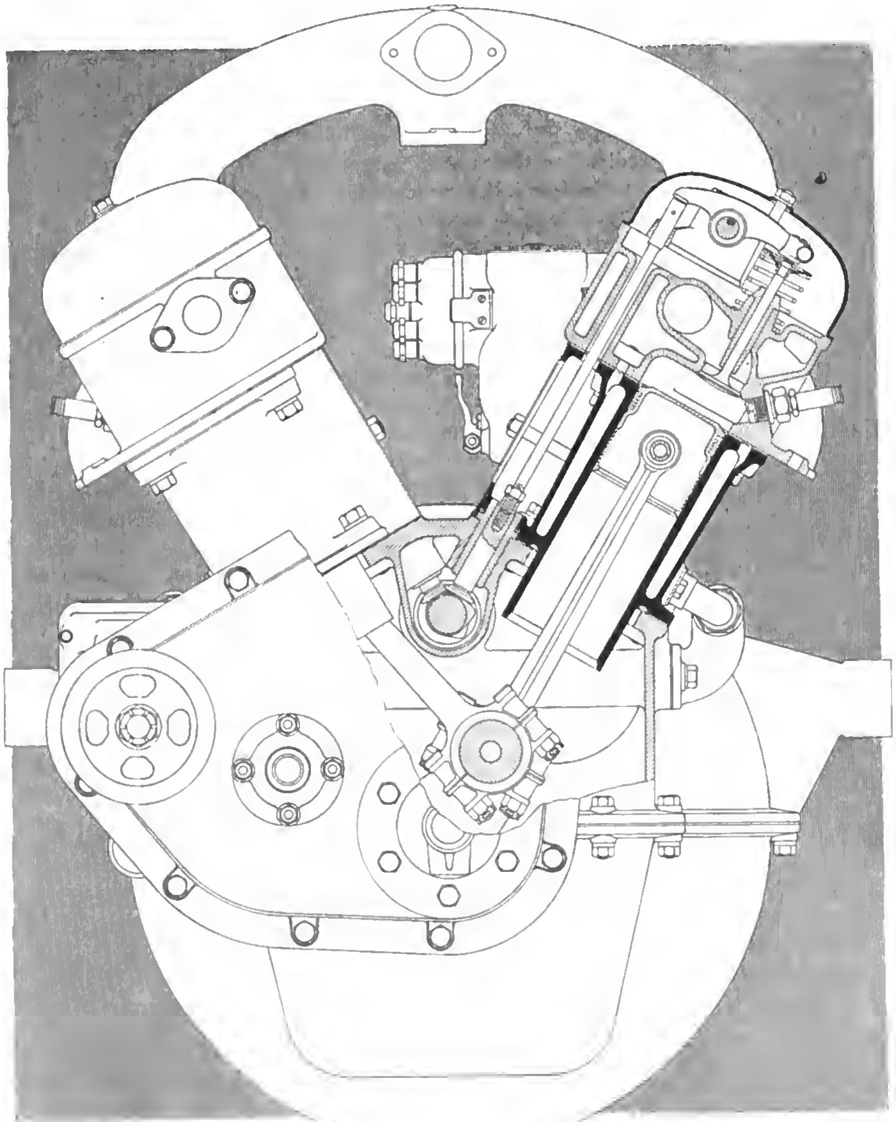
It may not be amiss to state that plans are under way for the organization of one or perhaps even several enormous motor manufacturing corporations which are to produce cars upon the myriad basis as it exists in the American industry. Germans thereby not only expect to curb the imports of American-made cars, which steadily increased during the six or eight years before the war, but they intend, in course of time, to become the chief power of supply for the international automobile market. For this, Germans state, they are indebted to the lesson Americans gave them during this war by exporting countless automobiles to Europe. Germany seems to believe that sooner or later there will be a chance for her also to determine history by commercial methods.

One more fact should not be forgotten in this connection. About one year ago, it looked as if the coming of peace would bring in time a wonderful chance for American industry exporting its products to Germany and the countries of her allies. For months, however, negotiations have been under way between these powers to complete, with the re-establishment of peace, a customs union, enabling them to buy industrial products from German and Austrian industry and to obtain agricultural products cheaply from the Balkans. Germans are inclined to believe that such a combination could soon be extended to include Italy and Scandinavia; and if these plans materialize only to the extent of one-half their scope, this will mean a huge obstacle in the way of any American industry figuring upon exporting to Central Europe after the war.

With peace expected in England by the end of next year, and in Germany considerably before that time, it is very important that Americans be prepared for the opportunities which the end of the war will bring. If rightly handled, these should be fully as profitable, if not more so, than the war has proved to industry of the Western Hemisphere.

Weidely Engine on Two Chassis

INTRODUCED toward the end of last summer, the Weidely twelve-cylinder engine has since been fitted to many Pathfinder cars and to a fair number of the new H. A. L. which made its maiden appearance at the New York show. The Weidely engine is comparatively small for a twelve, being 2⅞ by 5 in., giving a piston displacement of 389.5 cu. in. The overhead valves are operated by push rods from a single shaft with twenty-four cams, the tappets being of mushroom type. Adjustment is given by a screw in the end of each rocker, secured by a pinch screw, and this design makes the adjustment very accessible.



Section through Weidely twelve-cylinder 2⅞ by 5-in. engine

The crankshaft is 1⅞ in. in diameter and has three bearings, while it is drilled throughout for oil supply to the lower end connecting-rod bearings. The latter are placed adjacent on each crankpin and are stiff drop forgings.

Cast-Iron Pistons

For the pistons cast iron is used, with three narrow rings, and to reduce the spread of the cylinders the foot is carried down into the crankcase for a distance equal to three-quarters the length of the piston. There are four cylinder blocks, but the detachable heads are not thus sub-divided. In the sectional cut it can be seen that the intake manifold is duplex, carrying the water also. The water pump is located on the right side of the crankcase midway of the length, being driven in tandem with the generator. For the left blocks of cylinders a water pipe is taken across the engine passing through the crankcase at the center.

Camshaft Separately Oiled

For oiling the lubricant is fed from the gear pump to the three main bearings and is caught in centrifugal gutter rings on the crank webs as it escapes. From these gutters it is led into the crankpins and then taken up pipes to the wristpins. The camshaft is contained in a separate tunnel which gets a separate supply of oil, the overflow going to the front end of the engine where it lubricates the timing gears. There are two screens, one a sheet of fine mesh covering the whole of the bottom part of the crankcase, and the second still finer, being a smaller affair on the suction side of the pump.

The Rostrum

70,000 Miles at 3½ Cents per Mile

EDITOR THE AUTOMOBILE:—Perhaps the following figures will interest your readers. They give actual costs of operating an automobile for some 70,000 miles covering a period of three years, one man doing this driving and two cars worn to a point where it seemed best to sell them and buy new rather than spend more money for repairs.

In January, 1913, we bought a Ford runabout for one of our traveling representatives. In twenty months, or until September, 1914, he drove this car 37,550 miles at a total cost of operation of $1,256.72 or $0.0334 per mile. At that time we sold the car, purchasing a new Ford runabout. Adding the depreciation to the old car, the total expense was $1,566.72, making the total actual cost per mile $0.0417.

The new car was run 31,619 miles up to the present. We have just purchased a third runabout.

The total cost of operating the second car for eighteen months was, $817.43 or $0.02574 per mile. Including the depreciation the cost was $1,046.43 or an actual total cost per mile of $0.03309.

On the second car the itemized operating costs per mile were as follows:

Gasoline	$0.0082
Oil	0.00205
Tires	0.00784
Repairs	0.00495
Storage	0.0027
Total	$0.02574

You will note the cost of operating the second car was considerably less than that of the first car. We think this can be charged altogether to the skill of the driver who had never operated an automobile up to the time he began driving the first car purchased. Being entirely unfamiliar with the care of an automobile, he did not know how to handle it to get the best out of it. For instance, once he allowed the oil to get sufficiently low and a bearing was burned. After operating this make of car for some 70,000 miles, he has become something of an expert and gets the very most from his car all around in tires and repairs, oil, gasoline, etc. His gasoline mileage aside from the winter season averages 23 to 25 miles per gallon.

In conclusion we might say that he covers all kinds of roads in the three States of Connecticut, Rhode Island and Massachusetts.

Middletown, Conn. G. E. M.

Insufficient Gasoline at High Speeds

Editor THE AUTOMOBILE:—I have an Abbott-Detroit four-cylinder 4½ by 5½ Continental motor which has caused me a lot of annoyance. Every once in a while the motor will backfire at the most critical time, especially when climbing hills and sometimes on level ground when running at a moderate speed. There is a Stromberg carbureter and through the glass float chamber I am positive the gas is there. I cleaned out the whole of the gasoline system. Tried about forty different adjustments on the carbureter without results. Am positive valves do not stick and cylinders are free from carbon. Magneto is a Splitdorf model T and is a rebuilt one from the factory in exchange for the old one. Do not think the trouble is there as the car will run very well most of the time. Found leakage from high-tension wires in metal tube. Took those out and replaced clear of all metal and put in all new spark plugs. Thought I had it but the trouble still shows up. What is it?

2—Please illustrate by diagram distance armature breaks from field of Bosch and Splitdorf magneto to get the peak load. I understand the breaker points separate at this point throwing out the maximum amount of current to coil.

3—I am interested in running on kerosene, and two or three years ago I tried experiments on a Ford with such good results that you could not tell the difference in power. I used gasoline to start and the regular carbureter. I used to coil my feed pipe around the exhaust at its hottest place, thence to the carbureter, as the secret is to get the kerosene well heated before it enters the carbureter. On account of the heat a cork float is not good in the carbureter as it blisters the shellac. This is not practical on short runs as it needs too much manipulation; but on trucks or buses when the engine is not stopped all day it effects quite a saving. I also had a clean engine and as much power as I ever had.

Watertown, N. Y. A. F. W.

—Although you state you have cleaned out the whole gasoline system it seems quite evident that there is a clogging somewhere in the line or else the carbureter is too small. It is evident that you are not getting enough gasoline at high speeds. There is also a possibility that the carbureter air valve sticks open at higher speeds.

2—Your question is not quite clear but it is supposed that you mean to ask the point at which the primary circuit is broken in relation to the position of the armature with regard to the fields. On all magnetos it is the aim to break the primary circuit at the peak of the current wave and this is when the armature winding is cutting the greatest number of lines of force in the magnetic field. Exactly what this position is will depend on the arrangement of the magnets.

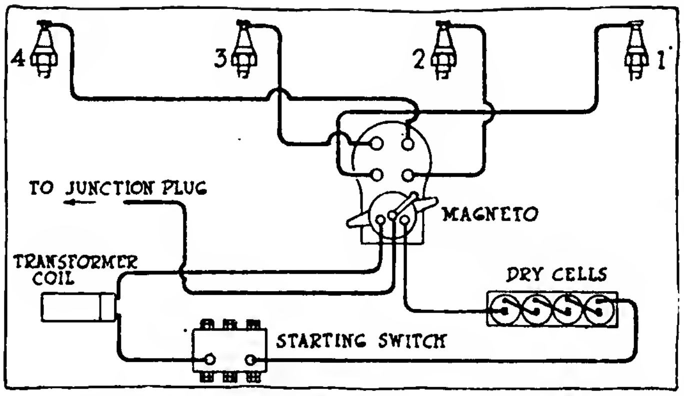
3—It seems to be quite practical to run on kerosene even with the ordinary type of carbureter as long as sufficient heat is added to assist the vaporization. The trouble of course is largely in being able to start the motor on this fuel.

Wants Information on Coey Flyer

Editor THE AUTOMOBILE:—Kindly publish information on adjusting the steering gear of the Coey Flyer 1916 model, so as to take up the backlash or play in the steering wheel. I have tightened up the nut on top of gear housing without avail, the wheel still has about 6 in. play.

The clutch thrust bearing on this car has given considerable trouble. The balls are ¼ in., nine in number and are contained in an ordinary ball retainer, such as is used in bicycles. This retainer has broken several times, allowing the balls to break and lose out. I have had to replace balls and retainer three times, during which time car was only driven 1600 miles.

2—What makes the motor keep on firing after being switched off? It appears to me to be the mixture. The carbureter is the Stromberg with only one adjustment, a small



Wiring diagram of the Maxwell car showing connections and circuits

knurled nut, on top of the float chamber. The motor seems to run best when this nut is opened about five or six turns to the left, but it consumes too much fuel. I can only get about ten or twelve miles per gallon of gasoline. Give a suggestion on adjusting this carbureter and state how many miles per gallon I should get out of this car, with the proper adjustment.

East Palestine, Ohio. E. M. G.

—The ring gear you refer to has two adjustments: On the top of the worm and on the side for the sector gear. In all probability you have taken up the end thrust on the worm but did not disturb the adjustment of the sector. It is also advised that you examine the steering arm as any steering arm has a tendency to work loose, owing to the great strains to which they are subjected. A little lost motion at any point in the steering gear means considerable at the wheel.

The clutch thrust bearing to which you are referring is being replaced gratis by the Coey company as the first few cars which were sent out had thrust rings which were not up to specifications. Since you have replaced these frequently there is a possibility that you have neglected to place light grease in and around the bearing, which is the only method of lubricating this thrust bearing.

2—Presumably this will be owing to carbon in the motor. It cannot be due to the carbureter if the ignition is switched off. Have the cylinder removed and all carbon thoroughly scraped off. You will probably find that cleaning the motor will enable you to operate the carbureter on an adjustment which will give a leaner mixture and therefore cure the present heavy consumption.

Float Valve Seat Is Damaged

Editor THE AUTOMOBILE:—Will you please tell me how to grind in the float valve of a Schebler carbureter that leaks slowly; a new needle has not cured the trouble. The needle has a steel cone on a brass stem.

Scranton, Pa. D. R. C.

—It is evident that the float seat valve has become damaged and this should be repaired with a float valve reseating tool. If the carbureter is sent to the manufacturer or to the nearest distributor, which in your case is the Manufacturers' Supplies Co. of Philadelphia, they will be glad to reseat the float valve seat in the bowl so that the valve will seat properly and eliminate flooding trouble.

This would have to be done with a special tool in order to get a satisfactory job, so it is better to either send the carbureter to the manufacturers in Indianapolis or to the agency in Philadelphia.

Ignition System of Maxwell 25

Editor THE AUTOMOBILE:—Please explain ignition system on 1916 Maxwell 25.

Uniontown, Pa. H. G.

—Ignition on the Maxwell car is furnished by a Simms high-tension magneto assisted by dry cells and transformer coil to facilitate starting. The ignition system is of the dual type, having a small non-vibrating coil which is attached to the frame of car. This coil is unaffected by either moisture or heat, and being non-vibrating there is nothing to get out of order or require any adjustment.

Four dry cells are used in connection with this system, and care must be taken to connect them correctly. This is most important, and the wiring diagram should be consulted before disconnecting or connecting any of the ignition wires.

The switch operating the battery circuit is in connection with the starting switch and when the starting pedal is depressed, thereby throwing the starting motor into operation, the current flows through the switch, coil and magneto. As soon as the engine starts or the starting pedal is released, the circuit is automatically disconnected and the engine runs on the magneto. It is readily apparent that the operation is extremely simple with the additional advantage that it is impossible to unconsciously leave the switch on and thus run down the batteries.

To start, the spark should be fully retarded—not only to eliminate the possibility of back-firing but because the spark is actually hotter when the spark control lever is fully retarded, with the engine running at very slow speed. At medium, or high speed the best results are secured with the ignition partly or fully advanced.

Data on 1912 Overland

Editor THE AUTOMOBILE:—Will you state, if possible, the amount of money earned as prizes by each of the following drivers during the 1915 racing season? Cooper; Anderson; Resta; O'Donnell; Rickenbacher; Alley; De Palma and Burman.

2—If possible will you print the horsepower curve of the 1912 Overland model 60?

3—What is the maximum number of revolutions of this motor per minute?

4—With this model stripped down, in good working order, geared 2½ to 1, what speed should it attain?

Somerville, Mass. C. R. N.

—The amount of money earned by the drivers you mention is as follows:

Resta	$37,750	Rickenbacher	24,000
Anderson	37,000	O'Donnell	19,000
Cooper	30,750	Alley	12,200
DePalma	24,600	Burman	11,000

2—THE AUTOMOBILE has no horsepower curve of the Overland 1912 model 60.

3—Maximum speed is from 1800 to 2000 r.p.m.

4—If this model were stripped down and in good working order geared 2½ to 1 you should be able to obtain a speed of from 60 to 65 m.p.h.

Recommends Use of Tire Caliper

Editor THE AUTOMOBILE:—In looking over THE AUTOMOBILE for March 9, I was much interested to read the article in The Rostrum by M. C. C. on prolonging the life of automobile tires. M. C. C.'s idea of changing the tires around on the different wheels seems to have worked out very well in his case, but he evidently is willing to go to more trouble than the most of us. In his letter, M. C. C. says, "While on this subject, why not give us a well worked-out table showing the actual inflation pressures for tires of different sizes and under different loads, giving actual road weights and not empty car weights which plainly mean nothing when taking a seven-passenger car and a runabout with the same size tires. There is no use carrying a greater inflation than is necessary and proper for the weight the tire has to support."

The writer has felt a good deal the same way about this, and a few months ago the problem was solved by the use of a tire caliper designed to take actual load into consideration in maintaining air pressures. For instance, the tire caliper is placed over the tire at the top where there is no load strain. After this is done, the reading is taken on one of two scales shown on the caliper. The caliper is then set at the same reading on the second scale, or load scale, and the caliper placed over that part of the tire which comes into contact with the ground. If the tire does not fill out the space within the jaws of the caliper, there is too much air in the tire for the load. On the other hand, if the caliper will not slip over the tire, there is not enough air in the tire, and more should be put in.

To the writer, this seems to be the simplest and most satisfactory method that he has used, it being much less trouble than the air gage, which necessitates removing dust and valve caps. I believe that M. C. C. will be interested in this, as well as many other motorists who are anxious to cut down tire bills.

Boston, Mass. G. A. S.

Wire Cloth Strainer vs. Chamois

Editor THE AUTOMOBILE:—In two different issues of THE AUTOMOBILE I saw articles concerning a charge of static electricity being generated by passing gasoline through a chamois. In order to set myself right on the matter I wrote to the Department of the Interior, Bureau of Mines, Washington, D. C., for authentic information and for the benefit of your readers I am quoting from a letter received from this department.

"There are various reports which have come to the attention of this bureau which would make it appear that when gasoline is poured through a chamois skin in a metal funnel, the funnel is charged with static electricity. If the funnel is grounded, naturally the charge passes off to the earth. In cases where the funnel is held above the metal receiving tank or the container, and when a considerable quantity of gasoline is passed through the chamois skin, a comparatively large charge accumulates from the funnel, and if the funnel should come in contact with the container, the charge is drawn off, resulting in a spark which, from reports received, has ignited gasoline vapor.

"A charge of static electricity was obtained by placing a chamois-lined funnel inside of a glass funnel, insulating the metal funnel from the container, which was insulated from the ground by being placed upon a rubber-covered table. A copper wire connected the glass funnel with an electroscope. Upon pouring gasoline through the chamois-lined funnel a charge of static electricity was generated, as indicated by violent separation of the leaves of the gold-leaf electroscope. When the container and funnel were grounded, no charge of electricity was generated. In damp, warm weather there is less danger of generating the charge than when the humidity is low."

It is evident from the above that it is preferable to strain the gasoline through a wire cloth and at all times to have the funnel, container and receiving tank in contact and properly grounded.

Media, Pa. R. A. H.

Removing Scale from Radiator

Editor THE AUTOMOBILE:—Please give complete directions for removing scale and other deposits from the radiator of an automobile.

I have seen general directions, but they never seem to be complete. If sal soda or soda ash is used, please state how much per gallon and under what conditions to use same, how long it should be left in the radiator, etc.?

Uniontown, Pa. E. T. P.

—Scale can be removed from radiators by using a saturated solution of common washing soda and water. Thoroughly flush the radiator out with the solution then clean with fresh, pure water. A mixture of ordinary washing soda in which 4 oz. is used to the gallon of water will do the work properly.

Horsepower and Pulling Power

Editor THE AUTOMOBILE:—Suppose two automobiles each weigh 2600 lb., one having a horsepower of 25 and the other 26; about how much more weight would the 26 hp. one move at usual driving speed than the 25-hp. car? Would it be as much as 500 lb.?

Rochester, N. Y. W. A. P.

—Assuming that both cars had the same frictional losses in transmission of power and had the same gear reduction, the ratio of pulling power under most circumstances would be 25 to 26. It is impossible to give definite figures.

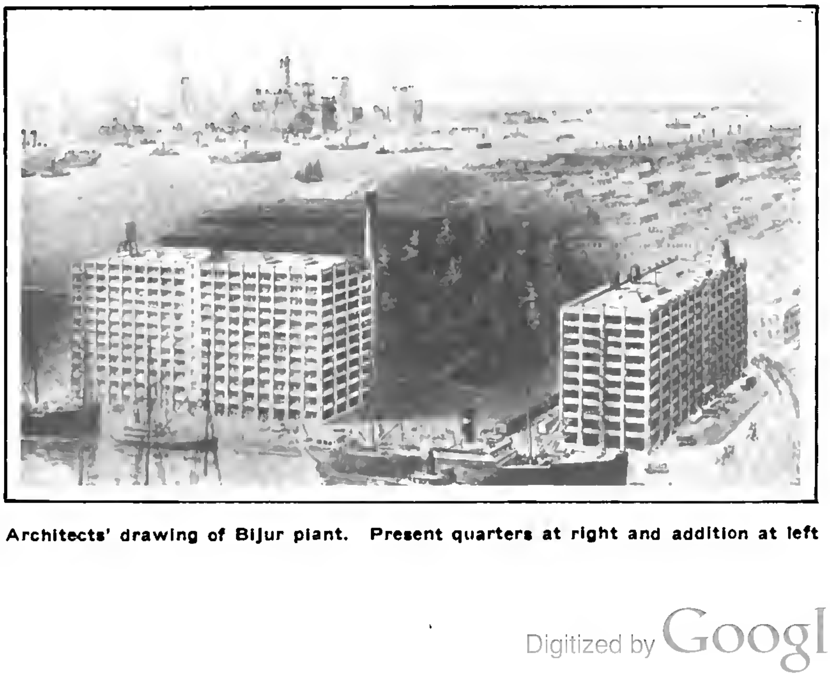
Correct Timing of Chandler

By a typographical error in giving the firing order of the Chandler six in The Rostrum last week, the fifth cylinder was mentioned twice. The correct firing order is 1-6-3-5-2-4.

Bijur Adds Twelve-Story Plant

NEW YORK CITY, April 8—The Bijur Motor Lighting Co., Hoboken, N. J., is erecting a fireproof twelve-story and basement addition to its plant, which will be 265 by 85 ft., giving 260,000 sq. ft. of floor space. The construction is steel, concrete and glass, and the building is located about 150 ft. from the company's present plant which will be continued. It is expected that the addition will be occupied by July. Offices will be on the top floor and a progressive system of manufacture will be used, the materials passing downward until emerging as complete machines on the ground floor. There are two passenger and two freight elevators and an automobile elevator.

It is probable that the spacious basement of the new building will be utilized for a garage which will be of the most up-to-date type. Shipping facilities of the Bijur company plant and its addition are excellent.



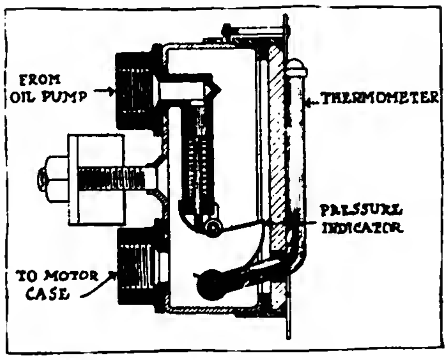
Architects' drawing of Bijur plant. Present quarters at right and addition at left

ACCESSORIES

Climax Motor Indicator

THIS device combines a pressure gage, motor indicator and oil sight feed and is mounted on the dash. The makers rely on the lubricating oil of the motor for registry, referring to it as "the blood of the motor," as it comes into contact with all the working parts. No matter how high the pressure may run when the motor is cold, the instrument is not affected by the additional strain imposed on it by such conditions, according to the manufacturers. The oil gage enables the driver of the car to see whether or not the oil is circulating properly and the indicator registers the temperature of the oil on the thermometer as it passes through the gage. The importance of this is that, should the quantity of the oil in the motor diminish, a rise in temperature would be indicated on the thermometer, as would also poor circulation of the cooling water, a late spark or too rich or too lean a mixture. When the thermometer registers "no higher" than the atmospheric temperature, the oil is not working. The indicator sells for $5.—Climax Motor Devices, Cleveland, Ohio.

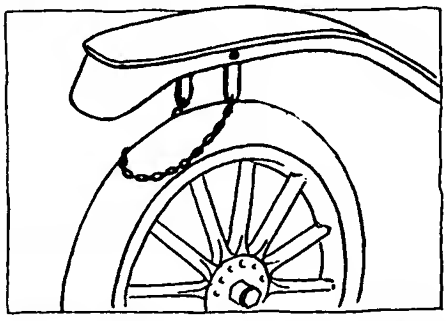
Climax motor indicator for dash mounting



Section through Climax indicator

Wild's Tire Guard

This guard consists of a chain resting on the tire, its purpose being to dislodge nails, sharp stones and similar objects before they can penetrate far enough to do serious damage. The chain attaches to fender brackets. Price, $1.25 each.—Motor Car Supply Co., Minneapolis, Minn.



Wild's tire guard for removing nails, etc.

Goodyear Tire-Saver Kit

This kit is designed to enable car owners to increase the mileage obtained from their tires by applying first-aid measures before serious troubles develop. It contains a rim cut patch; an outside protection patch; a No. 4 self-cure patch; a 2-oz. can of repair tape; a 2-oz. can of patching cement; a 2-oz. can of tire putty; a pressure gage and a tube of French talc. For tires of 3 and 3½-in. diameter, the kit sells for $3.50; for 4 and 4½-in., $3.75, and for 5 and 5½-in., $4.—Goodyear Tire & Rubber Co., Akron, Ohio.

Rives Never-Slip Pedal Pads

These rubber pedal pads are designed to obviate all tension, shock and wearing of the shoe sole, also to prevent the foot from slipping in operating the pedals. No. 1 is made for Fords and will fit all oval pedals from 1¾ by 3¾ in. to 1⅞ by 3½ in. No. 2 fits all pedals having flat or curved surfaces measuring from 2¼ by 3¼ in. to 2¾ by 3¾ in. No. 3 is for pedals with large oval surfaces from 2¼ by 4 to 2¾ by 4½ in. No. 4 is for Maxwell cars. No. 5 for Mitchell and Dodge Bros., being for pedals with round surfaces from 2¼ to 2¾-in. diameter. No. 6 fits pedals with long and narrow rectangular or oval surfaces from 1½ by 3¼ to 1¾ by 4 in. No. 7 is for pedals with flat or curved surfaces from 2⅜ by 4¼ to 2¾ by 4¾. The pads sell for $1 per set for all models.—George H. Rives Mfg. Co., New York City.

Rives adjustable rubber pedal pads. These are made for all makes of cars

Kilborn-Sauer Lamps

Among the many lamps in this line is a distinctive little projector only 3½ in. diameter which sells for $3.50. It has a one-piece cylindrical body, a universal joint so that the light can be projected in any direction, a handle at the back and a substantial bracket for attachment to the windshield; a dash switch goes with each lamp. A larger spotlight is made in two models, 6-in. and 8-in.; the former costs $6 and, with 4-in. mirror, $7, and the latter $9 and $10. In this lamp also the body is in one piece, but it is of the more conventional parabolic form. A Ford set of 2 side lamps and a tail lamp is offered at $5; the feature of the side lamps is that they throw light on the running-boards without shining in the eyes of the driver. A sufficient length of flexible cable is furnished with each set.—Kilborn-Sauer Co., Fairfield, Conn.

Two of the Kilborn-Sauer spotlights

Motor-Aid

A fan wheel with a heavy flywheel rim is installed in the exhaust line so that the gases impinge upon the blades of the fan and cause it to rotate rapidly. The strong exhaust impulses give the wheel a high rotative speed and this is maintained by the flywheel so that the fan acts as an exhauster between impulses, creating a partial vacuum in the exhaust pipe and assisting in clearing out the products of combustion. The makers claim better and more economical motor operation due to reduction of back pressure. Price, $30.—Motor Aid Co., Chicago, Ill.

The Automobile

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Stock Versus Custom

EVERY man knows that the reason the average American automobile is such excellent value for its price is because it is a stock product. Because it is reproduced in quantities without any difference between one car and the next of a particular series. It can be but a fraction of the price that would be needed if each car were of different design.

We have to-day stock cars of enough sizes, qualities and types to suit all classes of buyers. The custom built chassis has ceased to exist and the custom built body is asked for only by those who wish individuality for its own sake, who must have something different from their neighbors and are ready to pay the large price demanded. The custom built car came first and is still selling in large numbers, larger than ever probably, but the stock car grew alongside and multiplied at an immense pace so that the custom built car has become an insignificant percentage of the total.

Standardization, of the sort which has been carried out by the S.A.E., has the same effect upon the industry as a whole as has concentration upon one type of chassis upon the business of a single manufacturer. Without standardization of detail the stock cars of to-day would be quite considerably more costly.

The individual manufacturers effected standardization within their own factories as soon as ever they commenced to concentrate upon real manufacturing as opposed to car building. The S.A.E. standards begin where the individual manufacturer leaves off and carry the process on, so that the steel mill and the parts maker are saved the necessity of "building" their product for each manufacturer of automobiles. Over the whole range, from the melting of the ores to the shipping of the completed car, every saving in cost that can be made reaches the final buyer.

Work Only Begun

The standardizing work has but begun; it will never be completed as long as knowledge progresses, for new discoveries will demand new consideration. For the next 10 years automobile standardization will go on increasing in importance, will need more work and more money for its successful accomplishment. It is just about to expand out of America and to spread over the earth as the American automobile is spreading and acting as the missionary.

The Differential

THE suggestion that the differential may cease to be a part of automobile makeup will come as a shock to a good many engineers who have always thought it an essential. On the short wheelbase cars of the early days it was essential and, giving little trouble, few have given it much thought. Always it has been realized that the differential had a bad fault in that the power goes to the wheel with the least traction, and if one wheel has no traction, as when in a mud hole, then that wheel spins and the car comes to a stop. There have been many attempts to overcome this. One of the earliest was to fit each rear wheel with an overrunning clutch so that the outer wheel was driven when on a curve, the solid driveshaft turning idly within the inner wheel. This worked very well, but a car of this type could not be reversed without rather complicated locking mechanism for the clutches.

Many Alterations

Next attempts were made to devise an overrunning clutch which would act automatically both forward and reverse without hand control; then came differentials with high internal resistance, and finally solid axles without differentials. To-day all three of these types exist side by side and the engineers are becoming sufficiently interested to investigate them seriously. The outcome may easily be a distinct improvement in the conventional car by lessening the danger of skidding and increasing tire durability.

The ideal is to have a differential for some conditions and not to have one for others, while the wheel that has the least traction should receive the least power. Of the two wheels the one best able to transfer the tractive force to the road should get most of that force and the wheel with little traction not enough to make it spin.

328,366 Cars Built by Five Cities in Three Months

During January, February and March, Detroit, Toledo, Flint, Jackson and Lansing Broke All Records—238,076 of Total Built in Detroit Plants

DETROIT, MICH., April 8—Automobile production for January, February and March of this year has reached the total of 328,366 cars from the five cities of Detroit, Toledo, Flint, Jackson and Lansing, all in the great production zone surrounding this city. This increase for the first quarter has no precedent in automobile manufacturing annals. During the first three months of 1915 all of the automobile factories in the country built approximately 106,000 machines. The Detroit zone alone has tripled the production of the entire country during the first quarter of this year.

Detroit Plants Lead

Of this total of 328,366 machines built in these five cities, Detroit factories lead with 238,076 cars, according to a careful census made by THE AUTOMOBILE. This leaves 90,290 machines for the other four cities which house such large factories as Overland, Buick, Reo, Chevrolet, Oakland and Oldsmobile.

Figuring the average overall length of the 238,076 cars built in Detroit in the first three months of 1916 to be 12 ft., these cars would form a line 540 miles long if they were placed end-to-end. In other words, such a line would extend in a double line from Detroit to Chicago.

Naturally Ford leads in these almost staggering figures of production increase in this production zone. There were 149,005 Fords built during the three months. March was the greatest month in Ford history, there being 58,329 cars built at the home factory and the several assembly plants. Ford figures for the three months are: January 44,365; February 46,311; March 58,329. These figures almost eliminate any doubt as to the probability of 500,000 Ford cars being built during the fiscal year.

Overland Is Second

Following Ford comes Overland, the second largest producer of automobiles in the world. This Toledo factory has made extraordinary progress in production during the first three months of this year as compared with the corresponding months last year. January, February and March, 1916, resulted in the manufacture of 47,465 Overland cars, 12,393 in January; 15,292 in February and 19,780 in March. Compare this with the total for the first three months of 1915, which was 17,245 automobiles. In other words, March, 1916, exceeded the entire production of the first three months of 1915 by over 2000 cars and the entire quarter is nearly three times ahead of last year's first quarter.

Carload Shipments

January	12,000
February	21,502
March	28,600

Car Production

Ford

January	44,365
February	46,311
March	58,329

Overland

January	12,393
February	15,292
March	19,780

Many other factories have shown proportionate increases. Take the Saxon, for example. Last year's first quarter showed a combined production of 2591 Saxons, but for the present quarter 6391 machines carried the Saxon name. March just passed resulted in the building of 2604 Saxons, thus exceeding alone the record of the first three months of 1915.

Production's Rapid Increase

Everywhere you go you are met with information of unprecedented growth in production among the well-known companies.

Studebaker indicates an increase of 100 per cent over last year's first quarter. Packard declares that its production has stepped up 300 per cent.

Cadillac has shipped 26,563 eights since it started to make them, a wonderful showing for a high-priced car, as prices are reckoned these days. There are some 400 Cadillacs awaiting shipment now, and they would have been on the road long ago had there been freight cars in which to ship them.

Reo has been enjoying a wonderful growth in Lansing, and shows greatly increased output.

Oakland states that its production is 400 per cent better than for the first quarter of 1915.

March showed the best record for manufacture and shipment of cars in the history of the Paige-Detroit Motor Car Co., production facilities having been increased to 175 cars a day.

Maxwell is making over 300 cars a day now, and is attaining a monthly output of about 8000.

If it were possible to divulge the actual output in all of these cases, the public would be astounded at the figures. These give a good indication of the great advance which the industry is making in nearly all directions.

Many Handicaps

When you consider that a number of things of a more than passing seriousness have been confronting the makers this year, the results are all the more astonishing. Never has the tie-up of freight cars been so acute; never in the history of the business have raw materials been higher or more difficult to obtain; gasoline is high; prices in a great many instances have had to be raised on the cars as a result of materials conditions; labor of the right kind is scarce.

Yet with all their problems, the factories are striving in every way to meet the demand for cars. Higher prices do not seem to mitigate against the vehicles in any way, for the average purchaser seems willing to pay slightly more rather than have the quality of the car curtailed. All seem to realize the unusual market conditions and understand the reasons for increased prices.

Freight Situation Easier

Although the National Automobile Chamber of Commerce reports no betterment of the freight car situation, there are some who feel a bit easier over it, although nothing very beneficial has developed. The removal of certain embargoes to points in the East have helped somewhat, and with spring coming on, it seems likely that the congestion will automatically be bettered, at least slightly. March was the record shipping month so far in the history of the industry, the carload shipment statistics for 1916 being given herewith.

J. & D. Tire & Rubber Co. Formed

H. O. Smith Completes $500,000 Organization — Factory in Charlotte, N. C.

CHARLOTTE, N. C., April 7—The J. & D. Tire & Rubber Co. was organized here to-day for the manufacture of pneumatic tires for automobiles. The president of the organization is Harold O. Smith, who started in the rubber business in 1893 as one of the founders of the Indianapolis Rubber Co., which concern later became the G. & J. Tire Co. of Indianapolis, of which Mr. Smith was president. Mr. Smith was in the tire business approximately thirteen years until 1906, when he formed the Premier Motor Car Co. of Indianapolis, of which he was president until a year ago.

It has been known for more than a year that Mr. Smith has been arranging for the formation of the tire organization, which was completed to-day. Charlotte, N. C., was selected as a factory location because it is a favorable center for satisfactory labor for this class of work and offers good facilities for the necessary factory power.

The J. & D. Tire & Rubber Co. has been capitalized for $500,000 and will manufacture only one grade of pneumatic tire, which will be built in all the necessary tire sizes. It is expected that the trade name for these goods will be J. & D. Production will be started by July. This is possible, as Mr. Smith obtained options on tire machinery last October. Already plans have been drawn up for the erection of a new factory in this city and work has commenced. The factory contracts are such that production will be possible by July.

Mr. Smith has been elected president of the organization and has connected with him some most influential interests and men strongest financially in this section. To facilitate selling arrangements some of the largest distributing interests in the country have been taken into the organization, so that J. & D. tires will be sold largely to the company's own organization. Associated with President Smith are: Thomas J. Northway, Rochester, N. Y., vice-president; L. A. Falger, Charlotte, N. C., secretary; C. C. Coddington, Charlotte, N. C., treasurer. Directors, in addition to the officers, are: Harry S. Leyman, Cincinnati, Ohio, D. H. McColough and E. Thomonson.

22,773 Canadian Fords in 8 Months

FORD, ONT., April 7—From the beginning of the 1916 fiscal year of the Ford Motor Co. of Canada, Ltd.; that is from Aug. 1, 1915, to April 5, 1916, or a period of about eight months, the Canadian Ford company made and shipped 22,773 Fords, as compared with 7443 during the corresponding period of the 1915 fiscal year. The total production for the 1916 fiscal year is expected to be 40,000. During March 4500 cars were shipped, of which 1681 went to foreign countries. Of the total of 22,773 cars made, 12,442 were sold in the Dominion and 9569 went to foreign countries. March 29 the company had its biggest day of production, when 312 cars were made and shipped, of which 120 were for export.

Auburn and Lozier Raise Prices

NEW YORK CITY, April 8—The Auburn Automobile Co. has advanced the list price on its Model 6-38 from $1,050 to $1,085, effective April 1. Models 4-36 at $895 and 6-40A at $1,375 remain the same for the present.

A $100 increase will be made on the Lozier four, which will sell after April 15 for $1,695. For the time being there will be no raise in the price of the six selling at $2,775.

1,111,623 Champion Spark Plugs in March

TOLEDO, OHIO, April 10—All production and sales records of the Champion Spark Plug Co., Toledo, Ohio, were broken during the month of March, just past. In that month were produced 1,111,623 complete spark plugs and 167,420 assembled porcelains, while sales were 1,137,299 complete spark plugs and 94,277 porcelains.

However, the Champion Spark Plug Co. states that there will be a 100 per cent increase in production when the new six-story addition is finished.

4460 Overlands in One Week

TOLEDO, OHIO, April 10—During the week ending April 8, the Willys-Overland Co., established a new shipping record, a total of 4460 Overland cars being shipped. This is at the rate of 743 cars for each of the six working days and better than thirty cars per hour, on a twenty-four-hour schedule.

George Heads Napoleon Co.

NAPOLEON, OHIO, April 6—The recently incorporated Napoleon Auto Mfg. Co., this city, has elected A. O. George as president, F. P. Diemer and G. M. Donnelly, vice-presidents; O. A. Diemer, secretary and treasurer, and C. E. Donnelly, general manager.

The company will assemble a four-cylinder 25 hp. chassis at the start, and later on will produce a finished car. The Morningstar plant in this city has been secured.

$5,000,000 Perlman Stock Issue

Half of $10,000,000 Capital Offered to Public at $120 —Is Over-Subscribed

NEW YORK CITY, April 10—Stock of the $10,000,000 Perlman Rim Corp., recently organized here to manufacture the Perlman demountable rim, is to be offered to the public. Subscriptions to the underwriting of the 50,000 shares, no par value, out of 100,000 shares of the Perlman corporation, are being received by J. S. Bache & Co. at $120 a share. Underwriters will have the privilege of withdrawing half of their stock, which must be withheld from sale for six months.

Only $5,000,000 of the $10,000,000 stock was offered for subscription, the remaining $5,000,000 being retained by Messrs. Kaufman, Durant and Perlman, who jointly own the entire amount. Subscriptions received were nearly double the amount of the issue so that it was necessary to reduce the allotments.

The directors of the Perlman Rim Corp. are L. G. Kaufman, president of the Chatham & Phenix National Bank; W. C. Durant, president of the Chevrolet Motor Co.; L. H. Perlman; L. B. Rosenberg, banker, and Christian Girl, president of the Perfection Spring Co. Mr. Perlman is president of the new company and Mr. Girl vice-president. The executive committee is composed of L. G. Kaufman, chairman; W. C. Durant and L. H. Perlman.

The Perlman Rim Corp. will have 100,000 shares of stock of no par value, and will have no bonds or debt. The company will start with $3,000,000 cash.

Within ninety days it is expected that the output of the company will be established at the rate of 1,000,000 sets of rims a year. Earning power is estimated on this basis at between $2,500,000 and $3,000,000 per annum.

The application of the Standard Welding Co. for a temporary suspension of the injunction secured by the Perlman interests has been withdrawn.

Goldie Is Columbia Factory Manager

CLEVELAND, OHIO, April 6—R. J. Goldie has become factory manager of the Columbia Axle Co., this city. For the past two years he has been the works manager of the Metals Products Co. Previous to his connection with the Metal Products Co. he was with the Chalmers Motor Co. for five years.

Knight Tire Plant Reopens

CANTON, OHIO, April 6—The Knight Tire & Rubber Company, this city, closed since last week on account of a shortage of rubber, has reopened.

Bock Bearing Co. Reorganized

New $1,650,000 Bock Taper Roller Bearing Co. Takes Over Plant

TOLEDO, OHIO, April 6—Retaining the old name, a new $1,650,000 corporation has taken over the plant of the Bock Bearing Co., on Phillips Avenue, this city. The following officers have been elected: President, W. E. Bock; vice-president, Eugene Rheinfrank; secretary and treasurer, C. H. Clement.

The officers, with M. H. Murch of Cleveland and J. E. Dunipace of Toledo, comprise the directorate.

The new company was incorporated about a week ago under the name of the Bock Taper Roller Bearing Company.

Of the stock issue of the new corporation, $1,200,000 will be common and $450,000 will be 7 per cent cumulative preferred. The capital of the old company was $212,500 common and $150,000 preferred.

As part consideration in the transfer of the old company to the new, holders of old stock will exchange share for share of new stock, and holders of old preferred will receive two shares of new common for one of preferred.

The plant of the Bock Bearing Company will be tripled in its capacity. Work will be started immediately. The present output of bearings is 1200 a day. With the new facilities as planned, the daily output will be 3000 bearings. The company at present employs 200 men.

Briscoe Motor Corp. Leases Fuller Buggy Plant

JACKSON, MICH., April 7—The Briscoe Motor Corp. has leased the plant of the Fuller Buggy Co., and will probably use it as its final assembly plant. Business has been increasing right along for the past few months, and more manufacturing room has become a necessity. As it will take too much time to build additions it was found advisable to lease buildings where it will only require a few weeks to put them into operative condition.

Clyde Truck Plant in L. I. City

NEW YORK CITY, April 6—The Clyde Motor Truck Co., which was incorporated last month in Delaware with a capital of $750,000, of which $250,000 is preferred and the balance common stock with a par value of $10, has acquired a plant in the automobile district of Long Island City, near Woodside. It is expected that deliveries on its 1-ton truck, selling at $1,000, will begin in July. The purpose of the company is to assemble this truck exclusively. It is equipped with a Buda engine.

M. C. Swartz, a real estate operator, is president of the company; W. F. Melhuish, formerly of the White Motor Co., is vice-president; J. F. Mason is secretary, and E. E. Vreeland, an advertising man, is treasurer. Among the directors are P. R. McLean, a director of Fraser & Best, Ltd., Australian exporters and importers; Walter Kenlon, son of Fire Chief Kenlon, and P. J. Holdsworth.

White Motor Co. Elects Officers

CLEVELAND, OHIO, April 10—At the annual meeting of the White Motor Co., the capital stock of the White Co., which is owned by the White Motor Co., was reduced from $5,000,000 to $500,000. The White Co. will become the selling organization for White trucks and automobiles.

The following board of directors was elected at the annual stockholders' meeting of the White Motor Co., April 8: Windsor T. White, Walter C. White, A. R. Warner, E. W. Hulet, Otto Miller, M. B. Johnson and J. R. Nutt, of Cleveland; and J. H. Harding, A. M. Hall, 2d., Theodore Roosevelt, Jr., and E. R. Tinker, of New York.

At the first meeting of the directors, the following officers of the White Motor Co. will be elected: Windsor T. White, president; Walter C. White, first vice-president; E. W. Hulet, second vice-president; M. B. Johnson, chairman of the board; Otto Miller, treasurer; A. R. Warner, secretary and assistant treasurer.

The White Motor Co. is having quite a little trouble in securing cars for the shipment of trucks to New York for export. As a result a large number of trucks have accumulated in its yards. The traffic department believes that if the railroads would increase their own charge for holding cars over time from 45 cents to $1 per day, shippers would experience relief sooner than through the increased demurrage charge which the roads are now allowed to charge shippers.

Covert Incorporates for $1,000,000

LOCKPORT, N. Y., April 7—The Covert Gear Co., this city, has been incorporated with a capital of $1,000,000, to manufacture trucks, tractors and other vehicles. The incorporators are W. W. Armstrong, P. A. Clum, B. V. Covert.

Schwalbach Leaves Perlman Interests

NEW YORK CITY, April 10—Alexander Schwalbach, formerly with the J. S. Bretz Co., and more recently connected with the development of the Perlman Rim Corp., has severed his connection with the latter. Mr. Schwalbach has not as yet made any plans for the future.

G. M. C. Buys 35-Acre Tract

To Provide for Possible Concentration of Cadillac Co.'s Plants

DETROIT, MICH., April 11—*Special Telegram*—Thirty-five acres of land have been purchased by the General Motors Co. in the northeastern part of Detroit, and adjoining a 58-acre tract which was acquired three years ago by the company. This gives a frontage on the railroad of 4600 ft., with shipping facilities on the Grand Trunk, Detroit Belt Line and Michigan Central railroads.

President C. W. Nash stated to-day that the property had been acquired to safeguard the Cadillac Motor Car Co. in the event that the company should deem it advisable to concentrate its plant at one place. At the present time Cadillac plants are situated in several parts of the city and such a site as the General Motors Co. has provided would mean complete concentration at the one location. The body factory is now several miles from the main works, and the remarkable growth of the Cadillac company has meant many additions to the parent plant.

Peerless Truck Re-elects Directors

NEW YORK CITY, April 11—All the present members of the Peerless Truck & Motor Corp. were re-elected at the annual meeting in Richmond, Va., April 4. The election of officers will take place April 14. The board of directors is composed of the following members: C. V. Rich, vice-president of the National City Bank and president of the National City Co.; E. R. Tinker, Jr., vice-president Chase National Bank; P. J. McIntosh, 26 Broadway, president of the General Gas Appliance Co., director of Montreal Public Service Corp., and other Canadian companies; B. G. Tremaine, F. S. Terry, identified with General Electric Lamp Works at Cleveland; P. D. Wagoner, president of the General Vehicle Co., Long Island City; L. H. Kittredge, president of the Peerless Motor Car Co., Cleveland; Harrison Williams, identified with Cleveland Electric Illuminating Co., as chairman of board; E. W. Hargen; T. W. French, vice-president of the Peerless Motor Car Co.; and Harvey Hooke.

Haas Joins Monroe Co.

FLINT, MICH., April 10—L. D. Haas, sales manager of the Chevrolet Motor Co. of Michigan, has resigned to become sales manager of the Monroe Motor Co., this city. F. K. Lane will succeed Mr. Haas at the Chevrolet plant. He is at present manager of the Chevrolet branch at Dallas, Tex.

Premier Organization Completed

Officers, Directors and Department Heads Selected—$2,500,000 Capital

INDIANAPOLIS, IND., April 10—The organization of the Premier Motor Corp., this city, has been completed and that concern is now ready for business. The corporation starts with a capital stock of $2,500,000 and large production of quality cars is the intention.

The officers are as follows: J. C. Flowers, president; F. E. Smith and E. W. Steinhart, vice-presidents; C. F. Jensen, secretary; and H. L. Thompson, treasurer.

The directorate consists of George Woodruff, president of the Illinois Bankers' Assn. and president of the First National Bank, Joliet, Ill.; H. L. Thompson, secretary of the Gerlach-Barklow Co., Joliet, Ill.; T. R. Gerlach, vice-president of the Gerlach-Barklow Co., Joliet; C. F. Jensen, president of the Vanguard Mfg. Co., Detroit, Mich.; F. W. Woodruff, vice-president of the First National Bank and vice-president of the Woodruff Trust Co., Joliet, Ill.; J. C. Flowers, Joliet, Ill., and E. W. Steinhart, Indianapolis.

The department heads are P. D. Stubbs, director of sales; Homer McKee, director of advertising; P. W. Tracy, director of purchases and stores; E. G. Gunn, chief engineer; F. P. Nehrbas, factory production manager; C. S. Crawford, associate engineer, and J. L. Yarian, associate engineer.

The entire plant formerly occupied by the T. B. Laycock Co., with 300,000 sq. ft. of floorspace, has been rehabilitated.

Linsden, Goodrich European Manager, Here on Visit

NEW YORK CITY, April 8—Arthur E. Linsden, European manager of the B. F. Goodrich Co., Akron, Ohio, arrived in America last week on a short business trip. Mr. Linsden has charge of the Goodrich Paris factory, which was opened some five years ago. He is an American and well known in many car circles.

Studebaker Elects Officers

SOUTH BEND, IND., April 10—J. M. Studebaker, Sr., Col. George M. Studebaker and C. C. Hanch were re-elected to the directorate of the Studebaker Corp. at the annual meeting of the stockholders held in the office of the company in Jersey City, N. J. Later, in New York, the board of directors of the corporation held its annual meeting and elected officers for the ensuing year besides appointing the regular committees. J. M. Studebaker was re-elected honorary president; Frederick S. Fish, chairman of the board, and A. R. Erskine, president. The other officers chosen are: L. J. Ollier and J. G. Heaslet, vice-presidents; C. C. Hanch, treasurer; C. D. Fleming, W. P. Shillington and F. Studebaker Fish, assistant treasurers; A. G. Rumpf, secretary; John B. Marsh, assistant secretary; Frederick P. Delafield, counsel; George A. Fulmer, cashier; H. E. Dalton, general auditor. The executive committee is composed of Frederick S. Fish, Henry Goldman, A. R. Erskine, H. H. Lehman, Frederick P. Delafield and Col. George M. Studebaker; the finance committee of Frederick S. Fish, A. R. Erskine, Col. George M. Studebaker, James C. Heaslet and C. C. Hanch.

April 21 Standardization Day

CLEVELAND, OHIO, April 12—Large attendance is expected for the meeting of the standards committee of the S. A. E., which takes place here next week. April 20 will be a get-together day, there being several division meetings scheduled and the general meeting will begin at 10 a. m. April 21. The Cleveland section is arranging a most worthy entertainment for the visitors in the form of a paper and discussion on some of the most vital problems of carburetion. This will follow the meeting on April 21. The Statler Hotel has been chosen as headquarters and the management have placed a suitable meeting room at the disposal of the committee, these arrangements having been made by J. G. Utz, Perfection Spring Co., Cleveland, chairman of the miscellaneous division of the standards committee.

Smith and Vincent to Speak to Detroit S. A. E.

DETROIT, MICH., April 10—Two of the best known members of the automobile industry in this city will be the speakers at the next meeting of the Detroit Section of the Society of Automobile Engineers. Paul Smith, vice-president of the sales division of the Chalmers Motor Co., will talk on the subject of Interpreting the Public to the Engineer, while vice-president of engineering, J. G. Vincent, of the Packard Motor Car Co., has chosen as his subject Motors of the Air. The gathering, which is expected to draw a record-breaking attendance, will be held Monday, April 17, in the convention hall of the Hotel Pontchartrain.

The Detroit section's nominations for officers are: D. McCall White, chief engineer of the Cadillac Motor Car Co., to succeed George W. Dunham as chairman; O. E. Hunt, vice-chairman; W. C. Rands, treasurer; Bernard C. Koether, secretary; K. W. Zimmerschied, nominated as member of the national nominating committee.

S. A. E. Reservations Going Fast

Plans for Summer Cruise of Society Taking Definite Form—Papers Good

DETROIT, MICH., April 10—The 1916 meetings committee in charge of the summer cruise of the Society of Automobile Engineers has already made 147 reservations for members and guests for this outing. The S.S. Noronic has a total accommodation for 550 and, with over one-quarter of this taken up in a fortnight after the matter was first placed before the members, it seems certain that the capacity of the boat will be sold well before June 1.

For the convenience of members taking the cruise, arrangements have been made for the S.S. Noronic to stop at Sarnia, Ont., on the return trip Friday, June 16, so that those desiring to take railroads from this point can do so. Detroit hotels will be crowded the week of the cruise because of other conventions, and for the convenience of those members taking the trip the Northern Navigation Co. has agreed to let those members stay on the steamship Friday night who cannot secure accommodations. No meals will be served Friday night on the boat.

K. W. Zimmerschied, chairman of the standards committee during the past year and who is chairman of the papers committee, has already made extensive progress, and the subjects presented will be of a high engineering caliber. The subjects will cover the entire engineering field, including such pertinent subjects as design of agricultural tractors, design of aeroplane motors, problems connected with motor trucks in military transport. and possibilities of kerosene engines in motor vehicles. The question of carburetion, so pertinent to-day, will receive adequate attention. Practically one session will be given over to papers and discussions on high-speed motors. Motor fuels will be considered at another session. Howard Coffin, member of the Naval Consulting Board, will present a paper on preparedness. J. E. Hale of the Goodyear company will read a paper on straight side vs. clincher type tires. C. H. Eason of the Hyatt Roller Bearing Co. will read a paper on engines for foreign tractors. H. D. Church of the Packard company will have a paper on motor trucks, and E. A. Nelson on pressed steel construction in automobiles.

N. G. E. A. Opens Exchange Dept.

LAKEMONT, N. Y., April 11—An interesting method for assisting in the securing of the most efficient distribution of stock has just been adopted by the National Gas Engine Assn. Secretary Brate has just issued to members of the N. G. E. A. the following bulletin:

"At this time when it is very hard to obtain materials which go into the construction of internal combustion engines, together with slow deliveries and high prices, we are pleased to announce the opening of an Exchange Department.

"This is just what the words imply. Smith & Co. have an over-stock of crankshafts, etc., which Brown Bros., if they only knew about, could use to good advantage; while Brown Bros. have a dead stock of cold-rolled shafting which is the very thing Smith & Co. have been trying to get delivery on. Both clean up their dead stock; both get materials they are in great need of. A shut-down has been prevented. A customer has his order filled on time.

"Send to this office at once a list of your dead stock.

"Let us have your list of requirements.

"Just another form of N. G. E. A. coöperation.

"No charge, of course, to members for this service."

Tractor Co. May Occupy Crawford Plant in Streator

STREATOR, ILL., April 7—Representatives of the Auto Tractor Co. of Chicago are negotiating with the Commercial Club of Streator for the occupancy of the abandoned Crawford car plant to be utilized in the manufacture of a new device to be attached to an automobile by which it is possible to utilize the car for field work upon a farm, such as plowing, disking, harrowing, sowing, harvesting, or other lines. It is claimed by the inventor that with the use of this device the road speed of the car is diminished, while the pulling power of the engine is proportionately increased. The outfit consists of a pair of tractor wheels which are attached to a steel frame. Shafts are provided for transmitting the power from the automobile wheels to the speed reduction gearing and traction wheels. A radiator of sufficient cooling capacity to offset the slower speed is furnished.

Kelley Buys Bromfield & Field

NEW YORK CITY, April 11—Martin V. Kelley, president of the Toledo advertising company bearing his name, has purchased outright the advertising business of Bromfield & Field, this city.

Detroit Tube Co. to Expand

DETROIT, MICH., April 10—The Detroit Seamless Steel Tube Co., which makes tubing for automobiles and tractors, now located at 841 Jefferson Avenue, has purchased twelve acres of ground at Fort and Waterman Streets, and will erect a new plant, where it is expected, at least 2000 men will be employed.

No Shortage in Crude Petroleum

Trade Commission Reports 100,021,790 Gal. Held in February

WASHINGTON, D. C., April 10—The Federal Trade Commission to-day submitted to Congress a preliminary report on the gasoline situation. The commission finds there is no shortage in the supply of crude petroleum; in fact, the supply on hand in February, 1916, was 31,000,000 gal. in excess of that available in February, 1915. In the tables submitted with the report the commission shows that gasoline rose 4.88 cents a gallon in the Middle West refineries and 5.50 cents a gallon in eastern refineries. This is but a fraction of the rise to consumers. The report shows that while gasoline was increasing an average of a little over 5 cents a gallon at the refineries, crude oil was rising but 1.17 cents at western and 1.55 at eastern refineries.

Crude Supply Plentiful

The commission found that instead of there being a lesser supply of crude petroleum on hand now, there were 100,021,790 gal. held in February, 1916, as against 69,323,242 in February, 1915; that production of gasoline increased from 76,663,537 gal. in January, 1915, to 97,506,217 in December, 1915; that 15 per cent of the total production is exported.

The effect of decreased production in the Cushing field in gasoline terms is given in a footnote, which says the gasoline content of oil from the Cushing field fell from 96,000,000 gal. in April to 36,000,000 in December. The gasoline content of all the oil produced in the United States decreased during the year. The estimate of the year's total gasoline content for all the oil in the country was 1,892,500,000 gal.

S. O. Produced 60 Per Cent

Standard Oil companies, the tables show, produced about 60 per cent of the year's gasoline output. Their total was 681,750,000 gal. and that of the independents 400,000,000 in round numbers. Gasoline stock held by refineries decreased steadily from last May, when the total is put at 292,000,000 gal., to December, with a total of only 152,000,000. Stocks increased from the first of the year to May. Price ranges show that the price charged by the independents averages about 1 cent higher than Standard Oil prices. The Standard was selling gasoline f.o.b. its refineries at 7.82 cents a gallon Jan. 1, 1915, and the independents were charging 8.38 for the same grade. There was little change until August, when the Standard price went to 7.88 and the independent price dropped to 8.02. Four months later, in December, the Standard was charging 12.84 and the independents 13.07.

A digest of the preliminary report follows:

"The Federal Trade Commission has for some time been engaged in an investigation of the entire petroleum industry. The extraordinary advance in gasoline prices, however, together with numerous complaints of discrimination received, has made it evident that immediate investigation of the gasoline situation is most urgently needed.

"The following steps are now being taken in the active conduct of this investigation:

Gathering Statistics

"First, crude-oil production is being studied, and the most accurate information available concerning quantity of production, storage and prices is being gathered. In this connection, every important refinery in the United States has been asked to report the kind and quantity of oil used, the price paid, and the stocks of crude held at various times during the year 1915.

"Second, refiners making over 95 per cent of the total production of the country are reporting the following facts concerning their gasoline business for each month of the year 1915: Quantity purchased, quantity produced, quantity sold, and quantity in stock; prices received f.o.b. refinery and at tank-wagon stations. A force of accountants is now in the field collecting data concerning intercompany sales of gasoline. These data are being supplemented by a careful examination of the accounts of certain representative refiners to ascertain the exact cost of refining different kinds of crude to produce gasoline, kerosene, lubricating oil and fuel oil.

"The schedules sent to refiners include questions on freight rates and marketing costs, and the rates are being checked by comparison with the tariffs filed with the Interstate Commerce Commission. Finally, a force of field men has collected hundreds of cases of actual retail gasoline prices from all sections of the country. Tank-wagon tickets and invoices show the prices paid by the garages to refiners and jobbers, thus affording a check on statement by the latter.

Data on Oils

"In order to be able to judge whether, as alleged, relatively low prices of other refined products have made it necessary to increase gasoline prices out of normal proportion to the rise in crude, data concerning production and prices of kerosene, lubricants and fuel oil are being gathered.

"The capitalization, earnings, dividends, and the price of the stocks during

(*Continued on page* 700)

N. A. C. C. to Work for Preparedness

Government Has Authorized Creation of a Special Department of Wide Scope

NEW YORK CITY, April 12—The National Automobile Chamber of Commerce is going to assist the United States Government in military preparedness and has authorized Alfred Reeves, its general manager, to create a special department for this work. Mr. Reeves has already started to lay plans for the collection of information on motor trucks owned by private citizens throughout the country. The work will largely consist in compiling information on the numbers of different trucks in different cities throughout the country, so that in case of emergencies these trucks can be called upon for Government use and dispatched to any particular point without loss of time.

Formal Opening April 17

This new work of the N. A. C. C. will be formally opened at a luncheon at the War College, April 17, when Mr. Reeves and representatives of the different railroads and other transportation interests will discuss the matter with War College officials under General McComb. The plan is to co-operate with the Government in co-ordinating all of the transportation interests in the country. It is not enough that a plan for speedy mobilization of motor trucks in the different States be agreed upon, but it is essential that motor truck transportation be co-ordinated with railroad and perhaps steamboat service, so that the last word in efficiency would be possible in case of emergency.

The work of interesting the N. A. C. C. in this preparedness program has been carried on by Howard Coffin, who is a member of the naval consulting board and is devoting a great deal of time to this work. Mr. Coffin has discussed the question of motor truck military transportation with the War College, and as soon as the N. A. C. C. authorized the creation of a department for this work, the War College accepted the plan and issued invitations for the luncheon.

S. A. E. to Co-operate

It is expected that the Society of Automobile Engineers will co-operate in this work insofar as engineering questions are concerned. The S. A. E. Council went on record some months ago as being in favor of co-operating with the Government on questions of preparedness. Its work will naturally go hand in hand with that of the N. A. C. C.

Besides compiling information on the number of motor trucks in different cities as well as their capacity, it is expected that the N. A. C. C. preparedness plan will include a country-wide organization plan for the possible mobilizing of these vehicles into different divisions subdivisions, etc., so that should emergency arise the entire plan will have been perfected and nothing will remain but the putting into service of the vehicles.

The plan further contemplates arranging these trucks in convoy order according to makes, so that in an exigency it will be possible to form a convoy in any section of the country of thirty or forty trucks of the same make. This method of convoy formation has proved most effective in Europe.

It is further planned to arrange with factories for supplies of spare parts. The actual shipping of these parts will not be carried out, but unquestionably an inventory of spare parts carried in different parts of the country will be included.

The plan further embraces the organization of factory repair crews in the different truck factories. These crews could be organized and ready for transportation at short notice to any State in the Union. The plans include the possibility of organization within the crews to increase their effectiveness.

Steel King Tractor Manufacturing Plans Well Under Way

SAGINAW, MICH., April 8—The new tractor company, which will make the Steel King tractor, is a reality. The fact that $145,000 of the proposed capital stock of $200,000, which was declared by officials to have been subscribed for, and the announcement that the former plant of the Argo Electric Vehicle Co. has been secured makes it sure that activities will start without much delay.

Herman F. Moeller, who has done much of the experimental work, stated that construction of the first tractor was started about four years ago, and that since then about 100 were built, of which half are being used by farmers now and the other half are in the hands of dealers. The tractor has been perfected in many ways, and is believed to be as near perfect as it can be made. It will be sold for $985. It was announced that a contract has been made with a manufacturer of motors in Joliet, Ill., for motors having a total value of more than $200,000.

Saginaw Co. Yale Eight Maker?

SAGINAW, MICH., April 5—It is likely that the new concern which will make the Yale Eight will be known as the Saginaw Motor Car Co. The capital stock is to be $250,000. The price of the car is to be $1,285. L. J. Lampke is the designer of the car.

Reo Completes Plant Additions

New Truck Plant, Engineering Bldg. Addition, Warehouse and Clubhouse

LANSING, MICH., April 10—The factory additions of the Reo Motor Car Co., this city, started in October, 1915, are rapidly nearing completion. These when finished will add between 10 and 11 acres of floorspace and will include an addition to the engineering building, a new plant for the Reo Motor Truck Co., a receiving warehouse, and a clubhouse for the employees.

The largest building is the new truck plant which is 239 by 316 by 762 ft., totaling 176,294 sq. ft., or 4.05 acres. This building has been finished and is of the modern type of factory construction with ideal conditions for the workmen.

The clubhouse when finished will be a two-story building, 74 by 196 ft., totaling 45,672 sq. ft. This building is rapidly nearing completion and occupies the plot of ground once used as a testing track. In the new clubhouse there will be a large assembly room, where different kinds of entertainment may be had. There will be bowling alleys, billiard rooms, gymnasium with swimming pool. A serve-self restaurant for the workmen and separate dining rooms for the executives are other features.

Women Have Privileges

For the women who work in the offices there are rest rooms. Equal privileges are given the women in access to the libraries and reading rooms. On certain days the gymnasium and swimming pool and other sections are set aside for the women exclusively.

The three-story receiving warehouse is practically completed. The first floor of this building will be used as a part of the receiving and shipping department, the second floor to be equipped with equipment for enameling such parts as the hood, radiator cover, fenders, mud splasher, etc. From the third floor of the new warehouse to the third floor of the present paint shop there is a bridge of steel construction which crosses one street and two railroad tracks. This is for the convenience of handling the finished bodies as well as the completed car.

On March 1 there were on hand for immediate shipment at the Reo factories orders for more than 4200 automobiles and trucks, representing more orders on hand than have ever been at any one time since the inception of the company. Owing to this increased business, requiring practically a 24-hr. working schedule, the Reo Truck company will delay moving into the new plant for a time.

Chase Orders Over $300,000

March Business Booked by Syracuse Concern Largest in Its History

SYRACUSE, N. Y., April 8—At a meeting of the board of directors of the Chase Motor Truck Company of Syracuse, N. Y., held on April 7, a report was submitted by General Sales Manager H. T. Boulden, showing that up to April 1 the Chase company had on its books, and unfilled, orders amounting to $301,414.04, represented by business for domestic shipment. The Chase factory schedule outlined up to and including June 1 was practically contracted for by March 1, and as a result "stock chasers" from the Chase factory are on the jump to take care of the increased schedule production provided for. "Much credit for the rapid strides made by the Chase Motor Truck Co. in the past year is accredited to the aggressive selling methods instituted by our general sales manager," said E. A. Kingsbury, secretary and treasurer of the company.

The March business booked by the Chase company was the largest single month's business in the ten years' history of the company.

Railroads Anxious to Apply $5 Demurrage to Car Shipments

DETROIT, MICH., April 10—The freight car shortage, though improved, is still far from what it should be. Though the automobile dealers have shown improvement in taking prompt delivery of car shipments, the railroads feel that there is still much to be done in the way of co-operation on their part. The situation has caused the railroads much trouble, who are desirous of applying a special demurrage rate of $5 per day on automobile shipments. However, assurances that steps would be taken to correct the difficulty within the trade, has for the time delayed any such action. The proposition for a special increased demurrage charge to force the unloading of cars is likely to be brought up again on account of the extensive delays.

It is difficult to get a correct idea of the number of automobile freight cars needed daily by the Detroit manufacturers. Some of the automobile makers have been so greatly hampered in securing cars and have had at times such an accumulation of finished cars, all ready to be shipped, that they do not care to let any facts come into print, believing that the general public might not understand the situation and be under the impression that the manufacturer had been short on materials or was handicapped in some other way. One railroad man said that if 1000 more freight cars were placed at the disposal of the local automobile manufacturers to-day, tomorrow or any day, now, that they are all in the midst of their heaviest production, that, within 30 min. after the announcement of 1000 available cars was made, not one would be left without a bidder.

Market Prices Steady

NEW YORK CITY, April 11—Prices on automobile materials last week were steady. Copper has gone up ¼ cent a pound to 28¾, while rubber is a little lower. Demand for copper continues active, with a steady booking of orders from domestic consumers. Offerings were light in crude rubber. Consumers manifested little interest in the market.

Spring has brought a larger demand for gasoline. Garagemen in this city report that during the last few weeks a large number of automobiles have been withdrawn from storage, but say that the average time of withdrawal has been later than usual. The demand for gasoline has increased proportionately, but is not as large per car as in other years. If the purchase is made in a section of the city where rent is low and where other overhead expenses are not large, a gallon of gasoline may be bought as low as 27 cents, and in the suburban districts of Long Island this price prevails.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Ch'ge Week's
Aluminum	.59	.59	.59	.59	.59	.59	...
Antimony	.44½	.44½	.44½	.44½	.44½	.43½	— .01
Beams & Channels, 100 lb.	2.68	2.67	2.67	2.67	2.67	2.67	— .01
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	.28¾	+ .00¼
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	.28¾	+ .00¼
Cottonseed Oil, bbl.	10.40	10.35	10.40	10.35	10.38	10.35	— .05
Fish Oil, Menhaden, Brown	.53	.53	.53	.54	.54	.54	+ .01
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.95	.95	.96	.96	.96	.96	+ .01
Lead, 100 lb.	8.00	8.00	7.88	7.75	7.75	7.75	— .25
Linseed Oil	.77	.77	.77	.77	.77	.76	— .01
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine, Up-River, Para	.74	.73	.73½	.74	.74	.74	...
Rubber, Ceylon, First Latex	.87	.84	.86	.87	.86	.85	— .02
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	50.25	53.00	52.00	52.00	52.00	54.00	+3.75
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Insurance Men Organize

National Automobile Underwriters' Conference Formed—Combines Interests

NEW YORK CITY, April 10—In order to bring the automobile insurance companies into a general national organization and to obtain agreement of rate scales, etc., the National Automobile Underwriters' Conference has been organized. A constitution has been drawn up and submitted to the various non-conference organizations, or, in other words, to those organizations which at the present time are not affiliated with any of the small groups which have been formed throughout the country. The companies which have approved the draft of the constitution of the national organization are the following:

Aetna Accident & Liability, Automobile Ins. Co. of Hartford, German-American Ins. Co., German-Alliance Ins. Co., Rochester-German Underwriters, Globe & Rutgers Fire, London & Lancashire, Eastern Department; Orient Insurance Co., English American Underwriters, Safeguard Ins. Co., Massachusetts Fire & Marine, National Ben Franklin Company. National of Hartford, Colonial Fire Underwriters Agency, Newark Fire, Niagara Fire of New York, North British & Mercantile, Commonwealth Ins. Co., Mercantile Ins. Co., Pennsylvania Fire, Phoenix Ins. Co. of Hartford, Connecticut Fire, Equitable Fire & Marine, Prussian National, Springfield Fire & Marine, Westchester Fire.

Non-conference companies that have agreed to co-operate as set out in accompanying letter: Assurance Co. of America, Colonial Ins. Co., Merchants Fire Assur. Corp. of New York, New Jersey Fire, Standard Fire of Hartford.

Insurance Co. Gets Wisconsin Charter

MADISON, WIS., April 10—The National Automobile Owners' Inter-Insurers' Assn., home office, Gladstone, Mich., has been granted a license by the insurance commissioner of Wisconsin to do business in this State. The company reports that it has insurance in force amounting to $1,724,000.

Dividends Declared

U. S. Rubber Co.: quarterly of 2 per cent on first preferred and 1½ per cent on second preferred, payable April 29 to holders of record April 15.

Grant Motor Co., for fractional quarter from March 9 to April 15 at rate of 7 per cent per annum on preferred stock, payable May 1 to holders of record April 15.

Willys-Overland quarterly of 1½ per cent on common, payable May 1 to stock of record April 22.

Chalmers Motor quarterly of 2½ per cent on common.

Gasoline Steady in East—Higher in West

NEW YORK CITY, April 10—The price of gasoline remains steady in the East, the Standard Oil, Texas, Gulf and Crew-

Levick companies all quoting 24 cents, tank-wagon, basis in New York and 23 cents in New Jersey, which has been the prevailing rate for the past several weeks.

In Portland, Ore., however, a price record has been smashed, the Standard Oil Co. advancing the price to 19½ cents. Naphtha and distillate also advanced 1 cent to 18½ cents and 10 cents respectively in barrel lots. In Los Angeles gasoline has been advanced 1 cent to 19 cents.

The general impression among dealers appears to be that no further advance will be made in the immediate future but that there will be a slight drop, which may, perhaps, be followed by a further increase. This is berne out by a quotation credited to General Manager E. D. Warren of the Pennsylvania Gasoline Co. to the effect that his company will not make contracts for future delivery. He said there is a serious shortage of gasoline, and believes prices will reach a much higher level before Aug. 1.

In Decatur, Ill., the price remains 19½ cents wholesale, but many of the dealers have raised the retail price from 21 to 22 cents, the margin of profit at the former figure being too small; some dealers, however, are retailing at 20 cents.

There is a rather strange situation in Detroit, with regard to the gasoline situation, for while the Standard Oil Co.'s gasoline is being sold at 19 cents a gallon, the independent oil companies charge 22 cents a gallon. Officials of the latter concerns say that they cannot sell at a lower figure unless it be at a loss, while at the price charged by the Standard company it is claimed that this concern is making a big profit.

Chevrolet Features Securities

Reaches 191 at a 21-Point Gain —General Motors Lower —Paige Higher

New York City, April 10—Automobile and accessory issues are slated for higher prices, according to reports in Wall Street quarters. Chevrolet is predicted to go very high, as is Maxwell Motors and Studebaker. Last week Chevrolet continued its record rise of the previous work, reaching 191 on Saturday and 199½ the previous day. This stock has risen more than 100 per cent since last October, when it was offered to the public at 85.

When W. C. Durant, head of the Chevrolet company, decided to acquire control of the General Motors Co. by increasing the amount of Chevrolet stock and offering the new shares in exchange for General Motors, few people took advantage of the opportunity. The original offer was five shares of the smaller company's stock for each share of General Motors. At that time these figures represented parity between the two issues. After a few weeks, to take into account the advance in the price of Chevrolet, the ratio was changed to four for one, and shortly afterward the offer was withdrawn. Those who accepted the original offer are now over $500 ahead, as Chevrolet has nearly reached the 200 mark, while General Motors has fallen to 450.

An application to take Chevrolet stock from the curb and list it on the Stock Exchange has been pending for some weeks.

The Springfield Body Corp. has listed its stock on the curb. There is $750,000 of 8 per cent preferred and $1,500,000 common. The preferred was put out at par, and was reported sold the first day at 103. The common, which was put out at 50, sold up to 55.

Goodrich, Paige-Detroit, Chalmers, Reo and Willys-Overland shares have been fairly active. The strength and activity in the shares of Goodrich have been based on the sales during the first quarter of this year, which are understood to have increased more than 50 per cent. Paige-Detroit stock went up 60 points to 750.

Gray & Davis has put on the market $250,000 in common stock, which is being offered to investors at $40 a share, par value $25.

$100,000 Phelps Mfg. Co. Is Reorganization of F. & H.

Columbus, Ohio, April 10—The Phelps Mfg. Co., this city, incorporated with a capital of $100,000 to manufacture wire wheels for automobiles, is a reorganization of the F. & H. Wire Wheel Co., formerly of Columbus, but later of Springfield, Ohio. The concern was founded by Lee Frayer, and was at first called the Frayer Demountable Wire Wheel Co. Later it was called the F. & H. Wire Wheel Co., and moved to the Bauer Bros.' plant at Springfield. The plant will be established in the former Barndt & Johnson Auto Co.'s plant on South High Street, Columbus. New officers will be elected within the coming week.

Automobile Securities Quotations on the New Yor k and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	69½	70	+ ¼
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	75	80	87½	90	+2½
Chalmers Motor Co. com	91	93	159	..	+4
Cbalmers Motor Co. pfd	90	92½	98	101	..
Chevrolet Motor Co	..	..	191	192	+21
Electric Storage Battery Co	50	51	61½	62½	— ½
Firestone Tire & Rubber Co. com	450	455	765	..	..
Firestone Tire & Rubber Co. pfd	110	112	113	..	..
General Motors Co. com	145	148	450	470	—10
General Motors Co. pfd	103	104	115½	116½	+1½
B. F. Goodrich Co. com	52¾	53¼	77½	79	+1⅛
B. F. Goodrich Co. pfd	101	103	115¼	116¼	+ ¾
Goodyear Tire & Rubber Co. com	220	225	336	340	—1
Goodyear Tire & Rubber Co. pfd	104	106	115	117	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	13	14	17	19	—1
International Motor Co. pfd	32	35	30	37	—5
Kelly-Springfieid Tire Co. com	135	140	73	74	—2½
Kelly-Springfield Tire Co. 1st pfd	84½	85	96	97	..
Kelly-Springfield Tire Co. 2d pfd	137	140	..	..	..
Maxwell Motor Co. com	47	48	72½	73	+ ¼
Maxwell Motor Co. 1st pfd	85	85	85¼	86	— ¾
Maxwell Motor Co. 2d pfd	39¾	40½	56¾	57¼	+1
Miller Rubber Co. com	170	176	235	240	..
Miller Rubber Co. pfd	101	103	112	116	..
New Departure Mfg. Co. com	138	140	180	182	+5
New Departure Mfg. Co. pfd	106	..	111	..	..
Packard Motor Car Co. com	80	92	165	173	+2
Packard Motor Car Co. pfd	93¾	97½	100	104	..
Paige-Detroit Motor Car	..	..	750	850	+60
Peerless Motor & Truck Corp	..	..	26	27	+ ½
Portage Rubber Co. com	34	36	70	72	..
Portage Rubber Co. pfd	85	95	106	107	..
Regal Motor Co. pfd	..	..	15	20	+5
*Reo Motor Truck Co	13	14	28	29½	+1½
*Reo Motor Car Co	32	34	35¾	36½	+1⅛
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	62½	65	86	87	..
Stewart-Warner Speed. Corp. pfd	102	104	109	..	..
Studebaker Corp. com	66¾	68	141	142	— ½
Studebaker Corp. pfd	101	102	112	113	+1
Swinehart Tire & Rubber Co	80	85	88	89	..
Texas Co.	138	140	195	197	..
U. S. Rubber Co. com	73	74	51½	52½	+ ⅞
U. S. Rubber Co. pfd	108	109	110	112	+ ½
Vacuum Oil Co.	208	212	240	243	+10
White Motor Co. (new)	..	..	50	51	+ ½
Willys-Overland Co. com	131½	132½	230	235	+6
Willys-Overland Co. pfd	101¾	103	104	105	+2

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
Auto Body Co	..	..	31	32½	..
Chalmers Motor Co. com	83½	..	159	..	..
Cbalmers Motor Co. pfd	90	..	97	100	..
Continental Motor Co. com	165	182	..	38½	— ½
Continental Motor Co. pfd	..	..	9½	10¼	..
Ford Motor Co. of Canada	550	..	..	405	—10
General Motors Co. com	124½	126	450	480	+10
General Motors Co. pfd	102½	104	114	117	— ¼
Maxwell Motor Co. com	42½	44½	71	74	+ ½
Maxwell Motor Co. 1st pfd	80½	83	84	87	+ ½
Maxwell Motor Co. 2d pfd	36	37½	55½	58	+2¼
Packard Motor Car Co. com	80	92	165	175	+2
Packard Motor Car Co. pfd	93¾	97½	..	104	..
Paige-Detroit Motor Car Co	..	..	820	..	+10
*Reo Motor Car Co	29¾	..	36⅛	37	+2⅛
*Reo Motor Truck Co	12¼	13⅛	28	28¾	+1¼
Studebaker Corp. com	59	60¼	140	143	+1
Studebaker Coip. pfd	95	100	111	..	..

INACTIVE STOCKS

	1915 Bid	1915 Asked	1916 Bid	1916 Asked	Wk's Ch'ge
*Atlas Drop Forge Co	..	..	..	40	..
Kelsey Wbeel Co	195	..	320	365	..
*W. K. Prudden Co	19	20½	29	33	..
Regal Motor Car Co	10	20	16	..	+3

*Par value $10.

Treble Car Tax in England

Tax Doubled on 16 Hp. or Less—American Cars Severely Affected

LONDON, ENGLAND, April 6—A treble tax has been placed on all British automobiles, ranging from $21 to $630, according to horsepower. According to trade circles, this will not only kill pleasure riding, but will go a long way toward crippling the industry.

The new scale doubles the tax on automobiles of 16 hp. or less and trebles that on cars of more than 16 hp. The new tax will hit the American cheap automobiles more than British cars, as virtually all of American-made cars here come within the category of more than 16 hp. The tax will probably mean a big drop in the price of second-hand automobiles.

The taxes on automobiles in Great Britain last year were as follows: 6½ hp., $10.80; 12 hp., $15.75; 16 hp., $21; 26 hp., $31.50; 33 hp., $42; 40 hp., $52.50; 60 hp., $105, and exceeding 60 hp., $210.

Japan Builds More Cars

TOKIO, JAPAN, April 6—Increased manufacture of automobiles in this country is indicated by the import figures for 1915, which show a falling off as compared with those for 1914. The total from foreign sources in 1915 was twenty-six cars valued at $30,595, whereas in 1914 the imports were seventy-nine cars valued at $106,420. Most of the cars being manufactured here are low-priced, thus affecting the imports of higher-priced foreign cars.

The sources of the cars imported in 1915 were: Great Britain, four, valued at $8,721; United States, ten, valued at $15,798; other countries, twelve, valued at $6,076. For 1914 the figures were: Great Britain, seventeen cars, valued at $30,356; United States, thirty-three, at $28,787; and other countries, twenty-nine, at $47,277.

A firm owning a taxicab service in this city is now operating forty-two cars, averaging 700 passengers daily. All of the cars are of American make. Each car covers an average of 60 miles a day. This firm has also undertaken the extension of a motor-bus service in Chosen.

Pelton Steel Co. Incorporates

MILWAUKEE, WIS., April 10—The Pelton Steel Co. has been organized here, and incorporated with capital stock of $100,000. The company has taken over a crucible plant at Chicago Avenue and Elliott Place, on the main line of the Chicago, Milwaukee & St. Paul Railway. An electric furnace with 250 tons capacity will be put into operation about June 1, and at present there are nine crucible furnaces working. Orders have been received lately from automobile manufacturers at Detroit, Mich. E. T. Pelton, who was with the National Steel Foundries for twelve years, is general manager of the company.

Liberty and R. C. H. Unconnected

DETROIT, MICH., April 10—The fact that the new Liberty Motor Car Co. of Detroit, recently organized by Percy Owen, has taken over the plant formerly occupied by the R. C. H. Corp., has apparently given the impression that there is some connection between the two companies.

Liberty officials state that there is no relation whatever between the two companies. The Liberty company has simply taken over their factory buildings and offices and the previous occupant has moved to another location.

The Liberty Motor Car Company is an entirely new organization, headed by Percy Owen, who is president and general manager. Liberty officials also include such well-known men as James F. Bourquin, who is vice-president; H. M. Wirth, secretary and treasurer; and R. E. Cole, chief engineer. These men are all automobile men of wide experience and were officials in the Saxon, Chalmers or Paige companies. From their most recent connections the general impression is that the new Liberty will sell at a medium price.

While there is no denial from the Liberty factory of this rumor, it is also hinted that the car will be of an entirely new type, designed to appeal to those who use better class motor cars.

Gibson Co. Opens in Danville

DANVILLE, ILL., April 8—The Gibson Co., Indianapolis, Ind., opened its display rooms here to-day. Jack Ryan of Indianapolis is in charge.

Welton Fender Co. Reorganized

COLUMBUS, OHIO, April 7—At a meeting of the stockholders of the Welton Automobile Fender Co., Columbus, a complete reorganization was effected. The new corporation is known as the Auto Cushion Fender Co., and the capital stock is $20,000, of which $17,500 has been issued. Dr. John M. Thomas was made president and Dr. Fred Fletcher, secretary-treasurer. Plans were made for a vigorous selling campaign of the fender which is made under contract by the Columbus Auto Brass Co. Several new models of fenders will soon be placed on the market.

Army Pleased With Trucks

Transportation and Commissary Officers Find Them Better Than Mexican R. R.

FORT SAM HOUSTON, TEX., April 10—Gen. Frederick Funston and the officers in charge of the transportation and commissary departments of the army are well pleased with the service that has been performed by motor trucks and automobiles in the campaign against Villa. Many difficulties were encountered in bringing the service up to its present high standard of efficiency, but it is now announced that the motor truck trains are meeting promptly all the demands of the United States military force in Mexico and that they are transporting foodstuffs and supplies with fully as great dispatch as could be done by railroad. In view of the fact that the Mexico & Northwestern Railroad is in very bad physical condition and that it is impossible to make more than 10 or 12 m.p.h. over the line, the motor truck trains are able to do considerably better than this. The worst feature of the motor truck transportation proposition is the difficulty that is met with in keeping the roads in repair. According to reports received by General Funston, the main military highway leading south from Columbus, N. M., is now cut into deep ruts for a width of more than 200 yd.

United States Orders 108 Trucks for Army Use

NEW YORK CITY, April 10—Contracts for four more complete motor truck trains of twenty-seven cars each have been awarded by the War Department. The 108 trucks will cost approximately $2,300 each, thus making the value of the contracts about $248,000. Fifty-four are to be White, twenty-seven Jeffery and the other twenty-seven Packard. When these trucks have been delivered the Quartermaster's Department at Columbus will control more than 270 trucks for moving supplies. Last week the War Department bought fifteen more water wagons for immediate shipment to Mexico. Twenty-eight Packards going to Mexico were supplied with regulation army transport bodies, of tarpaulin-covered tox type, 11 ft. long, 5 ft. 6 in. wide and with hinged sideboards 24 in. high.

No Petroleum Shortage

Continued from page 696

the last year of the chief refiners have been ascertained and more extended information will be gathered soon to aid in judging whether the high prices have been necessary to maintain the normal rate of profit.

"For the purpose of bringing out the facts concerning alleged inequalities in the advance of prices in different sections, all statistics have been compiled by particular towns. Refiners and jobbers of gasoline have reported the the location of their tank stations in every town having a population of 2500 or over, throughout the entire country, and the quantity of gasoline sold thereat. Prices and costs can be computed by towns, States and sections, and the different conditions in the fields covered by different companies are being minutely examined. The dates at which prices changed at each point are recorded.

Grade Must Be Uniform

"A point of importance is the care used to make all price comparisons on the basis of the same grade of gasoline, as the investigation reveals considerable local differences in the quality of this product and changes therein during recent months.

Causes of Advanced Prices

"In its investigation of causes, the Commission is considering both domestic and foreign conditions, and is weighing every factor to detect any artificial or manipulative element. A letter of inquiry has been sent to every manufacturer of automobiles, farm tractors, and other gasoline engines in the country, to ascertain as far as possible the increased output of their products and the effect of the advance in gasoline prices upon the demand for their products and upon the consumption of gasoline. The following points are being examined: Forces of demand and supply as affecting the price of crude oil, exports and imports, deterioration in quality of crude, increased cost of refining, improved methods, and speculative holding of crude and gasoline.

"The close connection between the investigation of the causes of high prices and of the alleged discrimination should be noted: If prices are found to have been raised to higher levels in some sections than in others, making due allowance for quality of product, freight and marketing conditions, it may be inferred that an element of artificial manipulation has entered into the advance.

"In response to Senate Resolution 457, Sixty-third Congress, Second Session, the Commission is conducting its general investigation of the petroleum industry in such a way as to throw light upon the several companies into which the Standard Oil holding company was resolved in 1911. It is expected that the gasoline investigation will throw light upon this question.

O'Donnell Wins at Corona

Duesenberg Pilot Covers Boulevard Course in Grand Prix at 86.5 M.P.H.

Corona Grand Prize Winners

Car	Driver	Time	M.P.H.
Duesenberg	O'Donnell	3:29:52	86.5
Mercer	Thomas	3:36:01	84.0
Mercer	Pullen	3:38:36.4	83.0
Omar	Tetzlaff	3:58:04	76.1
Cyclone	Durant	4:05:24	73.9
Gandy Special	Waterman	Flagged	

CORONA, CAL., April 8—*Special Telegram*—The accident, which cost the lives of Bob Burman and his mechanic, Eric Schrader, is responsible for the final curtain in racing at Corona. Immediately following to-day's race, officials announced that with the tragic ending of the event came the decision never to hold another race on the boulevard course. The effect of to-day's fatalities overshadows Eddie O'Donnell's victory in a Duesenberg at the rate of 86.5 m.p.h.

Twelve Cars Started

Twelve cars were at the starting line when the signal was given and it was believed that Pullen's record of 87.8 m.p.h. set last year would fall. In practice the drivers had shown wonderful speed, and during the tryouts Hughes made laps at 106 m.p.h. There were five cars in the race that had lapped the course at better than 102 m.p.h. in practice, but during the practice dashes the weather had been cool. The intense heat to-day had a great deal to do with seemingly slow time made by O'Donnell.

Burman's car was wrecked in the ninety-seventh lap when he was in second place and less than a lap behind O'Donnell. Waterman, Oldfield and Hughes went out in the forty-seventh lap, leaving but seven cars on the course which made the race particularly attractive to the drivers since the purse was split five ways. Earl Cooper had gone out in the fifteenth, and the Tahais had left the course with a broken connecting-rod in the twenty-ninth.

Cooper's trouble was due to his wreck three days ago while traveling at 101 m.p.h. A front wheel left the axle and Cooper escaped death by a miracle. Both he and the mechanic, Reeve Dupton, escaped without a scratch but the car was badly damaged. Cooper worked for 48 hr. with a score of mechanics and had the Stutz at the starting line, but the engine had been strained so that the crankshaft was out of alignment and engine trouble developed from that cause early in the race. Tetzlaff's Milac was out of the list at the last moment due to a connecting-rod being broken in the last practice. Injury to Omar Toft caused his withdrawal and Tetzlaff took over his car, coming in fourth.

The Apperson was eliminated before the start. Blowing a tire on the back stretch near the point where Burman was wrecked, Sterling Price lost control of the car and after careening down the course for 200 ft. crashed into a palm tree. The car burned when the gasoline tank exploded. Tony Janette's Hartmann Special, a post entry that went in the day before the race, also was a victim of the jinx before the start, a broken connecting-rod keeping it out of the race. The Marmon entry also was cancelled at the last moment, by reason of inability of the driver, Jack Welsh, to get tires.

Some tires did not stand two laps, and every driver used all the tires he had in his pits with the exception of O'Donnell who went through the entire race with just one stop. The crowd was not so large as at the last Corona meet, there being only 68,000 admissions. Bosch magnetos were used on all the cars starting in the race and Bosch plugs on seven.

Corona's Last Race

The whole town is mourning for Burman and the little mechanic who rode to death with him. Citizens of the Circle City say that the only reason for the race this year was the fact that there never had been an accident on the fast course and after to-day's tragedy there never will be another Circle City speed event.

It was an unavoidable accident of the speedway, but it will never be forgotten by the many friends of Burman who saw the race. The main cause of the accident was the blowing of a rear tire. Burman had signalled that he was to change on his next visit to the pits, but he never reached there. He led the contest at the start and for seven laps he was out in front. Then he dropped back to second

Positions of Cars in the Corona Grand Prize

Driver	Car	Position by Laps 10	20	30	40	50	60	70	80	90	100	109	M.P.H.	Average, M.P.H.
O'Donnell	Duesenberg	4	3	2	2	1	1	1	1	1	1	1	3:29:52	97.1
Thomas	Mercer	3	5	3	4	3	3	3	4	4	2	2	3:36:01	93.2
Pullen	Mercer	1	1	1	1	5	5	5	5	5	5	3	3:38:36⅖	92.8
Tetzlaff	Omar	5	4	4	3	2	2	2	3	3	3	4	3:58:04	91.4
Durant	Chevrolet Cyclone	10	9	9	9	7	7	7	7	6	5	5	4:05:25	87.5
Waterman	Gandy Special	7	6	5	6	6	6	6	6	7			Flagged	87.5
Burman	Peugeot	6	2	6	5	4	4	4	2	2			Wrecked 97th lap	87.5
Oldfield	Delage	9	7	7	7								Broken rocker arm 47th lap	85.9
Gandy	Gandy Special	11	10	10									Engine trouble 47th lap	87.0
Hughes	Sunbeam	8	8	8	8								Broken clutch 47th lap	...
Teel	Tahais	12	11										Broken connecting rod in 29th lap	...
Cooper	Stutz	2											Engine trouble 15th lap	...

and Pullen took the lead, holding it until the fortieth lap, when O'Donnell went into first place and never was headed.

Burman stopped at his pit on the eleventh lap with a slipping clutch. He could do nothing for it and drove the race on high gear alone. To start the car after coming into the pit he would jack up the rear end and after the wheels were turning with the Peugeot in high gear the car would be let down in a pool of oil and dash off on high.

Burman Second in 80th

With only high gear, the car was hard on tires. It seemed as if Burman was always at his pit and it was hard to believe that he was in second place when it was shown on the scoreboard in the eightieth lap. He had less than a lap to make up when O'Donnell was making his first stop on the next round. Burman was driving the greatest race of his career. He had been in the back and had come up into the money several times during the race, and it seemed that he had a sure thing in second place and an even break for first when the accident happened.

When the left rear tire blew, the car went for the inside curve. After sliding down the curve about 100 ft. it struck a culvert and that flattened out one side of the wheel and bent the frame. The car then lurched out on the course, swung back to the curve and with one wheel in the gutter and the other on the curve, it plowed through two telephone poles, tore up 100 ft. of grass on the edge of the course, hit the curb again, crashed into a car standing on the inside of the course, then spun around, rolled over and finally came to a stop, 167 yd. from where it first hit the curb.

When news reached the pits that Burman was dying and Schrader was dead, drivers and mechanics cried like children.

Misdemeanor to Place Tacks on New York Roads

ALBANY, N. Y., April 11—It is a misdemeanor to place on roads anything likely to puncture automobile tires, according to a bill unanimously passed today by the Assembly.

The measure prohibits the placing on any road, highway or public place of glass, tacks, nails or other articles which might injure an animal or person or puncture a tire. It was introduced by Senator Slater of Westchester and already has passed the Senate.

Senator Hewitt introduced a resolution to-day providing for a joint legislative committee of two Senators and three Assemblymen to investigate the use of lights on automobiles, the various devices for eliminating the glare of headlights and the use of public highways by trucks and omnibuses.

Nine Entries for Indianapolis

Two Maxwells and Three Frontenacs Register for 300-Mile Grind

INDIANAPOLIS, IND., April 6—Two Maxwells and three Frontenacs have been entered in the 300-mile race at the local speedway on May 30. The Maxwells are entered under the name of the Prest-O-Lite racing team and the Frontenacs by the Frontenac Racing Car Co., formed last winter for the exclusive building of racing cars.

Eddie Rickenbacher and Peter Henderson will drive the Maxwell mounts, which have been reconstructed during the winter months at the Prest-O-Lite plant.

The three Chevrolet brothers—Louis, Arthur and Gaston—will drive the Frontenacs. The cars are being constructed in the plant of the Frontenac company. Louis Chevrolet, who heads the company, states that he has abandoned his plans of entering the New York race on May 13, and will devote all his time to getting the cars ready for the local race.

The entry of these five cars brings the total up to nine, three Duesenbergs having been entered during the early part of March. O'Donnell and D'Alene will drive two of the cars. Henderson was to have been the third driver.

The entry of Joseph Christiaens with a Sunbeam six has been received in a cable to the speedway management.

Three Events at Tacoma May 30

TACOMA, WASH., April 10—There will be just three sanctioned events on Decoration Day at the Tacoma Speedway. The first event will be for cars of 250 cu. in. displacement and less, for a distance of 10 miles. Event No. 2 will be for a distance of approximately 200 miles for cars of 600 cu. in. displacement, and event No. 3 will be for a distance of approximately 30 miles, fifteen laps of the speedway, for the same cars as event No. 2. Cash and accessory prizes will be given the winners in all three events. List of officials for the meet will be announced later.

Twin City Prepares Schedule

NEW YORK CITY, April 10—The contest board of the American Automobile Association has received a request from the Twin City Motor Speedway Co., Minneapolis, Minn., for sanction of six sprint races to be held on May 30. The main event of the day will be a 5-mile race for a purse of $2,000. Three shorter events will carry a purse of $300 each, and the other two, also sprint affairs, will be for trophies.

The main event of the season at the Twin City Speedway is scheduled for July 4, when the 300-mile International race will be held. In September another meet will take place on the track, according to present plans, although nothing has been decided in regard to the details except that sprint races will probably be the feature.

Cedar Rapids Tractor Demonstration on Aug. 14-18

CEDAR RAPIDS, IOWA, April 7—The dates for the big tractor demonstration to be held here this summer are Aug. 14 to 18, inclusive. Options have now been taken on over 1000 acres of land along the Iowa City interurban. Plans are being made to make the tractor demonstration a big Iowa home-coming and to entertain at least 35,000 people. There will be from thirty to sixty carloads of tractors.

Sheepshead Plans 24-Hr. Race

NEW YORK CITY, April 10—Preliminary arrangements have been completed for a twenty-four-hour automobile race to be held on the Sheepshead Bay Speedway, June 16 and 17, under the direction of the Trade Racing Assn.

The race will be open to stock cars only, and the cash prizes offered total $10,000. Besides the cash prizes, the Universal Film Trophy is offered, to be competed for in accordance with the terms of a deed of gift not yet disclosed.

300-Mile Race for Fresno

FRESNO, CAL., April 8—A feature of this year's celebration of Raisin Day in this city and throughout the San Joaquin Valley on April 29 will be a 300-mile road race over a 14-mile course containing two straightaways of 6 miles each and a 1-mile connecting road at each end. The Raisin Classic Motor Cup Holding Co., which is planning the race, expects that it will be an international event for a $10,000 trophy. A sanction has been requested from the A. A. A. contest board.

New Montana Town Needs Garage

LIVINGSTON, MONT., April 10—In southern Montana near the Arch entrance to Yellowstone National Park, on the Yellowstone Trail, the new town of Wonderland City has been started through the efforts of the Todd Photo & Film Co., which will establish moving picture studios there, and among the opportunities for those seeking business locations, according to representatives of the film company, is the chance to open a garage and gas station.

Hudson Covers Mile at 102.5 M. P. H.

Super Six Stock Chassis Electrically Timed in New Record

DAYTONA, FLA., April 10—A Hudson Super-Six stock chassis, electrically timed, to-day established a new record by negotiating 1 mile in 35 11/100 sec. on the Ormond-Daytona beach. This is at the rate of 102½ m.p.h. Five other trials were under 36 sec. The car is rated at 29.4 hp., and develops 77 hp. at about 2500 r.p.m.

This new record compares with Burman's mark of 25.40 sec. in the 200 hp. Benz at Daytona, April 23, 1911, at the rate of 141 m.p.h.; Marriott's mark of 28 1/5 sec. in a 30 hp. Stanley steamer at Ormond, Jan. 22, 1907, at the rate of 127.66 m.p.h.; and 40.32 sec. made by Wilcox in a 301-450 cu. in. National at Jacksonville, Fla., March 30, 1911, or 89.4 m.p.h.

Winton Opens Annual Chauffeurs' Contest

CLEVELAND, OHIO, April 10—Entry blanks for the ninth annual repair expense contest for Winton six chauffeurs will be distributed by the Winton company within a few days. In all $3,500 in cash prizes will be distributed to employed drivers of these cars between May 1 and Oct. 31, the capital prize being $500. These prizes are offered for the purpose of showing that the cars can be driven great mileage at a comparatively small expense. An average of eight years' records, secured in this way, show approximately 2,000,000 miles at an average repair expense of 19¼ cents per 1000 miles.

Maxwell Salesmen in Conference at Factory Are Optimistic

DETROIT, MICH., April 6—District salesmen of the Maxwell Motor Co., from many parts of the country were in conference at the Maxwell headquarters this week, to discuss the plans for the spring and summer sales campaign. The visitors say that there is more money to buy automobiles than almost anything else.

Among the district salesmen present are the following: J. P. Headley, Atlanta, Ga.; W. A. Fries, Oklahoma City, Okla.; A. E. Morrison, Buffalo; L. G. Peed, Philadelphia; C. B. McLaughlin, Kansas City; C. H. Batchelor, Atlanta, Ga.; A. C. Reed, Providence, R. I.; L. F. Smith, Boston; P. R. Young and W. H. Schroeder, Omaha, Neb.; M. J. Williams, Kansas City, Mo.; C. S. Riedel, Detroit; G. E. Swope, Wichita, Kans.; J. J. Grant, Jr., Salina, Kans.; V. L. Malmfeld, Kansas City, Mo.; A. W. Johnson, Jr., S. E. Eggleston and H. E. Smith, Dayton, Ohio; C. D. Fintzel, Billings, Mont.; W. H. Lolley, Louisville, Ky.; L. A. Smith, Dallas, Tex.; W. H. Keller, Pittsburgh; E. F. McConaha, St. Louis, Mo.; W. H. Turner, Kansas City, Mo.; C. E. Beloate, Atlanta, Ga.

In addition to many business conferences, the visitors were taken to the enlarged Oakland Avenue Maxwell plant, to get first-hand knowledge on the Maxwell assembly system.

Receiver for P. R. Mfg. Co.

DETROIT, MICH., April 7—The Security Trust Co. has been appointed permanent receiver for the P. R. Mfg. Co., of this city which, among many products, is making the Breeze carbureter and other parts for automobiles. The cause for the receivership is not a case of insolvency, but of stockholders being unable to agree among themselves. The Security Trust Co. was appointed a temporary receiver several months ago, and attempts were made by it to get the stockholders to work smoothly together, but the dissensions persisted and made the present move necessary. The trust company says that the P. R. company has assets of approximately $200,000, that its business has been good, and that there are plenty of orders on hand. The receiver will attempt to sell the company as a going concern.

Electric-Vehicle Day in Chicago

CHICAGO, ILL., April 10—A day has been set aside for discussion of electric vehicles at the forthcoming convention of the National Electric Light Association, which will take place in Chicago, May 22 to 26. The session will be held at the La Salle Hotel. Among those who will read papers are W. P. Kennedy, New York, consulting transportation engineer; P. D. Wagoner, president General Vehicle Co.; E. P. Chalfant, eastern representative, Anderson Electric Car Co.; S. V. Norton, manager truck tire sales department, B. F. Goodrich Co.; F. E. Whitney, general manager, Commercial Truck Co. of America; C. W. Squires, Jr., sales manager, General Vehicle Co.

Larger Show Building for Moline

MOLINE, ILL., April 7—Moline is planning to erect a coliseum which will furnish the largest public hall in the tri-cities, and which will be the home of the 1917 Tri-City Automobile Show. This action is taken owing to the fact that the Davenport Coliseum is inadequate, as regard to floor space, for the present annual motor exhibit.

May Close Garages on Sunday

Bay State Legislature Kills Bill to Repeal Present Statutes

BOSTON, MASS., April 11—*Special Telegram*—The bill which was introduced early this year in the Massachusetts Legislature and which would have permitted garages to be open on Sunday and to sell gasoline, oil, supplies, etc., has been killed in the State Senate.

This means, virtually, that under existing statutes, it is illegal for a garage to remain open on Sunday or to sell gasoline, oil or supplies. Local authorities, if they so desire, can force garages to close on Sunday, except to permit cars to go in and out.

The measure which would have eliminated this trouble passed the lower house in February and it was expected it would pass the Senate without trouble and be signed by the Governor. That it was killed has been a surprise to dealers and garagemen.

$5 Minimum Fee in Md.

BALTIMORE, MD., April 10—On July 1, 1916, automobiles in this State will be taxed 50 cents per horsepower. Five dollars per year will be the minimum charge for any car. Commercial vehicles will be taxed upon a rated carrying capacity; $8 for a 1-tonner and $6 more for each additional ton.

Under the new law, speed limits in the hamlets will be the same. This city will be allowed to charge a reasonable fee for the parking of automobiles in spaces set aside exclusively for parking purposes in congested sections, but will not be permitted to make a special charge for the privilege of having one's automobile stand on the streets generally.

Dealers Oppose Owners' License

NEW YORK CITY, April 11—The Automobile Dealers' Assn. of New York City is opposing the Simpson-Kelly bill in the Legislature; the bill would require that every operator of a car, whether chauffeur or owner, be licensed to drive. The bill as originally drawn included the State, but was amended to cover New York City only.

President R. H. Johnston of the association states that the opposition is on the general grounds of over-regulation; he states in a letter to Mayor Mitchell that there is so much regulation now and unintelligent enforcement of rules, that the car dealer and owner are harassed and made uncertain as to their personal and business conduct.

Factory Miscellany

Packett to Build—The Packett Motor Car Mfg. Co., St. Paul, Minn., will build a plant.

Agontz to Build—The Agontz Motor Car Co., Sandusky, Ohio, recently organized, will build a plant.

Hamilton Carbureter to Add—The Hamilton Carbureter Co., East Toronto, Ont., is erecting a large addition to its factory.

Marion Tire to Build—The Marion Tire & Rubber Co. is planning to build a plant at Marion, Ohio. The estimated cost is $20,000.

Thomas Co. to Add—The Thomas Mfg. Co. will construct an addition to its plant at Dayton, Ohio, for the manufacture of accessories.

To Make Truck Bodies—A. D. Moore and Mr. Shaw, Palmer, Mass., have leased the vacant belt factory in Belchertown, Mass., and will make automobile truck bodies.

To Make Piston Rings—The McCadden Machine Works, St. Cloud, Minn., have been formed to manufacture piston rings, machinery and machine parts. The capital is $50,000.

To Make Parts in Chattanooga—E. Van Winkle of Chattanooga, Tenn., is planning to establish a plant at Chattanooga, for the manufacture of parts and assembling motor trucks.

Gerlinger Truck to Build—The Gerlinger Motor Co., Portland, Ore., capitalized at $100,000, will construct a factory in Tacoma, Wash., to manufacture the Ger-Six motor truck.

Spartan Radiator to Build—The Spartan Radiator Co., Jackson, Mich., manufacturer of automobile radiators, has had plans prepared for a new plant. It will be two stories, of brick and steel, 70 by 336 ft.

Gresham Co. to Add—The Beaver State Auto Co., Gresham, Ore., will build a brick foundry and will add the manufacture of malleable castings to its products. The building is to be completed by June 1.

Goodyear to Build—The Goodyear Tire & Rubber Co., Akron, Ohio, has taken out a building permit for the erection of a five-story, 68 by 142-ft. addition to its general office. The structure will cost about $48,000.

Carbureter Plant for Basic City—Carbureters will be manufactured by the Jordan Carbureter Co., Basic City, Va., which has been incorporated with a capital of $300,000. L. F. Jordan, of Basic City, B. E. Watson, Waysboro, Va., and others are the incorporators of the new company.

To Build Battle Creek Tractor—The Battle Creek Tractor is to be the name of a new product to be made by a company in which H. C. King of the H. C. King Seed Co., Battle Creek, Mich., and Myron Nash, Vicksburg, are to be the principal stockholders. The company is to have a capital stock of $50,000. The tractor is to sell at $900 with the plows, and at 775 without plows.

Fleetwood Metal Body in New Bldg.—The Fleetwood Metal Body Co., Fleetwood, Pa., is preparing to occupy its new building along the P. & R. Railroad. The building is an addition to the present three-story plant and contains 80,000 sq. ft. of floor space. Its dimensions are 40 by 350 ft., with connecting wings 40 by 80 ft. and 110 by 50 ft. It is equipped with modern machinery and methods for the manufacture of automobile bodies.

The Automobile Calendar

April 10-15	Seattle, Wash., Show, Arena.
April 10-15	Danville, Ill., Eastern Ill. Automobile and Electric Show; Chambers Bldg.
April 11-13	Milwaukee, Wis., Spring Show; Dealers' Show Room Automobile Display; Milwaukee Automobile Dealers.
April 12-15	Champaign, Ill., Show, Gymnasium Bldg., University, Ill.
April 14-16	Milwaukee, Wis., Garage-Circuit Exposition, Milwaukee Automobile Dealers.
April 15	Altoona, Pa., Pennsylvania State Motor Federation.
April 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn.
May 6	Sioux City, Iowa, Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 14-20	Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Des Moines, Iowa, Iowa Derby, 20 Miles; Des Moines Special, 10 miles.
May 30	Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30	Indianapolis Speedway 300-Mile Race.
May 30	Minneapolis, Minn., Speedway Race.
June 8	New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphan's Automobile Day Outing Assn.
June 10	Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 12-16	S. A. E. Summer Trip on Great Lakes.
June 16-17	Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.
June 20	Galesburg, Ill., Track Race, 100 miles.
June 28	Des Moines, Iowa, Speedway Free-for-all, 300-mile race.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
July 17-21	Dallas, Tex., Tractor Demonstration.
July 24-28	Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4	St. Louis, Mo., Tractor Demonstration.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 7-11	Fremont, Neb., Tractor Demonstration.
Aug. 11-12	Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 14-18	Cedar Rapids, Ia., Tractor Demonstration.
Aug. 18-19	Elgin Road Race.
Aug. 21-25	Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1	Indiana Tractor Demonstration.
Sept. 4	Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 4-8	Madison, Wis., Tractor Demonstration.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City, Sheepshead Bay Speedway Race.
Oct. 7	Philadelphia Speedway Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race. Indianapolis Motor Speedway.
Nov.	Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in the Industry

La Crosse Chalmers Builds—The Chalmers Motor Co. will build a four-story factory, 60 by 400 ft in size with a 40 by 60-ft. wing. The estimated cost is $150,000.

Renshaw Succeeds Tilley—J. B. Renshaw has succeeded L. A. Tilley as automobile sales manager of the South Bend branch of the Studebaker corporation. Mr. Renshaw has been connected with the Studebaker corporation for some time, having been in the accounting department.

New Westinghouse Distributors—Westinghouse starting, lighting and ignition systems for Ford cars are now handled by the Central Rubber & Supply Co., Indianapolis, Ind. Other distributors are as follows: The Owen Schoenck Co., Chicago; Alex. Seewald Co., Atlanta, Ga.; Hirzig Co., Nashville, Tenn., and the Rose-Lyons Hardware Co., Little Rock, Ark.

New Detroit Battery Stations—The Detroit Battery Co., Detroit, has recently established the following service stations: Hydrox Storage Battery & Mfg. Co., Cincinnati, Ohio; Allen T. Hurst, Paris, Ill.; E. N. Egge Auto Co., Plainview, Tex.; Harry Lipman, 30 Sheridan Avenue, Albany, N. Y.; Vedder Bros., Johnstown, N. Y.; Power Accumulator Co., Dawson, Minn.; Rhymer's Garage, Hartford, Conn.; James C. Nichols, 1673 Broadway, New York; C. L. Thayer, 174 South Wall Street, Columbus, Ohio; Master Sales Co., Omaha, Neb.; Berg Auto Supply Co., Oakland, Cal.; P. Buford, 208 West Seventh Street, Austin, Tex.; H. & M. Garage, West Frankfort, Ill.; H. H. Karsten & Brother, Zeeland, Mich.

Splitdorf Branch in Oakland—The Splitdorf Electrical Co. has opened a branch and service station at 3040 Broadway, Oakland, Cal.

Washington Items—Beaumont & Williams, the Northwest distributors for Gramm-Bernstein motor trucks, have established headquarters in Seattle at Melrose Avenue and Pine Street.

The Seven-Seven Co., Spokane, Dodge distributor, has taken the agency for Hartford tires, the Trailmobile and Vedol oil for Spokane and the Inland Empire.

Another new line of automobiles has been added to the Spokane district. The Nelson Motor Co. was formed and appointed eastern Washington distributor of Lexington cars. E. O. Nelson is manager of the new firm.

Trade Happenings

Zertner Heads Philadelphia Oakland—Z. S. Zertner, for several years well known in the farm implement manufacturing circles, has taken charge of the Philadelphia branch of the Oakland Motor Co. recently. Mr. Zertner succeeds T. S. Johnson, who for several years has been branch manager, and who resigned to take up other work.

Kayser Heads Providence Chevrolet—A direct factory branch has been opened by the Chevrolet Motor Co. in Providence, R. I., in charge of R. B. Kayser, formerly assistant manager of the Chevrolet Motor Co. of N. E. in Boston.

Ross Fiat General Manager—R. R. Ross has been made vice-president and general manager of the Fiat Automobile Co., New York City.

Valerius Master Carbureter District Mgr.—G. P. Valerius has been appointed district manager by the Master Carbureter Corp., Detroit, Mich. He will cover Utah, California, Wyoming and Montana. He was formerly a district manager for the Maxwell company.

T. L. Grabe, who was formerly agent for the Autocar Co. in Philadelphia, and later on the Pacific Coast, has been appointed factory representative for the Master corporation for the States of Michigan, Ohio and Indiana.

Vesta's N. E. Change—The New England interests of the Vesta Accumulator Co., Chicago, Ill., are being taken care of and represented by the Boice Motor Equipment Co., 76 Brookline Avenue, Boston, Mass., instead of the Boice Perrine Co., that city, as heretofore.

Burd Ring Items—A. C. Preston, until just recently with the Gahran-Pinchbeck Co., Albany, N. Y., Buick distributer, has accepted a position with the Burd High Compression Ring Co., Rockford, Ill., and will represent that company in the Albany territory.

This company has opened sales offices at 899 Boylston Street, Boston, Mass., with E. B. Allen as manager.

The Milwaukee offices of the Burd company have been moved from 403 Jefferson Building to the ground floor location at 813 Grand Avenue, Rockford, Ill.

Robert Allan has resigned as sales manager of the San Francisco branch of the company. He will be succeeded by H. B. Rathbone.

The Seattle, Wash., office has been moved from 538 Central Building to 705 East Pike Street. A. C. Hansen is the manager in charge of the Seattle territory.

Eight Overland Stations in Cleveland—The Willys-Overland Co., 6604-18 Euclid Avenue, Cleveland distributors of Overland and Willys-Knight cars, will in a short time have eight service stations so located that no Cleveland owner of an Overland will live further than a mile and a half from a station. This announcement was made by M. L. Bridgeman, general manager of the local branch. Expenditure of $500,000 in completing the service chain is contemplated. Employment of 150 additional men will be necessary, Bridgeman said.

The service plan includes three immense stations—the one already established, another in the extreme East End and the third in the West End. Five smaller stations financed by the company but handled by dealers complete the Overland "mile-and-a-half" geographical plan.

In addition a new building four or five stories high, of steel and cement, 100 x 300 ft., will be erected on the property back of the present main service station and fronting on Carnegie Avenue. Tentative plans for the building have been drawn by the architect. The building will cost about $200,000. The Euclid Avenue service station will be converted into a salesroom, where "ready-to-roll" cars will be kept.

Nebraska News Items—The Standard Motor Car Co., Omaha, has taken the distributing agency for the Peoria in Nebraska, western Iowa and South Dakota.

Card, Adams & Brown of Lincoln, Neb., have taken the agency for the Chandler and will establish a local dealer in Omaha.

R. E. Davis has been appointed manager of the Murphy-O'Brien Co., Omaha. Douglas Bowie will be retail sales manager for the Paige and Dodge cars handled by this company.

The Hupmobile Co. of Nebraska has appointed G. H. Houliston, formerly with the Lininger Implement Co., to be manager of the Hupp branch house recently opened in Omaha.

Minneapolis News—The Northwestern Automobile Co. will open a new building May 1 at 1500 Harmon Place for the sale of Saxon and Chandler cars. It will be three stories and basement, giving 25,000 sq. ft. floor space and to cost $30,000. The show room is to be 50 by 90 ft.

The Fawkes Auto Co. will complete in two months a $75,000 building, three stories and basement, of steel concrete and terra cotta, to be occupied by the Brice Auto Co., Grant cars; Northwest Hupmobile Co., Hupmobiles; John E. Fawkes, Oldsmobile.

New quarters for the Goodyear Tire & Rubber Co. will be erected at Harmon Place and Thirteenth Street, 66 by 150 ft., three stories and basement. This will give the northwestern branch double its present capacity.

St. Paul News—The Detroit Electric Car. Co. has moved to Grand Avenue and Victoria Streets to get larger quarters. E. P. Wright has resigned a railroad position to become Twin City representative of the Gary Motor Truck Co., with offices at 1032 Merchants Bank Bldg. and show rooms at 352 Market Street.

E. R. Boutell, Inc., is a new automobile sales company, headed by E. R. Boutell, J. M. Boutell and M. B. Mitchell. Capital is $50,000 and liability limit $100,000.

An independent oil company has been capitalized at $50,000 by Harry Loomis, Ross Larson, H. P. Keller and H. L. Dunn. It is called the Nonpareil Oil Co., and plans to build.

The White Auto Supply Co., St. Paul, has been formed, and J. T. White has resigned from the Bartles Oil Co. to become its active head. Salesroom is in the Bartles Building, occupying a block front. The company is local agent for Federal tires and will handle accessories.

The Duesenberg Motor Co., St. Paul, is making aeroplane engines in addition to the manufacture of Duesenberg cars. The Gallaudet Aeroplane Co., of Norwich, Conn., has ordered the motors, which are 130 hp. and four cylinders. The company is making also a 12-cylinder motor for Canada.

Ohio Items—R. E. Sewell, direct from the factory at Akron, Ohio, has been placed in charge of the service department of the Columbus branch of the Firestone Tire & Rubber Co.

The Lima-Overland Co., of Lima, has closed a deal whereby a new garage will be built at 322 West Market Street, which will be occupied as a garage and sales agency.

Wisconsin Items—The Fisk Rubber Co., Chicopee Falls, Mass., is about to establish a general Northwestern distributing branch at La Crosse, and has engaged architects to plan a branch house building, two stories high, located at Sixth and State Streets.

W. H. Krueger, formerly of the Boulevard Garage Co., Milwaukee, has taken charge of the Cole Motor Co. of Chicago's business in Milwaukee and surrounding territory. An efficient service department for Cole owners has been established at 485 Jefferson Street, Milwaukee. F. E. Tabbert is associated with Mr. Krueger as manager of the retail sales department.

The Pioneer Mfg. Co. of West Allis, Milwaukee County, has been organized by H. E. Wellbourne and established a machine shop, factory and garage at 6703 Greenfield Avenue. A specialty will be made of self-starting mechanisms for motor cars and cycles. O. E. Birkekab, L. K. Anderson and D. L. Christiansen are associated with Mr. Wellbourne in the enterprise.

A. R. Callender, for several years chief clerk of the manufacturing department of the J. I. Case T. M. Co., Racine, Wis., has purchased the Badger Foundry Co. and resigned his position with the Case company to take the general management of the business.

L. K. Cooper has severed his connection with the Maxwell Motor Co. to assume the management of the Cleveland Maxwell agency at 1924 Euclid Avenue, Cleveland.

The Forest City Garage Co., distributor of the Interstate car, Cleveland, has leased a salesroom at 2052 Euclid Avenue, and will move from 10,926 Superior Avenue within a short time.

The Packard-Cleveland Motor Co., Cleveland, has exercised the option in its lease and purchased the 20-year lease on its new building at 5206 Prospect Avenue, and in addition has leased another parcel of land with a frontage of 70 ft. on Prospect Avenue. The building into which the company recently moved will be almost duplicated. The new portion will be used for the truck sales department, while the present building will be devoted entirely to pleasure cars.

The branch of the Goodyear Tire & Rubber Co., Cleveland, has moved to its new quarters on East Nineteenth Street, just off Euclid Avenue.

Southwest News Items—The Pioneer Motor Co., El Paso, Tex., is now agent there for the Scripps-Booth and Moon. This company also handles Kissel and Denby trucks.

H. A. Deans, manager of the McArthur Bros. branch at Tucson, Ariz., has purchased the Velie garage, formerly operated by J. Wood Walker, and will conduct it as a service station for Dodge cars.

The territory of the Southwestern Carburetor Co., Michelin tire agent at Phoenix, Ariz., has been extended to cover the entire State.

Little Bros. to Enlarge.—Little Bros., Port Huron, Mich., who have a foundry here, where certain parts for the Buick cars are made, will enlarge their plant. A building, 60 by 66 ft., is in course of erection now, and another, 30 by 66, will be started. The members of the concern are A. R., E. and W. F. Little and Henry Holth.

Oregon Items—W. M. Morris, an executive official of the Weed Tire Chain Co., spent the past week in Portland, Ore., visiting the company's trade connections. Mr. Morris is one of the directors of the company and is about to go to Europe to look after the Weed interests.

W. J. La Casse, manager of the Northwest zone of the Maxwell company, reports that 100 Maxwell cars were sold in the State of Oregon during the month of February. The Salem, Ore., agency alone took twenty-two cars of this allotment.

Michigan Items.—The Detroit Engineering Products Co., Detroit, manufacturer of automobile accessories, has moved its offices to 604 Woodward Avenue.

During the first half of March $674,110.66 was paid to the employees of twenty-one Flint, Mich., local manufacturing concerns, of which fifteen make either automobiles or motor car parts and accessories. Four concerns, the Buick, Chevrolet, Weston-Mott and Mason companies paid out $40,000 more than during the second half of February.

The Ross Automobile Co., Detroit, has opened local salesrooms at 734 Woodward Avenue, Detroit, under the name of Ross Motor Sales Co.

The Central Garage, Cedar Springs, Mich., has been formed by Carl Zunwalt, Roy Peasley and George E. Waycott.

M. L. Perigo, Alma, Mich., has taken the agency for the Dort for Gratiot County and part of Isabella County.

Claus Co. Breaks Ground—The Claus Automatic Gas Cock Co., now located in leased quarters at 2601-2605 Vliet Street, Milwaukee, has broken ground for a plant of its own on Booth Street, near Keefe Avenue, Milwaukee. The main building will be 90 by 150 ft. in size, of brick and steel, and will be ready about June 15.

Stephenson in Lumber Business—G. L. Stephenson, former president of the Stephenson Motor Truck Co., Milwaukee, for seven years identified with the pleasure and commercial car business of Wisconsin, has been elected secretary and general manager of the Foster Creek

Gay Plant for Sale—Bids will be opened by the receiver of the S. G. Gay Co., Ottawa, Ill., for the plant and equipment of the concern. The Gay company is the manufacturer of the Gay truck. The property has been divided into several parcels, comprising a factory building and land, four lots 140 by 60 ft. each, and a three-story brick building, shop and office equipment, power plant, warehouses of frame construction, a lumber yard, wood and metal-working machinery and stock consisting of finished trucks and parts and a number of horse vehicles.

The AUTOMOBILE

Vol. XXXIV,
No. 16

NEW YORK, APRIL 20, 1916

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The AUTOMOBILE

Are Other Cycles Possible?

Recent Suggestions Heard in Engineering Conferences Lead to the Belief That Cycles Other Than the Otto May Prove Useful—Constant Pressure Type a Possible Answer

By J. Edward Schipper

ONE of the effects of the fuel controversy which has spread from one end of the world to the other, has been to cause engineers to wonder if there be not some other way of utilizing the heat energy in liquid fuel. The present method employed in automobiles makes use of the basic scheme known as the Otto cycle. This method of transforming the latent heat energy in the fuel into dynamic mechanical energy, was first suggested by Beau de Rochas in 1870, and actually employed in an engine designed by Otto in 1876.

With wide open throttle and with excellent carburetion, and nearly complete combustion, the thermal efficiency of the up-to-date automobile engine is from 18 to 20 per cent. When the car is running at a touring speed of 15 to 18 m.p.h. and the throttle is possibly less than one-third open, the thermal efficiency is somewhere around 5 per cent. In other words, for every dollar's worth of fuel 5 cents in power is returned. The maximum possible efficiency of the Otto cycle is somewhere around 35 per cent, and it is these conditions, coupled with the increased price of fuel, which has caused some engineers to wonder if some other type of cycle, which had been developed mechanically to the same extent as the Otto cycle, could not be used to better advantage.

Thermo-Dynamic Classification

Thermo-dynamically engines are classified according to the way in which the heat is introduced. Engines may operate on a constant temperature cycle, a constant volume cycle or a constant pressure cycle. Each of these is distinctive in the manner in which the fuel is handled, and each has a certain efficiency which could be reached by a theoretically perfect engine, but which is beyond attainment by a mechanical creation designed to work upon that cycle.

Engines operating on the constant-temperature cycle take the heat in at a temperature which remains constant throughout the period of supply. Expansion then follows the cut off and the heat is also rejected at a constant temperature.

Constant volume engines take in and reject the heat at a constant volume and constant pressure engines take in and reject the heat at a constant pressure.

The Otto cycle is theoretically a constant-volume cycle and the point which it is desired to determine is whether or not it would be possible to mechanically develop engines working under the constant temperature or constant pressure cycles which would give as great or more satisfaction.

The effect of compression on the Otto cycle is very important, and there is little doubt but what manufacturers would work to a much higher pressure than they do now, if it were not for the fear of pre-ignition. The difference in efficiency between motors of 75 lb. compression and those of 100 lb. which are the same in other details of design is marked. The instability of the compressed mixture is the greatest difficulty to overcome.

Constant Temperature Cycle

The constant temperature cycle may be considered first and its maximum theoretical efficiency noted. Referring to the constant temperature cycle diagram, Fig. 1, the line *OV* represents the reference line of volumes, *OP* the reference line of pressures, and *abcd* the line which diagrammatically represents the pressure and volume conditions in the cylinder at any point.

On this cycle the line *bc* represents compression, heat is taken in from *c* to *d* at constant temperature and expansion takes place from *d* to *a*. From *a* to *b* heat is rejected at constant temperature. The efficiency of this cycle is equal to the amount of heat taken in by the gas less that rejected at the lowest temperature, divided by the heat taken in.

Steam engines working on this cycle with a steam pressure of about 150 lb. to the square inch and exhausting into a condenser having 28 in. vacuum, or in other words, working between absolute Fahrenheit temperatures of 819 and

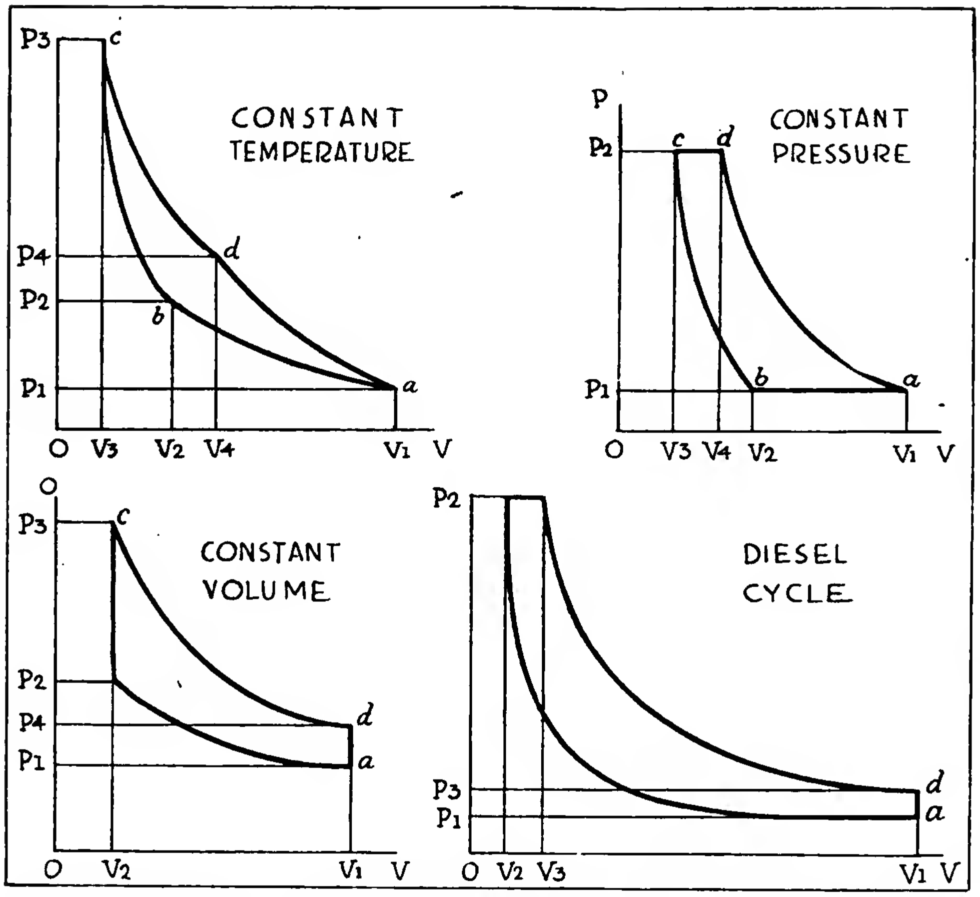


Fig. 1—Indicator diagrams of the constant temperature, constant pressure and constant volume cycles and the Diesel cycle

563 deg. would have a theoretical efficiency of 31.3 per cent. Practically an engine under these circumstances would reach about 15 per cent. In a gas engine when ignition occurred at *c*, the piston travel would have to be very rapid in order to hold the temperature constant down to the point *d* where expansion begins, or else the gas would have to be burned as it was introduced. This would allow of expansion during combustion and after cut off.

Suggests Slow Combustion

This process of working immediately suggests slow combustion, as compared to explosion, and that in turn suggests lower grade fuel; but this situation suggests heavy, slow-moving parts which are in every way opposed to the present requirements of a high-speed internal combustion engine. When worked out practically, the area inclosed in the thin crescent-shaped diagram would no doubt be very small, giving a low work value. Another loss as compared to the theoretical card would be that the point *a* on the practical diagram would not be on the atmospheric line but above it. This would still further reduce the area inclosed by the diagram, or, in other words, reduce the amount of work per charge. With these points in view and with the general clashing of the possibilities of this cycle with the requirements of up-to-date practice it can be discarded and thoughts turned toward the other cycle, the constant pressure, the possible alternative.

Studying the diagram of the constant pressure cycle, Fig. 1, and comparing it with the constant volume diagram, Fig. 1, it will be seen that the line *bc* in the constant volume diagram is vertical, showing that during the entire explosion stroke on the theoretical engine the piston has not moved, or in other words, instantaneous combustion has taken place. This condition, of course, is not reached in practice and the line *bc* is never vertical even at very high speeds with wide open throttle. On the constant pressure diagram the line *cd* is exactly horizontal which shows that during the time of burning the piston has moved in such a way that the volume has increased sufficiently to hold the pressure constant. Both lines *cd* in the constant volume diagram and *da* in the constant pressure are adiabatic expansions.

Similar conditions hold true at exhaust where the exhaust line in the constant volume diagram is vertical and in the constant pressure is horizontal on the theoretical cards.

It is this constant pressure cycle which some engineers are studying with a view to determining whether or not the conditions which hold true with the lower grades of fuel render its use commercially advantageous. With the more volatile fuels and the greater possibilities of exploding or burning the charge at constant volume, the constant volume cycle has been favored, but with fuels that are slower burning but

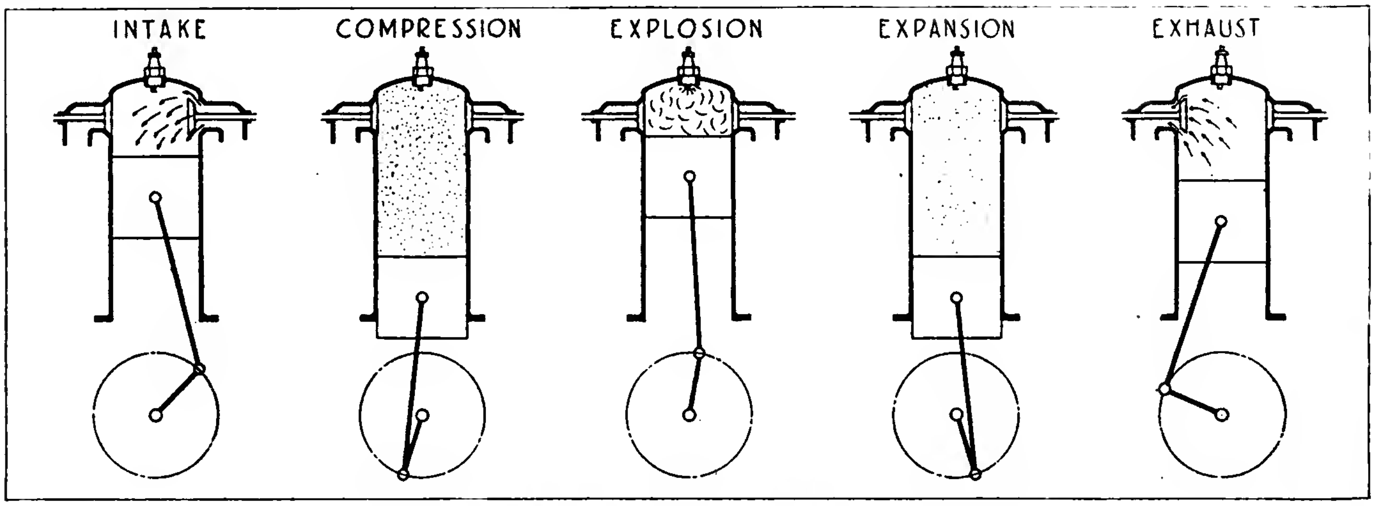


Fig. 2—The ordinary Otto cycle has five operations, intake, compression, explosion, expansion and exhaust

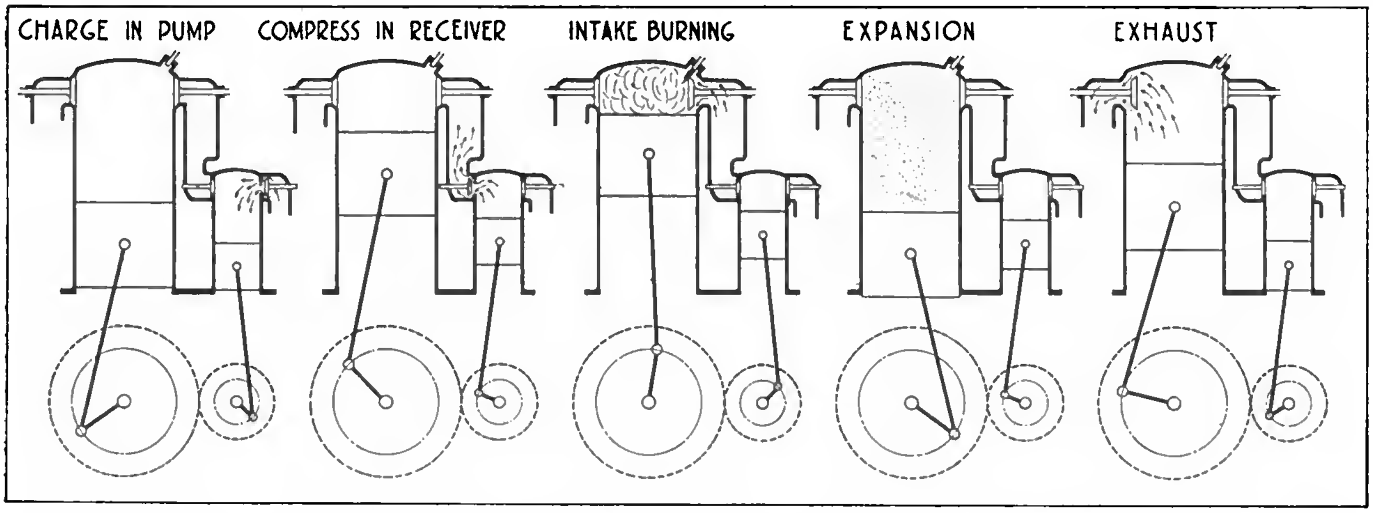


Fig. 3—Ignition at constant pressure with previous compression: charging pump at atmospheric pressure, compressing into receiver, admitting burning charge, expansion and exhaust

which at the same time contain a greater amount of heat energy for the same volume, it may be quite possible that the constant pressure cycle can be adapted to use.

Constant Volume Engine Efficient

While under similar conditions and with the same explosive fuel the constant volume engine is more efficient than the constant pressure, it seems possible that by carrying out the expansion line of a constant pressure type a higher efficiency may be reached, particularly at reduced throttle opening. The Diesel engine, for example, works on a cycle which as far as heat intake is concerned is a constant pressure type, but which at exhaust is more like the constant volume engine. The diagram of the Diesel cycle is shown in Fig. 1.

The high efficiency of the Diesel engine in large units has naturally attracted many to the view that it should be possible to make this power plant in small enough units to use in automobiles, and several attempts have been made to do this. While it does not seem possible just at this time to make the Diesel engine a commercial possibility as far as automobile work is concerned, the idea of coming quite close to this by using the constant pressure cycle is one which is provoking a great amount of thought at this time when fuel is far more plentiful in the heavier than in the more volatile grades.

The first thought suggested by the constant pressure engine is high compression. The idea that this necessarily means an efficiency loss, is often held by those who have not realized that practically all of the energy necessary for compression is returned in the expansion stroke. Ignition begins at upper dead center on the firing stroke and burning takes place along the horizontal pressure line until the predetermined cut-off point is reached. This means that fuel must be constantly introduced against the maximum cylinder pressure and this in turn means a receiver capable of withstanding the high pressures. It also means the employment of a compression pump with its consequent efficiency losses and a satisfactory ignition scheme; but the question to be determined is whether or not other gains do not offset this.

Engines working under the constant volume principle cannot carry compression beyond the pre-ignition point of the fuel, but in the Diesel engine pure air alone is drawn into the cylinder and the fuel is not admitted until after compression, so that very much higher compressions may be used with it. This same possibility holds true with the constant pressure engines, and in fact it seems that in order to secure the maximum amount of efficiency this compression ratio must be high.

In actual working, Dr. Rudolf Diesel points out, the compression ratio with his engines is about twelve as against six or seven with other gas engines. Working out the efficiencies in the two cases with the ratio six in one case and twelve in another, he shows that they are 0.51 for the six ratio and 0.63 for the twelve ratio.

It must be granted then, that in order to secure the desired efficiency from the constant pressure engine it is necessary to work at high compression and the point for practical engineers to determine is whether or not it is possible to secure the high compression ratios in satisfactory and reliable units of the size which would allow them to be used on automobiles.

Lost Work Area

There is no doubt but that at the present time we are sacrificing work at the end of the stroke by cutting off the expansion line and exhausting at high pressure. In the ordinary timing diagram the exhaust valve starts to open at fully 45 deg. before lower dead center so that the pressure will

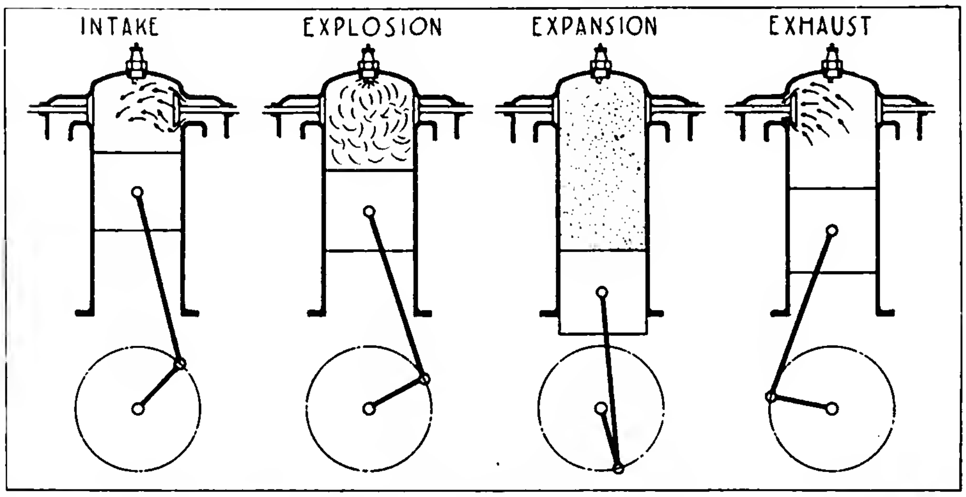


Fig. 4—Charging cylinder at atmospheric pressure, exploding the charge, expansion and exhaust

have dropped to near atmospheric by the end of the stroke. With very high speed motors the time at which the exhaust valve starts to open is much further advanced than this, and the difference of a degree or two on the timing circle is quite large when the angle between the crank and 90 deg. position is less than 45 deg.

To carry the working diagram all the way out until it is quite close to atmospheric pressure generally means a lower speed engine than what would be considered satisfactory in the light of present-day practice.

Mechanical Cycles Classified

It is of hardly any use to go over the old adaptations of these three types of cycles in the early gas engines. It is interesting to note, however, how these early designers who had nothing but the theoretical consideration to work from sought to apply the principles to practical engines. The constant temperature cycle for internal combustion purposes was neglected and the engines which really were built and put into operation can be classified as follows:

1—Those with ignition at constant volume without compression.

2—Ignition at constant pressure with compression.

3—Constant volume engines with compression.

The operations which each of these engines perform are shown diagrammatically in Figs. 1, 2 and 3. The engines under class 1 are of course commercially impossible and of low efficiency. The cylinder is charged as shown in Fig. 4, with explosive mixture at atmospheric pressure. The charge is exploded, expanded and exhausted.

Second Type

The second type with ignition at constant pressure with previous compression is the type of engine just discussed and the one in which it is supposed by some there lies some hope of higher efficiency with lower grade fuels. Engineers who have made history in the gas engine field have worked on this cycle. Among them may be mentioned Brayton, who had an engine in 1872; Foulis in 1878; Crow in 1883; Clerk in 1889 and Diesel in 1892.

Although the engines operating on this cycle perform five operations this was generally accomplished by the engineers named in two strokes. The pioneers in the two-stroke field were Clerk, Robson and Atkinson, in Great Britain and Koerting on the continent. Very ingenious mechanical cycles were invented by these early workers and the engines performed in a manner sufficiently satisfactory to guarantee the future of the gas engine.

The five operations performed by the second class of engines igniting at constant pressure with previous compression are: First, charging a pump cylinder with gas and air mixture at atmospheric pressure. Second, compressing the charge into an intermediate receiver. Third, admitting the charge into the cylinder from the receiver against the compression pressure in a burning state. Fourth, expansion. Fifth, exhaust.

Third Type

The third type of engine is the constant volume design with previous compression which is represented by the Otto cycle and which is in use in all our cars to-day. Although this cycle is generally performed mechanically in four strokes there are in all five operations: First, intake in which the cylinder is charged with gas and air at atmospheric pressure; second, compression; third, explosion; fourth, expansion; fifth, exhaust.

Thus in the two cycles which it is desired to compare each has five separate and distinct operations. We are so accustomed to the seeming ease of accommodation of this third type of engine to the requirements of the automobile that it may be that the possibilities of the second type or the constant pressure engine have been somewhat overlooked. If difficulty is to be encountered, however, in the latter, it will no doubt be in the accommodation of small but efficient high-pressure units to take care of the necessity of injecting the fuel into the cylinder against compression pressure.

Something has been said recently about altering the point of cut-off of the constant volume engine as a means of holding up the thermal efficiency even when operating on partial throttle opening. This in practice would be accomplished by variable cam action and has in fact been tried. It has not worked out satisfactorily, however, on account of mechanical complications. The possibilities of variable cut-off in constant pressure engines are very much greater. On this cycle it is possible to definitely determine the amount of burning fuel admitted to the cylinder in the same way that it is possible on the steam engine to determine the amount of steam admitted. In fact the indicator card has a similarity in many respects to what would occur in a constant pressure gas engine with variable cut-off.

Variable Cut-off Possible

Whether or not the variable cut-off constant-pressure gas engine can ever be adapted to the quick-accelerating, lightweight automobile is a question that is now so hazy that it is impossible to make any predictions with clearness. Yet there can be no doubt that since this subject is one which is ripe for investigation at the present time much light can be thrown upon it and possibly some interesting developments occur. Even with kerosene engines running on the Otto cycle or at least a modification of it, there have been vaporizing instruments suggested which admit the fuel to the cylinder in a state of flame. This is not by any means an impossible state of affairs, but rather one which lends itself readily to the idea of carrying out the expansion line to the greatest possible extent in order to secure the maximum work area on the indicator card from a given amount of charge.

It seems very well possible that the answer to the whole problem lies not in compressing the combustible mixture but rather in compressing the air only and adding the fuel by small successive charges during the stroke. This gives a series of small explosions giving the high-compression efficiency and at the same time holding down the violence of explosion by substituting burning in a highly-compressed atmosphere. A fine line between burning and explosion cannot be drawn, but where successive small quantities of fuel are injected into the compressed air the result is a series of small impulses instead of one violent blow.

This burning charge idea brings back to mind the arguments used by many of those who favored steam in the earlier days of engine manufacture. The burning fuel closely parallels in many of its characteristics super-heated steam. If it can be introduced into the cylinder, cut off, expanded and exhausted in much the same way as steam, it would have in many respects the advantages of the steam engine without the boiler apparatus necessary for the conversion of water into steam. In other words, the proposition is quite plainly a question of whether or not the Diesel or some modification of its cycle cannot be utilized in automobiles.

In many ways the constant pressure cycle seems to be more elastic than the constant volume. Once you have a given cylinder size to fill and a definite compression, which must always be worked to regardless of throttle opening, the engine is bound to fall off in thermal efficiency to a great degree on lesser throttle openings. On the other hand in an engine where the length of the stroke does not necessarily fix the amount of mixture drawn in, and where the volumetric efficiency of the engine does not cut such a heavy figure, it seems quite possible that engines may be constructed which, although no more efficient on full throttle opening, will at least exceed the 3 or 4 per cent secured with the throttle opening used at touring speeds.

Imperfections of Lubrication

How Oil Is Contaminated in an Automobile Engine by Water, Gasoline and Dust—Precautions That Should Be Taken To Prevent Ill Effects

By C. W. Stratford

CONTAMINATION of lubricating oil in the crankcases of automobile motors is without question one of the most potent causes of defective lubrication, and of the numberless attendant evils that follow in its wake. However good the quality of lubricating oil may be originally, when seriously contaminated in the motor sump by water, gasoline, carbonaceous and metallic sediment, or sand, it soon becomes unsatisfactory as a lubricant and its continued use will prove to be very costly in the end.

Water Forms in Oil

Many motorists are astonished to find a considerable quantity of water in the oil drained from the crankcases of their motors. This water has its origin principally in the products of combustion. The burning of a mixture of gasoline with air results in the formation of water vapor and other gases, which are of minor interest here. These gaseous products escape past pistons and rings during the expansion stroke into the crankcase, where the superheated steam condenses into water and sinks to the bottom of the oil sump. Some leakage inevitably occurs, even past the most carefully fitted pistons and piston rings.

The percentage of water formed by combustion is variable and depends to a considerable degree upon the adjustment of the carbureter; that is, whether the mixture is oxygen-rich or oxygen-poor. On burning, rich mixtures (oxygen-poor) give the largest percentage of water and result in the deposit of free carbon. Lean mixtures (oxygen-rich) give the smallest amount of water on burning, and leave behind no carbon deposit. With the average carbureter adjustment the quantity of water present in the products of combustion is approximately 10 per cent. Therefore it is evident that if these products are allowed to leak into the crankcase, past defective piston rings, a relatively large amount of water will be condensed there. During hot weather most of the water vapor passes out through the breather orifices before condensation can take place. This accounts for less trouble being experienced in summer than in winter.

Temperature Is Influence

The operating temperature of the motor has also a marked influence upon the rate of water formation in the crankcase. The lower the operating temperature, and the greater the leakage past pistons, the greater will be the quantity of water formed and vice versa.

All small-bore multiple-cylinder motors experience this difficulty to a greater extent than do larger motors which operate at higher temperatures. Another feature peculiar to multiple-cylinder motors, compared to four- and six-cylinder motors of like capacity, is that of a greater total piston ring length exposed to leakage.

This means that in the multiple-cylinder motor there is an increased likelihood for leakage, due alone to the increased lengths of the piston ring surfaces.

If the lubricating oil is of good quality and free from "sulpho" compounds and animal or vegetable oils which cause emulsification, the admixture of water in the crankcase will have no injurious effect whatever upon the oil.

If, on the other hand, the oil emulsifies readily with water the gelatinous product formed may clog the entire lubricating system and lead eventually to burned-out bearings or other serious damage to the motor. The admission, however, even of good oil mixed with water into the circulating pump is sure to decrease materially the efficiency of lubrication, if not to cause more serious damage especially when the motor is running at full load and high speed.

When water is present in the sump of a motor, and the inlet side of the oil circulating pump is exposed to it, the water is likely to freeze during very cold weather, and, when the motor is started, the pump itself may be damaged or broken. During the past winter this trouble has been widely prevalent, but the cause for such breakage has not always been clearly recognized by users and service men.

Gasoline in Oil

Accumulation of gasoline in the motor crankcase arises from leakage of the gasoline-air mixture past pistons and rings during the compression stroke. In cold weather, if low grade fuels are used, part of the atomized gasoline is not completely vaporized by the heat of compression but falls upon the piston head and is blown past the piston and rings into the crankcase by the pressure of the compression and explosion.

Leakage Always Occurs

Some mixture leakage occurs with all fuels. In this way gasoline, accumulated by leakage either in liquid form or by condensation after leakage, in the motor sump, thins down the oil. As in the case of water condensation, less trouble is had with crankcase gasoline in summer than in winter and for the same reason. As an indication of the thinning effect which gasoline has upon lubricating oil, 5 and 10 per cent mixtures were made with a fresh sample of oil of known viscosity.

OIL GASOLINE BLENDS

Viscosity (Saybolt)	Fresh Oil	Fresh Oil Plus 5 Per Cent Gasoline	Fresh Oil Plus 10 Per Cent Gasoline
100 deg. Fahr.	241	163	111
212 deg. Fahr.	45	42	40

The results show that the body of the oil at average crankcase temperatures, 100 deg. Fahr., with 5 per cent gasoline mixture is thinned down 32 per cent and with the 10 per cent blend, at the same temperature, 54 per cent. At 212 deg. the viscosity of the oil is reduced 7 and 12 per cent, respectively with the 5 and 10 per cent mixtures. This goes to show that the higher the temperature, the less is the thinning effect of gasoline.

Viewing these results from a practical angle, the effect of using oil in which there is a considerable percentage of gasoline would be to increase greatly the direct leakage of oil from the crankcase to the outside, as well as to cause a more rapid leakage of oil past the pistons into the explosion chamber, thus augmenting carbon deposits. Insofar as lubrication goes, very little difference in motor efficiency or immediate wear would be noticed. In general terms, this means that when a motor is started with fresh oil of medium body, gasoline contamination up to 10 per cent would result in thinning down the oil to a viscosity about equivalent to that of a light oil at cylinder wall temperatures.

Over a season's running, however, an appreciable increase in wear would doubtless be noticed. In addition, the weakening of the oil seal between pistons and cylinder facilitates the escape of gases from the combustion chamber.

Carbon and Carbonaceous Matter

When any hydro-carbon oil is exposed to high temperatures, as in the crankcase of an automobile motor, it suffers gradual decomposition. The rate of decomposition depends chiefly upon the temperature of the parts with which the oil comes into intimate contact, and upon the chemical purity and stability of the oil. The products of this decomposition consist of lighter hydro-carbons, free carbon, and complex, solid, polymerized compounds, called carbonaceous matter. The character of crankcase sediment varies widely and is greatly influenced by the thickness of the piston heads and the fit of pistons and rings in the cylinders, also upon the load carried by the motor. An analysis of sediment, taken from the crankcase of a touring car motor, after a month's running, shows free carbon under 2 per cent, metal dust under 1 per cent, road dust 1½ per cent, carbonaceous matter approximately 96 per cent.

Value of Aluminum Piston

The superior conductivity of aluminum pistons reduces the temperature of the piston heads to such a degree as to practically eliminate the formation of a carbon cake on the underside of the piston heads. The use of aluminum pistons is accompanied by a decrease in the rate of decomposition of the oil in the crankcase, due to their lower temperatures. The operating temperature of most cast-iron or steel pistons is sufficiently high to cause the formation of a carbon deposit on the bottom of the piston head. As this carbon deposit becomes thicker and thicker, the temperature of the piston head, due to the poor conductivity of the carbon cake, builds up to a point where premature ignition occurs. Particles of the carbon cake formed under the piston heads are washed off by the oil splash, and fall back into the crankcase and there mix with the oil in circulation. The application of screens between the main crankcase and the oil sump prevents the greater part of this deposit from mixing with the oil. A goodly quantity of it is sufficiently fine, nevertheless, to pass through the screens and in that way to enter the lubricating system.

Neither carbon nor carbonaceous matter, present in the crankcase sediment or as constituents of the carbon residue on the explosion chamber walls, are hard enough to cut the bearing surfaces in moving contact. But they possess, no lubricating properties. They partially take up the place of useful oil in the bearings and consequently decrease the efficiency of lubrication in proportion to the quantity present.

Use of Filters

The application of filters to the lubricating system of an automobile motor would effect the separation of the sediment in the oil, but such filters rapidly clog unless given attention and cleaning. In the hands of inexperienced operators, any filters interposed in the lubricating system of a motor might lead to under-lubrication and injury of the motor parts.

Metallic Sediment

Metal dust results from the abrasion of parts which come into moving contact. No machine was ever built in which there is no wear, consequently in automobile motors an amount will occur directly proportional to the efficiency of lubrication, and metal sediment will always be present in the used oil. It is obvious that the presence of hard metallic particles in the lubricating oil will appreciably increase the rate of wear.

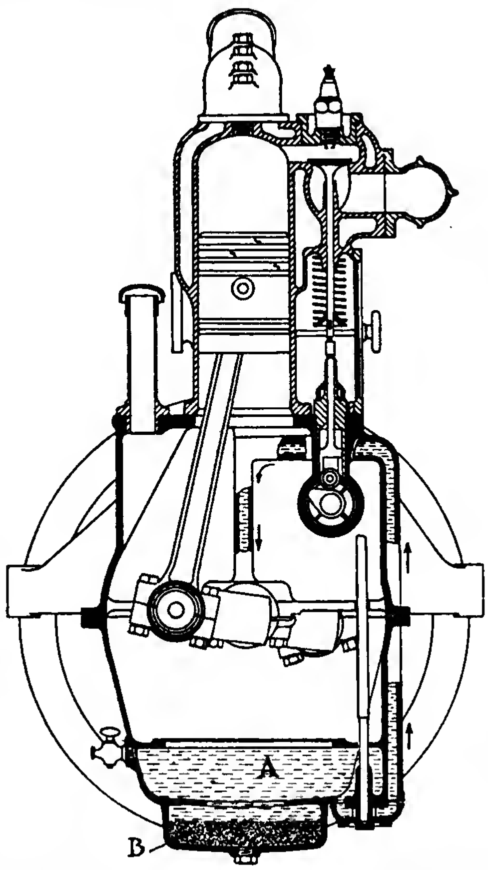
In new motors, formation of metallic sediment proceeds rapidly during the process of "running in." To obviate possible injury, the crankcase of new motors should be drained and thoroughly rinsed out with kerosene at the end of the first hundred miles of running. Part of the small percentage of metal sediment which accumulates in the oil, is sufficiently fine to remain in permanent suspension so long as the oil is in motion, unless provision is made for its separation.

Road Dust and Sand in Air

As we all know, for the operation of internal combustion motors, a continuous stream of air passes through the carbureter into the cylinders. Were this air dustless at all times, no sand or road dust would be found in the carbon deposit above the piston or in the oil within the crankcase. Such a condition of air purity is exceptional. The quantity of dust in the air is affected by many things such as wind, weather, character of roadbed, etc. When a motor car is driven over the average road, especially in dry weather, or in the wake of other vehicles, the air which is drawn through the carburetor is highly charged with finely divided sand or earth particles. This sand is carried in the charge at high velocity into the cylinders where it collects in the oil covering the cylinder surfaces and contributes to the friction load of the motor.

It is possible that part of this dust works its way from the cylinder walls into the crankcase. The pulsation of the air within the crankcase may also cause the entrance of dust by way of the breather pipe. The danger of scored cylinders and bearings is much greater with sand than with metal dust.

From the foregoing it is apparent that some positive means of separating all sediment, which becomes mixed with the lubricating oil in circulation, would be highly desirable from the viewpoint of both manufacturers and users. In very few modern automobile motors has sufficient provision been made for natural sedimentation. The location of most circulating pumps is



A shows clean oil and B dirty sediment. Observe that the intake to the oil pump is in the clean oil and well above the sediment.

such as to offer comparatively easy entrance of the sediment into the pumps and thence to the bearings. It would be difficult to assign any definite figure to the rate of wear and resultant maintenance cost.

Research work on motors in the laboratory, and a few careful tests of automobile motors on the road, have proved beyond doubt that a separation of all injurious sediment from the lubricating oil in circulation more than trebles the possible mileage between complete motor overhauls.

As a suggestion, looking toward higher efficiency of lubrication, a sediment basin of approximately one-fifth of the total volume of the oil sump is to be recommended. The crankcase illustrated is thoroughly practical and shows the correct position of the inlet to the circulating oil pump, sediment basin, baffle ledges to prevent mixing sediment with the oil in circulation, and the plug for draining the sediment basin.

The advantages accruing from this design are multiple, making possible the automatic separation of all deleterious matter and water from the lubricating oil. The frequency of draining the sediment basin will depend upon the rate of leakage of all contaminating substances into the crankcase, operating temperatures, service conditions of the motor and essentially upon the quality and suitability of the oil used. A complete draining of the sediment basin once every thousand miles should be sufficient with the majority of motors.

Since wear and maintenance cost depend directly upon the efficiency of lubrication, the application, in the manner shown, of sediment basins on every motor manufactured, should substantially repay the manufacturer by immediately decreasing the length of his complaint lists, and extending the popularity of his car. The benefit to the car owners would be less motor trouble, fewer repair bills, unfailing and efficient lubrication —satisfactory service.

Getting Proper Brake Action with Hotchkiss Drive

Special Precautions Necessary to Prevent Automatic Application of Brakes by Road Shocks

By A. Ludlow Clayden

IT is a well-known fact that the movement of a rear axle with respect to the frame of a chassis is irregular. With a firmly anchored torque tube the axle center swings as on a pivot and must have its vertical displacement along the arc of a circle, but when the drive is taken through the springs the flattening or curving of the spring causes the axle to move fore and aft as well as up and down, this having to be allowed for on the driveshaft by the provision of at least one universal with a sliding member or telescopic joint.

With the usual cambered spring, compression on passing over a bump in the road causes the axle to move back relative to the frame, and the rebound after the bump will pull the axle forward beyond its normal position. For the majority of bumps the total deflection of the spring is small, which means that the fore and aft movement of the axle is insignificant; but there are cases where this general law does not hold true, and the most important is that of motor trucks.

On a passenger car the load does not vary much, but on a truck the load may account for inches of compression on the spring. Suppose the camber of a truck spring is 8 in. deep when the truck is empty, this may be reduced to 3 in. when the full load is on. This means that the axle moves backward as the truck is loaded and forward as it is unloaded, passing over bumps causing the usual fore and aft movement but with a different mean position for the axle according to the load.

Brakes Applied Automatically

On a truck, the total amount of movement fore and aft may be quite considerable when the variation due to load is taken into consideration, together with that due to road shocks. Therefore, allowance must be made somewhere to prevent automatic application of the brake caused by the movement of the axle.

Consider the case geometrically. The brake actuating lever on the axle moves in a curved path; to it is attached the brake pull rod, and the front end of the pull rod is attached to a lever somewhere on the chassis frame. The rod is of fixed length and so the end which is pinned to the brake lever on the axle must swing in an arc of a circle having the front end of the rod for its center.

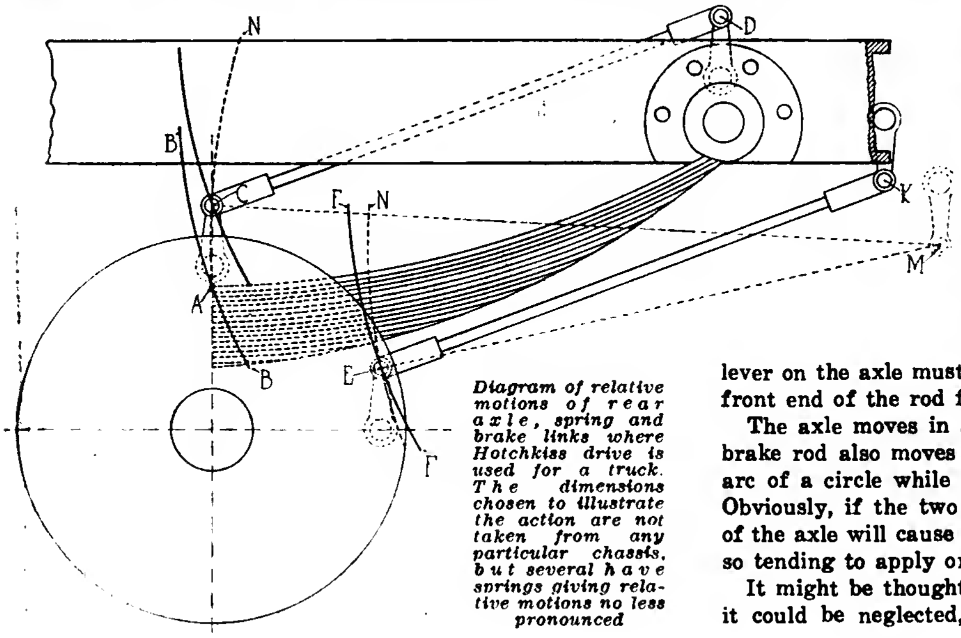


Diagram of relative motions of rear axle, spring and brake links where Hotchkiss drive is used for a truck. The dimensions chosen to illustrate the action are not taken from any particular chassis, but several have springs giving relative motions no less pronounced

The axle moves in a curved path and the rear end of the brake rod also moves in a curved path, but the latter is an arc of a circle while the former need not be and seldom is. Obviously, if the two paths do not coincide, then movement of the axle will cause the brake lever on the axle to oscillate, so tending to apply or to release the brake.

It might be thought that this tendency was so slight that it could be neglected, but laying out the curves on paper shows that this is not true. Often it is not sufficient to place the brake countershaft at any convenient position and to link it up to the axle while trusting to lost motion in the brake band itself to care for the oscillation. That this is so is shown in the cut below. Admittedly, the case chosen for illustration is an extreme one, but there are plenty of such cases to be found in trucks. The proportions of the spring are not so very abnormal.

Referring to the illustration, the path of the middle point of the spring as under compression and expansion is plotted, *A* being the normal point and *BB* the curve. Also the paths of two brake lever eyes, one at the top of the brake and the other on the horizontal line. Regarding these two curves, it is obvious that there is for each of them a circle, an arc of which will approximate closely to their curvature. Choosing two such arcs, one for each position of the brake lever, we then see that there are only two possible centers for the front end of the brake rod; in other words that the length of the pull rod and the position of the front end of the pull rod are fixed absolutely when the position of the brake lever on the axle has been decided.

Variations Are Large

Taking the top position for the lever on the axle, the arc which corresponds most nearly to the path of the eye has a radius *C, D*, which gives a pull rod of normal length. If this rod swings on a high placed center *D* it will be possible to have all variations of load and road shock without disturbing the brake setting, but if the center is low placed, as at *M* then the travel to and fro of the end of the brake operating lever can easily be as much as 3 in.

Taking the horizontal position for the lever, the nearest arc has a radius *E K*, permitting the use of a brake rod placed in a more convenient position, but here observe the evil effect of using too long a pull rod by contrasting the arc *F* obtained from center *K* with the arc *N* obtained from center *M*.

It may often be found on passenger car chassis, especially those with flat springs, that there is considerable latitude for the pull rod center. On trucks, however, there can seldom be much latitude, for maximum brake effectiveness.

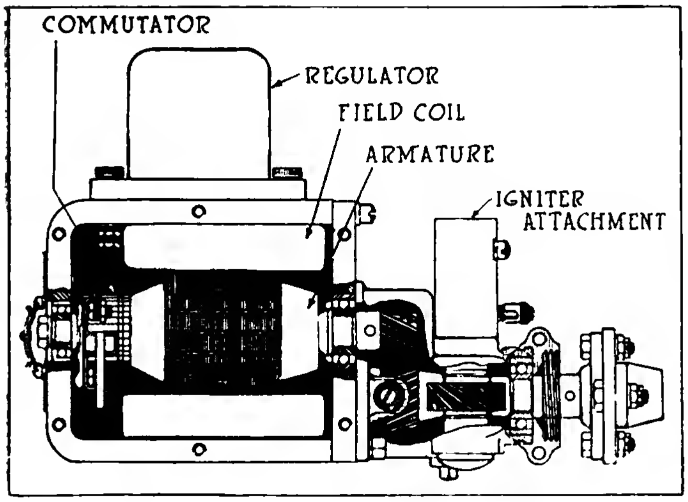
In brake design there is one very definite limitation, and this is the amount of movement that can be given to the brake pedal. The operating range for the driver's foot is not very large, so that lost motion anywhere in the linkage is equivalent to a reduction in the useful travel of the pedal. This means that, if allowance has to be made for much lost motion, adjustment of the brake will need to be made far more frequently. Suppose the pedal has a travel of 6 in. and there is no lost motion, it will be possible to adjust the brake to come into operation fully after the pedal has been depressed 2 in., leaving 4 in. to take care of wear, 4 in. to be used up before adjustment is necessary. If a big allowance for lost motion is required this 4 in. may easily be reduced to 2 or less, so cutting in half, or less than half, the period before adjustment will be called for.

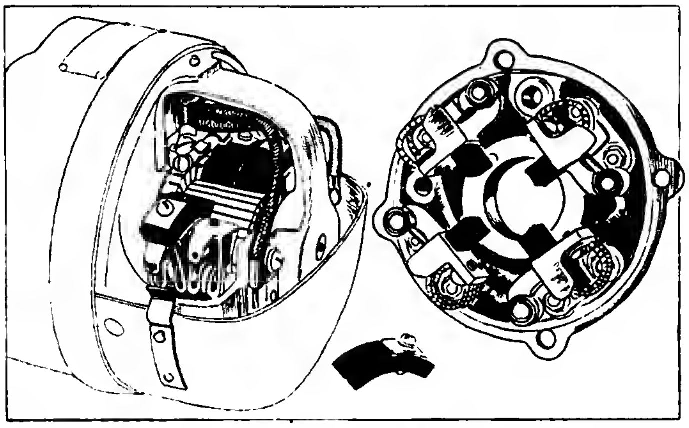
Fifteen Studebaker Ambulances for Russia—One for France

FIFTEEN Studebaker Sixes, all 1916 models, equipped for service as ambulances in the Russian Army, are to be sent to Russia, April 20, by the American Ambulance in Russia, which within two months raised funds enough for the complete purchase of this flotilla and its equipment.

On April 10 the ambulances were formally turned over to Consul General Oustinoff after they received the blessing of Archbishop Evdokim of the Greek Orthodox Church of North America.

The ambulances will be in charge of Dr. Phillip Newton, who holds a general's commission in the Russian army, bestowed upon him by the Czar for his services with the Russian army under fire. Dr. Newton came to this country about two months ago to raise funds for this flotilla, which will include two repair cars, one pilot car, a hospital car with tent, and twelve ambulances, one of which goes to France. These ambulances will be equipped with four stretchers, and there will be sitting room for eight wounded.





Right—North East unit, showing commutator. Autolite brush assembly. Left—Gray & Davis generator, showing regulator, armature, etc.

Automobile Electricity

Locating and Curing Troubles

PART III

Troubles by Units Considering Each Individual Part of the System Separately and Denoting the Troubles Which Are Commonly Found in Those Parts

By J. Edward Schipper

Synopsis

Part I—April 6

¶ *Three fundamental thoughts were established in the first part of this electrical series.*

¶ *First: Continuity of which the circle is the symbol. Electricity flows in a circle or circuit. The circle must be complete.*

¶ *Second: The basic law of current flow. In order that this should exist there must be sufficient voltage.*

¶ *Third: Trouble testing by elimination. The electric circles are divided into a number of arcs by bridging across and these arcs are gone over one by one. These three principles are applied to the lighting, starting and ignition circles.*

Part II—Last Week

¶ *Finding trouble by symptoms in starting and lighting systems. Classifying these and indicating the possible troubles for each set of symptoms.*

Part III—This Week

¶ *Locating troubles by units in starting and lighting. Knowing the unit in which the trouble exists, the possible locations and causes are given in detail.*

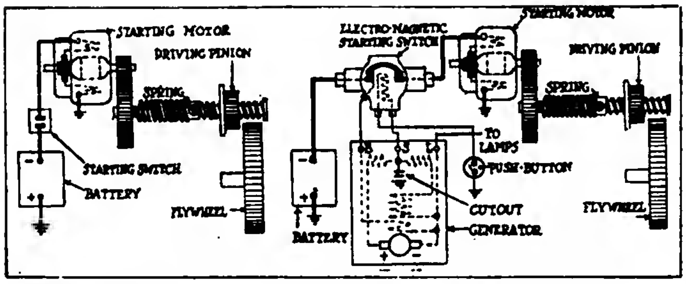
IN a large percentage of instances it will take only a minute's inspection to determine exactly in what unit the trouble is located. For instance, if the trouble is in the starting motor there may be symptoms that render it impossible for one to come to the conclusion that the trouble were anywhere else. The next step would be generally to have the starting motor removed and brought into the shop where the work could be done upon that unit.

This part of the electrical series deals with troubles which are located in a definite unit.

Basically, even if the troublesome unit is known, the matter is simply one of elimination. It is a case of traveling from the known to the unknown, step by step until finally the bad spot is reached. However, there are short cuts which can be employed on definite units which will greatly lessen the work and prevent the repairman from taking down the entire part in a search for some little defect which can probably be located by using simple tests. These cannot be classified under general heads but will be suggested in taking up the troubles which occur under their particular heads.

Units of Starting and Lighting Systems

Since all starting and lighting systems are manufactured to perform the same functions, it is but natural that they should be made up of units which do the identical work. All systems are provided with a storage battery, all have generators to maintain the current supply, all have starting motors to crank the engine, regulators to govern the rate of charging, switches to control the action of the various units and wiring to connect these units and provide a path, the circle, over which the current shall flow. Certain types of each of these units have certain inherent weaknesses and these are naturally the points watched more closely by the man familiar with the business. Again, just as in cars it very frequently happens that the first run of a certain series will have certain weak spots which are corrected in the cars



Westinghouse starting awitches; mechanical and magnetic on left and right

bearing a higher serial number, so in electric lighting and starting systems the earlier developments may be electrically correct but mechanically weak, or vice versa, causing certain troubles to develop in the earlier models which do not occur in the later, and it is only fair to state that the latest developments in starting and lighting systems show a remarkable amount of attention given to these little kinks which at first were the causes of most of the trouble.[*]

Logically the only method by which the troubles can be taken up in detail is to take up each unit singly and, since the battery is the starting point, it is considered first.

Battery Troubles and Their Remedies

SYMPTOMS that the trouble is in the battery are superficially given when the light in the car lamps burns but dimly, when the starting motor cannot turn over the engine rapidly or at all, or when the lamps turn on brightly and soon die down. Any one of these may be due to other causes, but when two or three of them come together the trouble is practically surely in the battery. The common method of testing the battery to find if it is in good condition or whether it is giving any current at all is to connect the terminals of a test lamp across the positive and negative battery terminals. When testing a three-cell battery the 6-volt lamp can be put across each cell and the light should burn dimly each time. When the test lamp lights across the terminals of two of the cells and not across the third it is an immediate indication that the trouble is in that definite locality and the battery should be immediately referred to the service station of the maker. If the cells are all weak, as is shown by no glow of the test lamp across any of the cells or only a dim light when put across the positive and negative terminals of the entire battery, it indicates that the battery is partially exhausted and it should be charged. If the charging does not increase the electrolyte's specific gravity or the voltage up to standard the trouble should be referred to a battery service station if possible. One precaution must be observed, do not run the engine with the generator in place and the battery removed without lifting a brush from the commutator. There are a few systems in which no damage will occur when this precaution is not taken, but unless you are positive the system you are working on is one of the exceptions, it is far wiser to follow this rule.

With the hydrometer syringe measure the gravity of the electrolyte and when charged the reading should be between 1.275 and 1.300 and when discharged never below 1.150. The facilities of the ordinary car owner or repairman will not allow him to do any practical work in batteries, as far as the internal construction is concerned.

Sulphation of the battery lies within the scope of the repairman as it can be generally cured by giving a long slow charge, or in other words by making the charging rate of the battery three times as slow as normal. The repairman, however, should go further than merely curing the sulphation as he should take up the inherent trouble or defect which is making the sulphation possible. Generally the causes of the over-sulphation are over-discharge or rapid discharge either of the entire mass of active material due to some exterior short or more than normal ampere draw, or from some local short which quickly discharges certain portions of the active material. Dead shorts will more than sulphate the battery as a rule and will generally cause the cracking and shedding of the active material from the plates or cause them to buckle. Insufficient charging also causes sulphation.

Batteries should be cleaned from time to time so that the sediment does not rise up to the plates, cutting down their available surface. Battery repair, however, should only be undertaken by those who have the necessary equipment and experience. One point of battery care which is important, however obvious, is that the exterior must be kept clean, and where acid has leaked out and collected on the top of the battery it must be cleaned off. It gives a slight short across the top of the battery which makes a material reduction in the supply of current after a time. In fact, acid on top of the battery will often fool an experienced repairman who knows that there is a slight short somewhere and will look for it in the wiring. All trouble searching or shooting, as it is often called, should start from the battery and work out, and before the battery is left the repairman should make sure that there is no leakage of electrolyte through the sides or top, that the terminals are not bent over touching the metal battery box and that none of the insulation of the wires is soaked with acid. Tight terminals should also be the rule, although of course this belongs more to the wiring than to the battery.

Repairs on the Generator

GENERATOR troubles can be divided into two heads, mechanical and electrical. They are often combined as a mechanical trouble will also set up an electrical interruption as a general rule. Probably the most frequent cause of generator trouble in the average type of machine is in neglect of the lubrication of the armature shaft bearings, although it is true that a number of makes are free from this due to the specific care taken to avoid this trouble. If trouble has been traced to the generator, as it can be as a rule through the fact that the ammeter reading indicates either no charge or weak charge, the first place to look is at the commutator. Removing the commutator housing, the commutator surface and brush mechanism will be exposed, giving access to what is generally the heart of any electrical troubles which might have occurred.

Commutator Assembly

With the commutator housing removed, or any other housings possible on the particular make under consideration, the armature shaft is rotated slowly by hand allowing the repairman to locate binding or worn out bearings. As the armature shaft is rotated the surface of the commutator is examined to see if it has become rough or blackened.

Since the brushes of the generator are constantly in contact with the commutator it is but natural that they should wear away, and they do so in the form of metallic powder or dust. If this is allowed to accumulate it will sometimes

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[*] It will be interesting in passing to give an instance of this. On a certain make of generator the armature bearings were inclosed in such a way that unless the driver of the car oiled the bearings every 500 miles they ran dry. It is a well-known fact that a car owner will not oil anything that he cannot see and the result is that very soon these generators, which were driven at three times crankshaft speed and hence were the fastest moving parts on the car, soon began to come into the repair shops for bearing replacements, and often, because the bearings had worn so far that the armature swept against the pole pieces, the armatures were also frequently destroyed and required replacement. This fault was soon perceived by the manufacturers, who installed a bearing which held the lubricant so that if only oiled at long intervals sufficient lubrication was provided. Instances of this kind can be cited almost without number and on this score it can only be said that experience is the only thing which will teach a repairman the little peculiarities of the great number of starting and lighting systems which were put on the market during the early development of this method of cranking and illumination.

fill the ridges between the commutator bars causing occasionally a short-circuit between the brush holders. A rough or blackened commutator should be cleaned and smoothed with fine sandpaper while the armature is rotated. A rule which must be remembered is that emery should not be employed for cleaning the commutator. Loose commutator bars or broken windings almost invariably mean that the machine must be returned to the factory.

A common trouble which can be cured in an ordinarily equipped shop is high mica, which protrudes between the commutator segments. These high mica parts must be cut down carefully so as to be below the surface of the commutator, and generally in doing this work it will be necessary to take the machine down. Little need be said about the work of taking a generator down except that in the case of permanent magnet types, where the permanent fields have to be removed, a keeper, or heavy piece of steel, should be put across the magnet poles in order to preserve the magnetism. In returning the magnets great care must be taken that they are replaced in the same positions as they were before.

Brush Troubles

Brushes will sometimes be found to be sticking in the brush holders, with the result that imperfect contact is made between the commutator and the brush, or occasionally no contact at all. Grease and dirt will generally be found to be the cause of sticking, and the cure is cleanliness. Should the trouble, however, be due to brushes which are too large, they can be filed carefully to secure perfect fit in the holders. Sometimes the poor contact is due to bad spring tension which does not press the brush against the commutator. This trouble is overcome by a fresh adjustment on the spring, or a spring replacement. Too much pressure, however, between the brushes and the commutator should be guarded against, as excessive pressure would cause the brushes to overheat and deteriorate.

It is not good economy to use any but the best brushes, and in making brush replacements the best policy is to secure the new brushes from the maker of the generator. Commutators naturally must be clean, free from grease and bright. It is also of great importance to have a clean complete contact between the brush and the commutator.

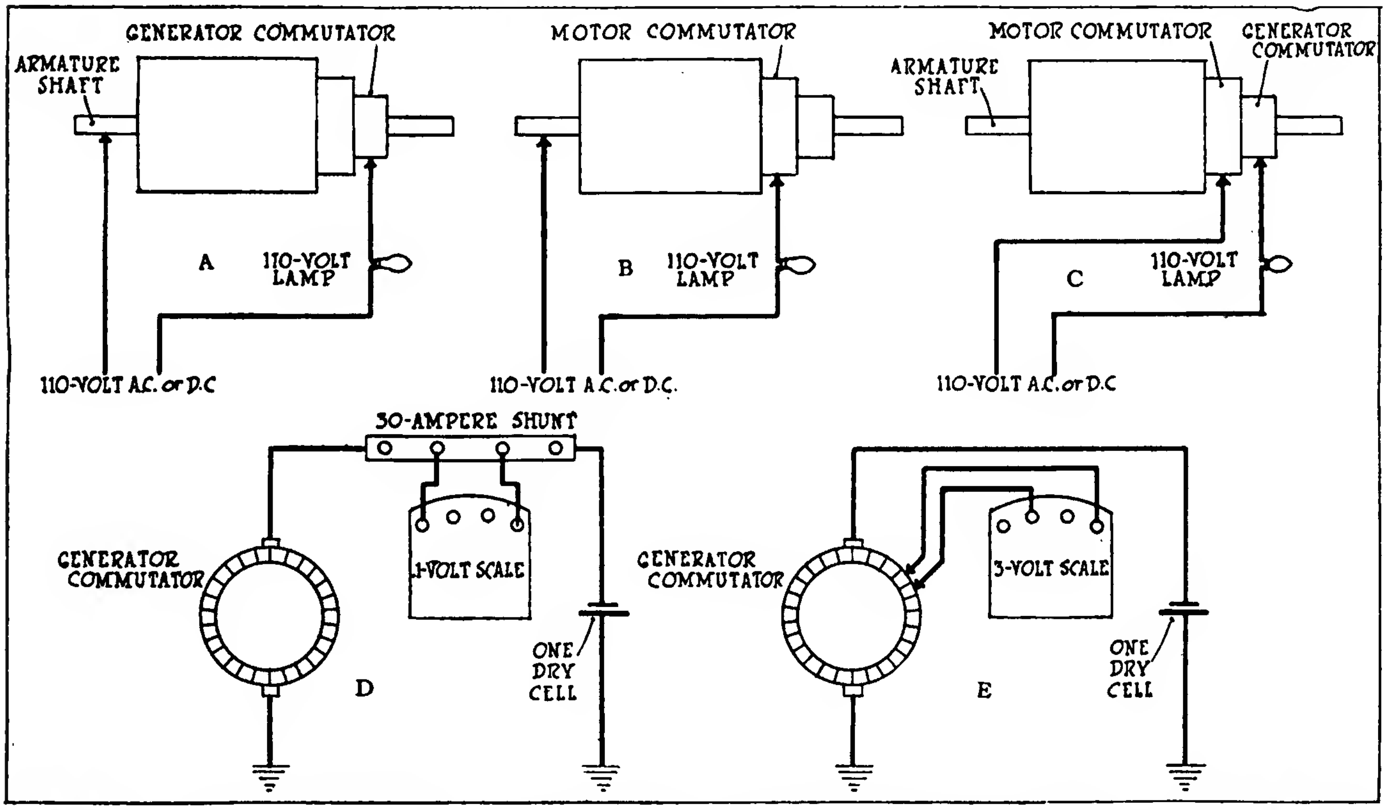
Automatic Cutout and Regulator

The automatic cutout and the regulator may be considered a part of the generator since they have so much to do with its action and since as a growing practice they are mounted directly in unit with it. The automatic cutout prevents the battery from becoming discharged through the generator when the engine is not running. It also connects the generator to the battery when it is time to charge the latter or when the car speed reaches a fixed amount.

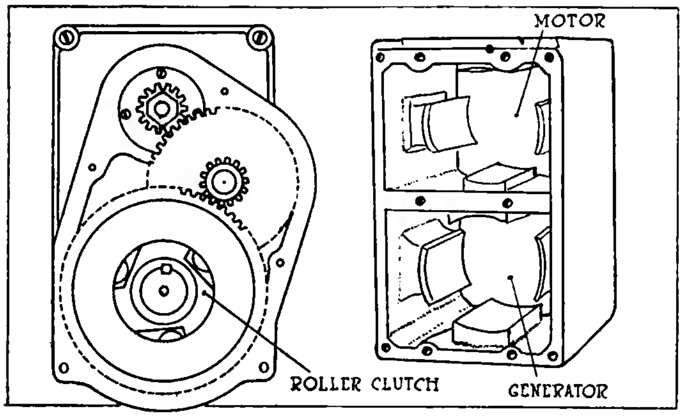
Troubles in the automatic cutout are generally those of adjustment of the spring tension or weight which acts against the tendency of the relay magnet to close the contact between the generator and the battery. On some regulators it is impossible to make any adjustment on the spring controlling the automatic cutout because the makers seal the regulators and avoid all guarantees when the seals are broken. Adjustment can be made on others by bending the flat spring carefully or by lengthening or shortening the coil springs. In general the farther apart the cutout points are separated the higher the cutting in speed of the generator. Therefore if the cutout closes at too low a speed this can generally be cured by separating the points.

Cars which are driven practically always at night require a different setting of the cutin mechanism than on cars which are seldom driven after dark, and the charging rate of the generator on a car driven practically always at night is often changed by the service manager who happens to know exactly the conditions. If a battery does not receive sufficient charge or it is continually in a run-down condition it is generally considered evidence that the cutout is not closing soon enough, provided there are no shorts anywhere on the line.

If some method of regulation were not employed the charging rate of a generator would increase rapidly with the speed, but in order to maintain the life of the battery the



Delco Tests—A—Test for grounded generator coil on one-wire single unit systems. B—For grounded motor coil. C—Short between motor and generator armature. D—Open or short-circuited generator armature. E—Generator commutator



Remy model 150 reduction gears, over-running clutch and frame

ampere flow entering it must not rise above a certain point. There are two basic methods of doing this, one by regulating the amperage of a quantity of current and the other by regulating the voltage or the pressure of the current. The voltage or pressure is what causes the current in amperes to flow. With the realization of the importance of the regulator in mind the ammeter should be carefully watched to check the charging rate.

Electric Starting Motors

WITH rare exceptions electric starting motors are series wound. This means that the current passes from the commutator through the brush, through the series field, then out through the line and back through the other brush to the commutator. Electrically, therefore, practically all starting motors are alike. Mechanically, they vary in their shape and construction and in the method by which they are connected to and detached from the gasoline engine.

Electrical troubles are very scarce in starting motors for two reasons; first because they are simple, and second because they are only in use a limited length of time in starting the engine. The mechanical troubles are in the majority of instances connected with the mechanism for throwing the starting pinion in and out of mesh. The arrangements for doing this are generally different, probably the most common method now being a magnetic scheme or by the Bendix gear. Roller clutches are also used and sometimes the starting pinion is engaged positively by pressure on the starting pedal. Where motor generators are used constant mesh machines are sometimes employed in which the machine acts as a motor below certain speeds and a generator above a given speed. Cases where the meshing mechanism fails to work are easily detected, and generally the case is one which should be treated mechanically, although in magnetic designs the solenoid should be examined to see if coils are in good condition and are pulling the starting pinion into place.

Armature, commutator and brush troubles may occur on the motor just as in the generator, and the detailed explanations and descriptions given under the generator head may be applied to the motor. A clean commutator and proper brushes in correct adjustment are necessary to the proper performance of the starting motor the same as they are to the generator.

Wiring and Connections

A LARGE percentage of the minor troubles encountered by the car driver are in the wiring and connections. Small grounds, short circuits and current leaks are due to some defect in insulation, especially of terminals, connectors, switches, etc. Sometimes these troubles may become the cause of more serious difficulties if they are allowed to go without attention. A small ground in the battery circuit may result eventually in the sulphation of the storage battery. A worn starting switch has been known to cause a stripped flywheel gear, and thus although the trouble in itself may be only some little detail it may be serious enough to give a great amount of annoyance if it is not looked after.

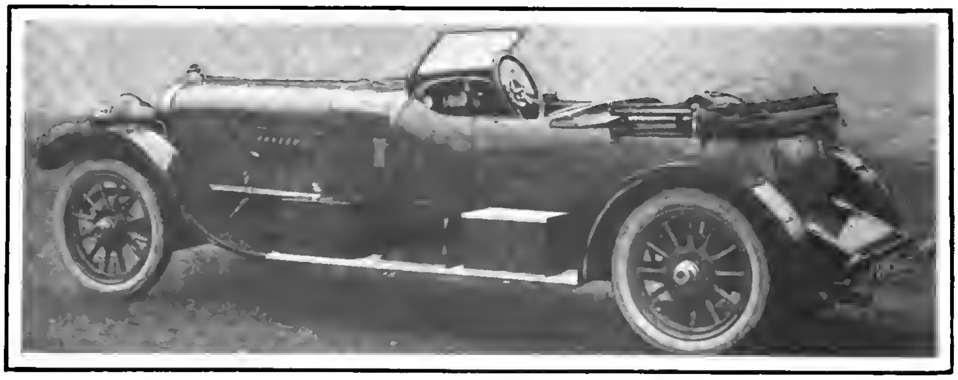
In a two-wire system in order to secure a ground, contact has to be made with both wires and some part of the frame of the car. In a single wire system any contact with the car frame gives a ground. In either system all wires should be insulated from each other except at points where contact is necessarily made, and there the connections should be soldered and taped.

Wires must be secured against chafing and therefore should be fastened securely in position. The installation should be made so that there is no possibility of sharp metal corners or edges cutting through the insulation and eventually establishing a ground or short circuit. Wherever grease and water are to be found wires should be especially protected because of the rotting action on the insulation.

With these points in mind repairs can be made after they have been found by the systematic method of search explained. Motor and car vibrations will often loosen the wiring and cause poor and intermittent contacts to be made. The connections to such units as the motor switch, dash instruments and switches, battery, generator, motor, etc., should all be so carefully made that a great factor of safety is given against possible disconnection. The contact pieces and electric switches should break quickly and not be in a position to cause arcs across the contacts thereby burning them and quickly destroying their usefulness. Switches, connectors, lamp sockets sometimes short-circuit or wear out and should be replaced. Burned-out bulbs are obvious and are the first things looked for when the lamps do not light. They form one of the little detail parts which must be constantly watched in maintaining the proper functioning of an electric lighting and starting system.

A New Sunbeam Six-Cylinder Model

THE accompanying illustration shows a new model of Sunbeam six which has been prepared for after-war business and is interesting because it shows the latest ideas in British bodywork. In general the lines are not unlike those of the Mercer, the top of the hood being fairly flat and the radiator much the same shape. The "tumble home" on the sides of the body is apparently greater than on any American stock car. The use of flt fenders is to be noticed, the domed pattern having found less favor in England and France than in America.



Building Up Sheet Aluminum Bodies

Eliminating Elaborate Hammering by Using Acetylene Welding

LAST Fall THE AUTOMOBILE described the Franklin car construction fully with the idea of showing how the light weight was obtained. Mention was made of the large amount of weight cut out by using sheet aluminum for the fenders and for the body panels. Sheet aluminum is a very ductile substance and can be bent and hammered into almost any shape, but very elaborate hammering is costly, as it is not a rapid process and calls for highly skilled labor.

Minimizing Waste of Material

It is an ideal with many body builders to-day to cover all wood completely, so as to have a continuous sheet of metal without seams or joints all over the outside of the body. This can be done in steel when there are no elaborate curves, and in aluminium for almost any shape, but the modern trend is toward the use of several pieces of the covering sheet metal, welded together so as to avoid the joint without the necessity for wasting much sheet in cutting out or for difficult forming operations.

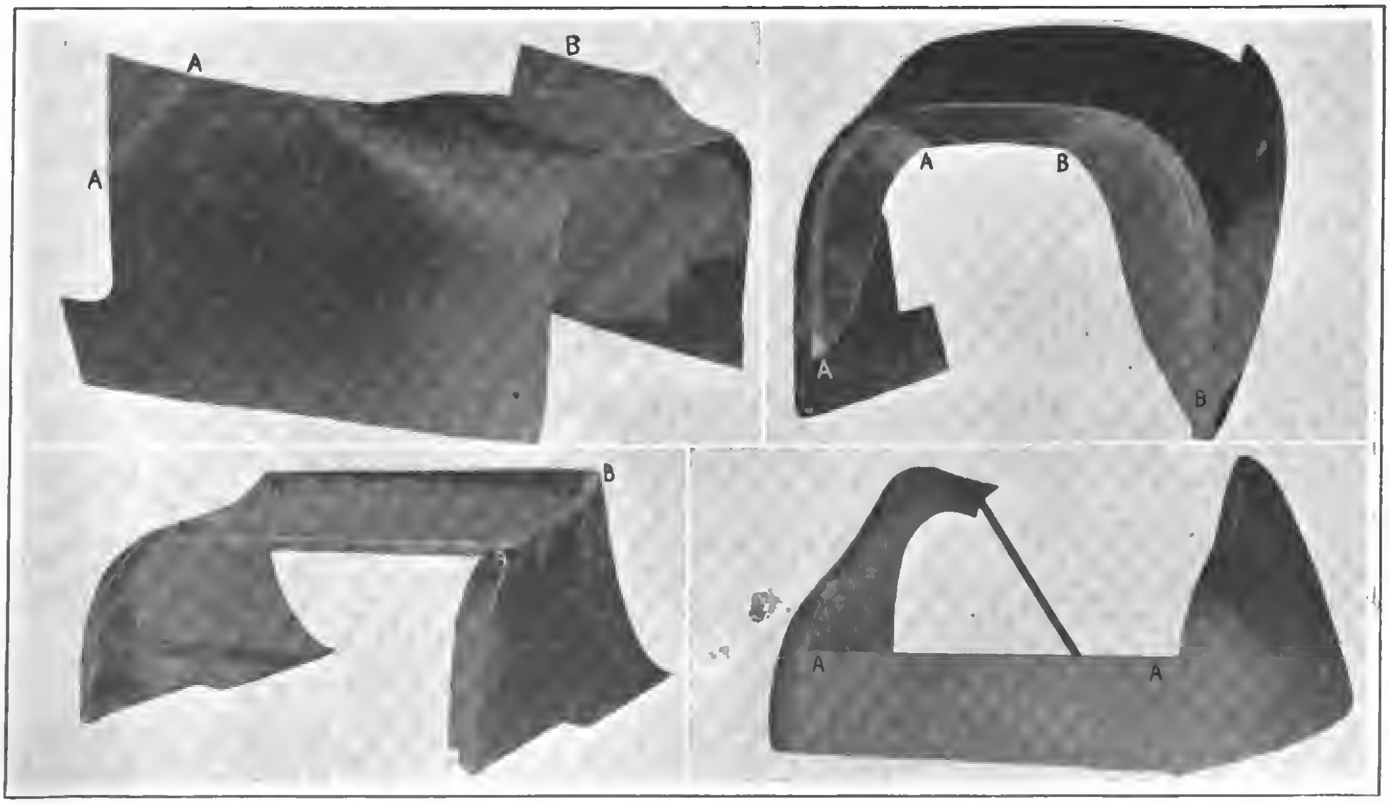
Welding Franklin Cowl

The Walker-Wells Co., Amesbury, Mass., is doing some interesting welding work on the Franklin bodies, with economy of production, excellence of jointing and avoidance of the need for much hammering as the aims, and some of the work is shown in the accompanying illustrations. A striking example is the Franklin cowl. This formerly presented many difficulties, owing to the very large amount of metal needed on the front to form the face of the dashboard where the hood junction occurs. Now, the cowl is hammered to shape to get the top and sides, but very little metal is turned over in front. Two pieces of metal are then cut to shape and welded in by a Prest-O-Lite outfit, using the "baby" or type G blowpipe. That the work is very rapid is shown by the time taken for this job, seven minutes, the length of the weld being 60 in.

Roadster Rear Boot a Problem

Another awkward piece of body metal is the portion covering the rear boot on a roadster. This has a curved top and two curved sides which are now made in three pieces and mounted upon a jig. When thus rigged up from five to eight minutes suffice for completing the weld. This particular design of boot could scarcely be covered with a single sheet of metal prepared any other way as it would be an almost impossible hammering job to make a piece of the required shape.

The system of welding small pieces together is adopted by the Walker-Wells Co. for other jobs besides the Franklin bodies; one of the Winton inclosed bodies is made on this plan with great economy of time and material, and many other examples could be mentioned.



Some excellent examples of acetylene welding work in the building of sheet aluminum bodies. Upper left—Small pieces of aluminum sheets welded to corners of sedan cowl, saving a considerable amount of material in the layout of this pattern. The welds are indicated by the letters A and B. The time required for the operation was five minutes.

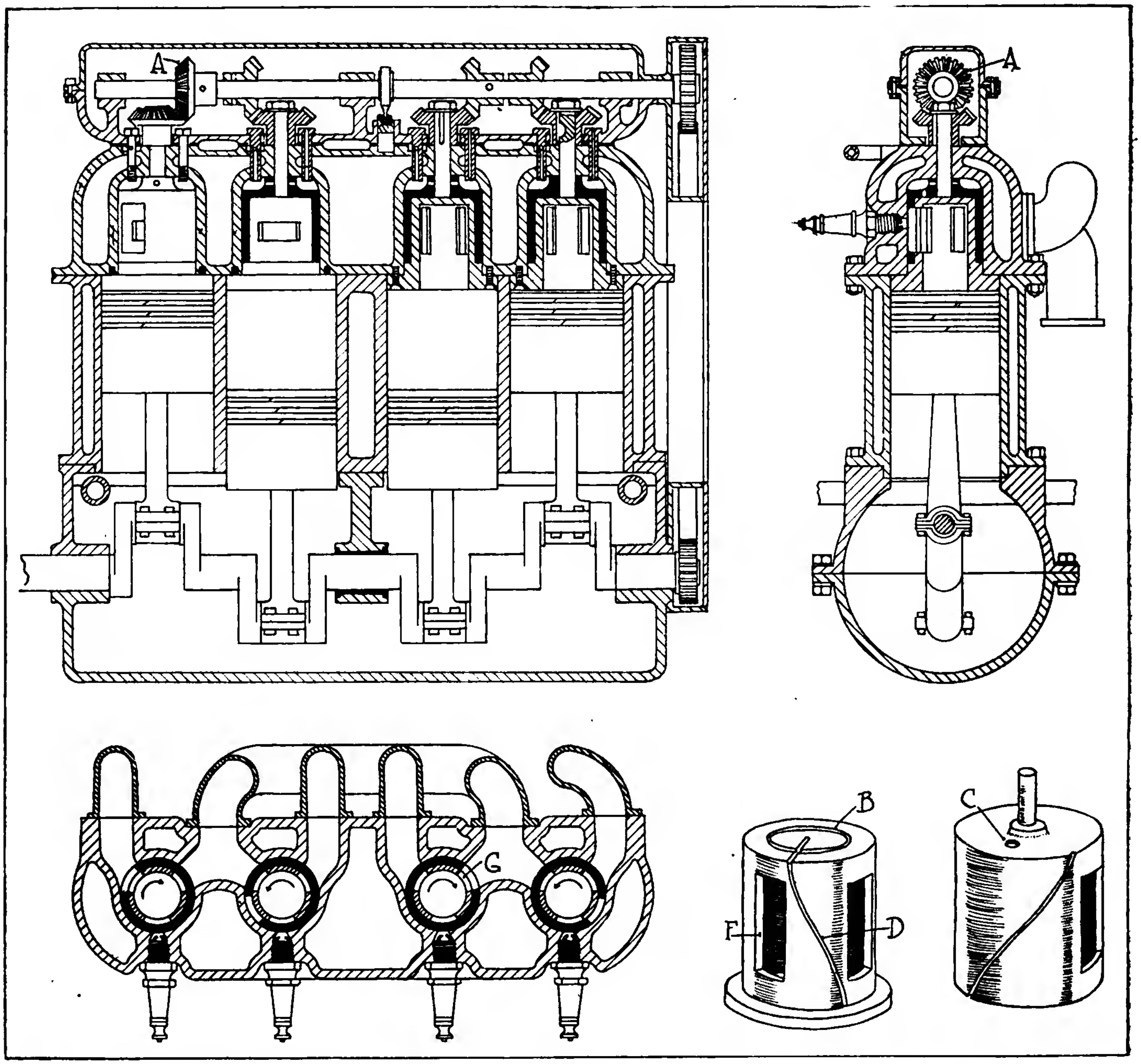
Upper right—Front panels welded into the Franklin cowl to meet the lines of the sloping hood. Two welds are indicated by the letters A and B. This operation was completed in seven minutes.

Lower left—Another view of roadster rear boot. This operation was also carried out in seven minutes, the two welds being indicated by the letters A and B.

Lower right—Rear quarter panels of Franklin roadster which were welded at A, the work being done in four minutes.

Schofield Motor Employs Inverted Cylindrical Cup Valve

All Valve Parts Rotating—Combustion Chamber of Smaller Diameter Than Cylinder Proper—Balance Valve Construction



Sectional views of the Schofield rotating inverted cylindrical valve motor, showing details of valve operation and construction

A ROTATING sleeve motor which incorporates a number of novel features is being developed by George L. Schofield, Kansas City, Mo. The motor does not differ from ordinary practice anywhere in the assembly between the bottom of the crankcase and the top of that part of the cylinder swept by the piston. Above this point, however, incorporated in the superstructure necessary with this motor, is the valve action. The valve proper is an inverted cylindrical cup pierced by rectangular openings which form the ports. Each of these valves is carried on a vertical stem or shaft which is rotated by a single longitudinal shaft.

Referring to the sectional and diagrammatic illustrations herewith, it will be noted that these inverted cylindrical valves rotate within an annular space provided for them above the main cylinder. The space within the valve chambers forms the combustion space of the motor so that the combustion space is of smaller diameter than the expansion chamber in the cylinder.

Referring to the plan views, it will be seen that the interior wall of the combustion chamber is pierced by three ports, one for intake, one for exhaust and the third at the spark plug opening. The rotating valve itself contains only one port, and when this single port is in line with any of the three in the interior wall of the combustion chamber, as at *G*, either exhaustion, intake or firing takes place.

As the valve is rotated from the longitudinal shaft by means of the bevel gears *A*, the port comes in line with the intake opening, allowing a charge of gas to pass in through the openings in the rotating valve which is shown in solid black in the sectional illustrations. This charge then passes through the opening in the inner wall of the combustion chamber and at the proper time the intake is closed when the valve port no longer registers with the intake passage.

The piston then moves up on its compression stroke while the valve is rotating until when the firing point is reached the valve opening registers with the spark plug opening and firing occurs. Immediately after this takes place the spark plug is cut off from contact with the hot gasses and the valve moves around until it finally registers with the exhaust port, allowing the gas to escape into the manifold and the pressure in the cylinder to fall to atmospheric.

Pressure Feed Lubricates Valve

The valve must be lubricated on two surfaces, since it rotates within an annular passage and this is accomplished by a pressure feed which forces the oil down on to the top of the valve where it enters a groove cut down along the side of its cylindrical surface, thus taking care of the exterior wall. There is also a hole *C* cut in the top of the valve, allowing oil to enter into the groove *B*. From here it is led through the groove *D* to the inner surface of the valve wall providing a lubricating film at this point.

The construction used with this motor allows the entire head to be taken off, exposing the cylinder walls. The internal valve member *F* is bolted to the superstructure and is removed with it. The advantage of accessibility is claimed for this construction.

As regards balance of the valve this is obtained by the arrangement of the ports which permits equal pressure on all sides. The engine is also said to run cool due to the great amount of water space surrounding the combustion chamber and the fact that the gas is allowed to expand into a separate chamber below. Thus there is a much greater amount of water around the combustion space where it is needed than there is around the expansion chamber where there is a desire to conserve the heat to as great an extent as possible.

Valve Mechanism Is Chain Driven

The arrangement for the valve drive is simple and in the drawings consists of a silent chain drive to the longitudinal shaft above. In order that the engine may be balanced mechanically the adjacent valves rotate in opposite directions. There is no reciprocating action in any of the valve parts, the entire cycle being accomplished by rotation.

A study of the details of construction in the illustrations herewith shows the valve driving mechanism to be mounted at one end of the motor taking the silent chain drive from the end of the crankshaft. The longitudinal valve shaft is carried on three bearings. The lubricating pump is operated from the valve shaft supplying oil under pressure to the oil distributing grooves in the valves. The entire valve drive mechanism operates in a bath of oil, allowing the top of the motor containing the bevel gears to act as a reservoir.

Benninghofen Engine for Small Plants

A SINGLE-CYLINDER, four-cycle vertical gasoline engine intended for power purposes in small plants or as an auxiliary in large plants, has been brought out by C. Benninghofen & Sons, Hamilton, Ohio. This is a throttle-governed engine developed to supply the demand for a small, efficient unit capable of operating at a uniform speed at low fuel consumption.

To secure close regulation and speed, it has been found necessary to use liberal weights in the flywheels and also to control carefully the amount of fuel admitted to the cylinder. This dual condition has been met by the use of the Benninghofen throttle governor which is designed to be sensitive and to hold the fuel consumption down to the minimum. An example of this is given by the company, which states that these engines have been known to operate continually for 7 hr. and 40 min. on 1 gal. of gasoline.

The uniform speed of the engine and its low operating cost make it adaptable for driving generators in connection with small lighting plants, and the function of regulation is performed entirely by the sensitive governor, so that the lights can be burned from the generator without showing variations in brilliancy.

Benninghofen stationary gasoline engine

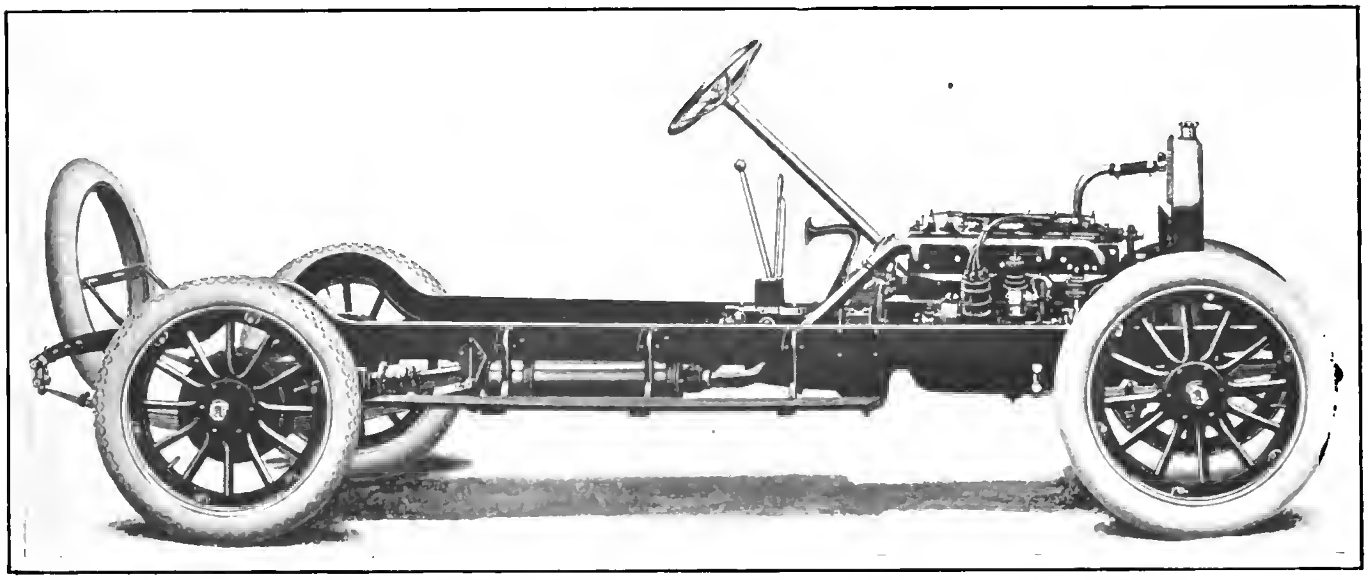
Besides the throttling governor the engine has other novel features, among which may be mentioned the force-proof cooling hopper; the solid cast-iron fuel tank forming a part of the engine; the quickly-removable cylinder head with valves and spark plug as well as other features. Each engine is supplied with a priming cup to facilitate starting. Its weight with complete equipment, including battery, coil box, coil, plug, carbureter, skids, etc., ready to run, is 475 lb. The price is $35 f.o.b. Hamilton, Ohio. A table of specifications is given herewith.

Brake hp.	2
r.p.m. at which power is developed	450
Maximum r.p.m.	600
Stroke	5 in.
Bore	4 in.
Overall length skids	40 in.
Overall width	31 in.
Overall height	42 in.
Solid driving pulley, 4-in. face by 8-in. diam.	
Flywheels (2) face	1¾ in.
Shipping weight	500 lb.

For engines like the Benninghofen there is a much larger field than is realized by the majority of people. An engine built with solid proportions intended for stationary use is nearly always a much more efficient and economical power plant for a small shop or for farm work than the old automobile engines so frequently used. For a stationary engine reliability and economical running are the first essentials.

Anderson Six a Southern Product

Good Units Assembled in Neat Chassis with Extra Lavish Equipment



Anderson six chassis made by Anderson Motor Co., Rock Hill, S. C., showing frame kick-up over rear axle

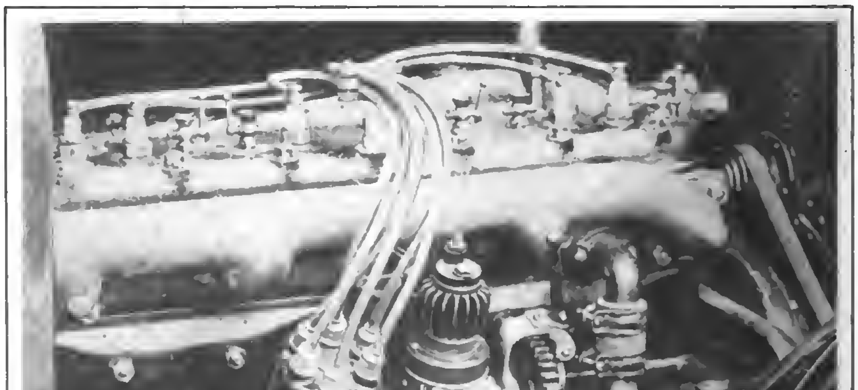
A NEW car manufactured in a new territory as far as the automobile industry is concerned is announced under the name of the Anderson 6-40. The manufacturer is the Anderson Motor Co., Rock Hill, S. C., and the officers of the company are members of the Rock Hill Buggy Co., which company has been in business for a number of years manufacturing buggies and wagons.

The new car is an assembled design worked out by Joseph A. Anglada, who is chief engineer of the concern. The work on the car has been going forward for about eighteen months and production has now been started. The car sells for $1,250.

Probably the most noteworthy feature of the car is in the fact that it is unusually complete in its equipmnet. The standard car is fitted with a power tire pump, searchlight, trouble light, cigar lighter, Motometer and tonneau heater, all as regular equipment at the list price. Another feature is the arrangement of the crowned fenders and mudguards which are manufactured together with the complete bodies in the factory of the Rock Hill Buggy Co. A thoroughly up-to-date job has been done in the upholstering and in the seating arrangement which incorporates divided front seats with an intermediate extra seat just behind and a roomy three-passenger seat in the rear. This gives a seating capacity of six in the touring car.

The roadster has a capacity of four passengers, and even five could be seated without excessive crowding. This is accomplished by using a folding seat in the rear which can carry either two or three persons as desired. The roadster, and the touring car as well, have an individuality of coloring which is unusual, the touring car is dark brewster green body with the fenders, etc., black. There is a red pen stripe around the body. On the roadster the color of the body is a khaki gray with dark brown fenders giving a contrasting appearance. The price of the roadster is the same as that of the touring car.

Standard units are used throughout the mechanical construction of the car. The motor is the Continental six-cylinder 3¼ by 4½-in. L-head type. The S. A. E. horsepower rating is 25.35 and the piston displacement 224 cu. in. The valves are on the right side and are operated through a helical gear drive. Cooling is by pump and oiling by splash pressure with the oil carried in the usual way in the lower part of the crankcase with pressure feed to the main bear-



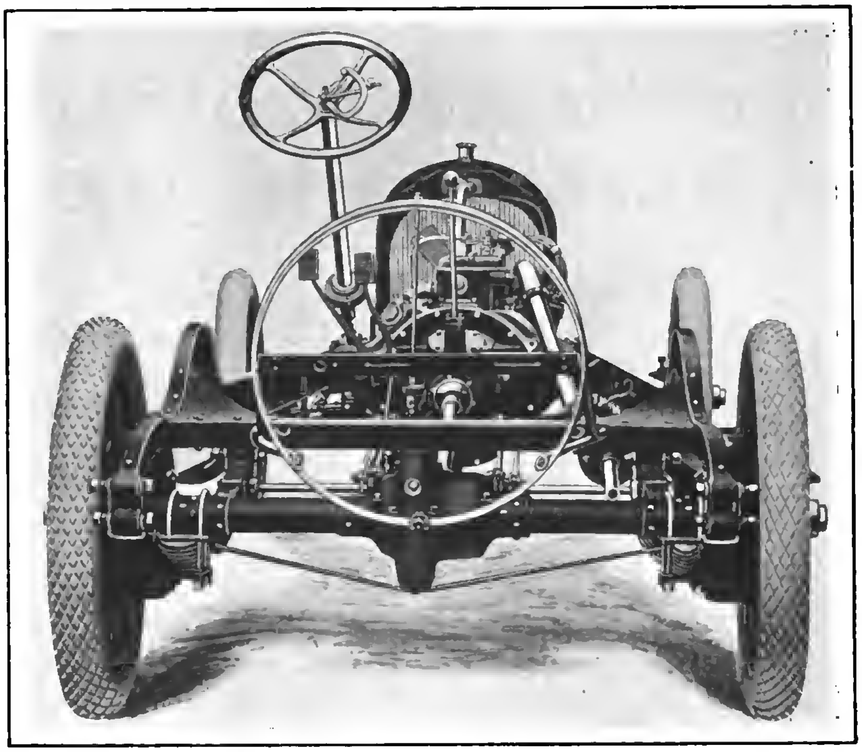
Layout of Westinghouse generator-ignition unit and tire pump on Continental motor ings. The cylinders are taken care of by splash. The oil is circulated by a piston type pump.

For carburetion and ignition standard units are used, the Zenith instrument being used on both touring and roadster for carburetion and the entire car being Westinghouse as far as electrical equipment is concerned. The Westinghouse two-unit system is used, operating at 6 volts for starting, lighting and ignition. Ignition advance is automatic, and the system is thoroughly outfitted with ammeter, dimmer switch, etc. The storage battery has a capacity of 80 amp.-hr., the electric horn is motor-driven, and armored cable is used in all the wiring. Other electrical instruments used on the car are the cigar lighter, searchlight and trouble light.

Tire Pump Under Hood

The power tire pump is mounted on the right side of the motor with a sliding gear engagement operated by a hand lever easily accessible on raising the hood. The drive for the tire pump is taken off the water pump shaft which also provides drive for the generator.

The clutch is a Borg & Beck dry disk type, 10 in. in diameter. It transmits the power through a three-speed selective gearbox to an Anderson-Mott floating axle. The front axle is also an Anderson-Mott of reversed Elliot type. The springs are semi-elliptic designed to be flat under normal load. They have phosphor bronze bushings for ⅝ in. bolts in the spring eyes. The front spring has 5-in. play, being 36 in. in length and 2 in. in width. The underslung rear spring has a maximum play of 8 in. and is 56 in. long and 2 in. wide.


Showing ample proportions of underslung rear springs on Anderson six

The frame construction is simple, being composed of two main members which taper in straight lines from the rear of the car forward. There is a cross member just behind the radiator and another at the rear. Both of these are rigidly connected to the side members by gusset plates. The rear support of the unit power plant and the radiator supporting members also act as virtual cross members, giving the frame construction rigidity although having but few actual parts and consequently being clean and light. The front support of the motor is hung in the front cross member of the frame, giving a three-point suspension of the unit power plant.


Both touring car and roadster sell for $1,250

Wheels are twelve-spoke types of selected hickory. Spokes are 1⅜ in. wide, and on the rear wheels are 14-in. brake drums. The brakes themselves are completely inclosed within the drums, being of the internal expanding type. The brake linkage is equalized through an equalizing bar which is placed some distance forward of the rear axle.

Hotchkiss Drive

Hotchkiss drive, in which both drive and torque are taken through the rear springs, is employed. This simple type of drive taken in connection with the chassis layout, gives a clean design which should tend to keep the car free of rattle. The speedometer drive is also rattle-proof, being strongly mounted just behind the gearset.

Besides the special equipment mentioned, the car has quick-demountable rims, one-man top, crown fenders with complete splash guards, ventilating windshield, speedometer, hand pump, repair kit and a complete set of the usual tools.

Seats Are Comfortable

The illustrations of the complete touring car and the roadster show that handsome appearance has not been sought in vain. There is ample depth in the rear seat, despite the very low appearance of the side. It will be noticed that an exceptional amount of clearance is allowed between the rear axle and the frame, this giving the rear springs an abnormal amplitude of movement and so making for easy riding over very bad roads.

The History of the American Automobile Industry—26

Petroleum Mentioned by Early Biblical Writers—Used in Mexico in 16th Century—Washington Appreciated Its Value—Gasoline Considered a Nuisance by Salt Men

By David Beecroft

THE earliest Bible writers make references which cannot be other than petroleum. In Genesis 14, "The Vale of Siddim was full of slime pits," refers to a method of collecting the oily liquid that has been practised in all parts of the world.

"Oil out of the flinty rock" (Deuteronomy 32), and "the rock poured me out rivers of oil" (Job 39) were not many years ago so certainly impossible as to be held up by skeptics as proof of the falsity of the Good Book, but, with the knowledge of today, they are seen to be plain statements of probably well-known things.

Other Early References

Many ancient writers mention or describe petroleum in no unmistakable language. Pliny and Dioscorides both mention the use of oil in Italy which was burned in lamps, the latter saying, "the people of Argrigentum save oil in pits and burn it in lamps." He also mentioned it as being called Sicilian oil. There seems to be no doubt that its use in embalming in Egypt extends back fully 2000 years B. C., and it is stated that mummies and their wrappings have sometimes been used by the Arabs for fuel. The use of petroleum for heating purposes is unquestionably quite old even though of limited application, but its use for power and as a lubricant now so common and extensive is of course a recent matter.

Its Use in Mexico

In 1520, Friar Sagahim, in writing of what he saw in Mexico, says Chapopote is sold in the Mexican markets; is collected from the sea, and in Yucatan is used to build with, and his description makes it plain that this was a petroleum product, which we can quite well believe, knowing the enormous Mexican fields now developed.

More than a century later A. A. Barbou, writing at Potosi in 1640, describes La Naphthe or Oyl of Peter, Rock oil, which was sometimes white and sometimes black and which had the peculiar property of drawing fire as a lodestone draws iron or steel. He cites an interesting example of this latter property in which a certain well polluted by the leaking of the oil through its walls into the water, was ordered repaired and a laborer sent down to stop the leak by which the oil entered. He asked for a light and a "lanthorn" being sent down to him, the oil drew the fire through the holes of the lantern and caused the well to discharge itself like a huge cannon with much noise, killing the laborer. The vividness of this account leaves no doubt in modern minds as to its correctness, but it must have excited some wonder in those days.

In what is now the United States there were many early mentions of oil springs. In 1629 Father d'Allion, a French missionary, mentioned a spring near what is now Cuba, N. Y., and a map prepared by French missionaries in 1670 shows a "font bitume" in the same locality. In 1757, the commandant located at Ft. Duquesne, now Pittsburgh, wrote his superior, concerning a fete of the Seneca Indians which he had attended some distance up the river and at which they set the river afire by igniting oil floating on its surface. Ten years later Sir Williams Johns described the Cuba spring in Alleghany county, N. Y., and David Leisberger, a Moravian missionary, also in 1767, gave an account of the petroleum springs and explained that there were three kinds, one of which gathered oil by seepage on the surrounding higher ground, another which flowed out of the earth and dissipated itself by running away and being absorbed, while a third showed the oil coming out and flowing away with water as if it came from beneath.

Washington Appreciated Oil Land

In 1775 George Washington took title to three tracts of land in the Ohio valley and in his will instructed his heirs not to sell the one on the Kanawha River which contained the bituminous spring because he considered it of great value. In 1783 General B. Lincoln's soldiers used the oil they found along Oil Creek, Pa., to bathe their joints, and otherwise, as a medicine. The Philadelphia *Gazetteer*, the first of its kind in the United States, published in 1795, tells of Oil Creek and bitumen springs having a capacity of several gallons of oil per day which was deemed good for a variety of complaints.

That any one desiring oil and finding it seeping out of the ground should hollow a pit into which it might collect is but natural, so no wonder need be felt that we find oil pits wherever we find oil, but the early discoverers reported that along Oil Creek they found numbers of pits some 6 or 8 ft. and probably 12 ft. deep lined with rough hewn logs and filled with debris in which trees had grown up whose rings showed an age of several centuries. These remains seemed to indicate that an older and higher civilization than the Indians knew of these petroleum sources and used them. The Indians and early settlers would gather the oil floating on the top of the water in these pits by scraping it up on a piece of wood and transferring it to a pot or by dipping a blanket into it and wringing it out. They removed the coarser dirt by straining or by heating the oil and permitting it to settle.

Draining Away Gasoline

The white settlers seemed to find no greater use for petroleum than their Indian predecessors, until it forced itself upon their attention in connection with their salt wells and even they failed to take the hint. Beginning with about 1808, the production of salt by boring until brine was found and then evaporating the brine became a considerable industry. Buildings, bridges, fences and even roads were built of wood. Timber was plentiful and sawmills became quite common. Sawing wood requires considerable power, however, and the engines were usually of the cheapest construction and non-condensive, so they were throwing much valuable heat in the exhaust steam and to use this in the evaporation of brine involved very little expense. Although their well casings were of wood, wrapped with leather at the joints, and packed inside the wrapping with flaxseed which, when wet, expanded and made a perfectly tight joint, and their other drilling and well apparatus were equally crude, these pioneers were quite successful in their boring operations. A well, 475 ft. deep, was drilled in 1814; in 1818, before reaching the brine layer, oil was struck at 171 ft. and gushed forth in such quantity as to make considerable trouble. The much disgusted owner dubbed it Devil's tar, and drained it into the nearest stream, down which it floated to the Cumberland River, 35 miles away. On one occasion a spark from a passing boat was supposed to have set it afire and the whole 35 miles blazed up. So common did the presence of oil on the surface of the water become that one stream was called Old Greasy.

Truck Club Holds Military Run

WITH the idea of eventually organizing motor truck owners to render transport service if national necessity should arise, the Motor Truck Club of America on April 8 and 9 conducted the first of what may develop into a series of military test runs over the roads of southern New York and northern New Jersey. This run was the club's first act as an arm of the Automobile Reserve Corps.

Carrying a net load of 20 tons, six heavy trucks and seven touring cars covered 65½ miles in 10 hr. and 36 min., running time, in spite of a severe blizzard and other difficulties.

1 and 2—Commissary truck tries to pass an emergency truck and runs into the ditch. Trucks 1 and 5 haul it out with tow lines. 3—Four bad hills ranging from 8 to 14 per cent grade are encountered in succession on Palisade Avenue, Englewood, N. J., on the way to the ferry. 4—The trucks making their way down the long hill to theferry which brought them back to New York

Alloys To Resist Corrosion

British Institute of Metals Issues Report on Bronzes and Similar Alloys—Valuable Data for Manufacturers of Marine Engines and Parts of Hydro-Aeroplanes

LONDON, ENG., April 10.—The third report to the Corrosion Committee of the Institute of Metals is a volume of some 127 pages. It records work on the corrosion of condenser tubes that has been done with the institute's experimental plant at Liverpool. To condense the mass of practical information contained in the report is not an easy matter, for even the author's summary runs to seven pages, a paper in itself.

However, in default of reproducing this summary of results it may briefly be recorded that the sea-water corrosion of ordinary brass, 70 per cent copper, 30 per cent zinc, at 30 deg. C., 50 deg. C., and 60 deg. C., has been compared with that of Admiralty metal (70:29:1), a special lead-brass (70:28:2), phosphor bronze (96:4) and aluminum-copper (92:8). It is found that aluminum-copper dissolves more slowly than the brasses. The phosphor bronze dissolves more rapidly than the brasses. In each case both hard drawn and annealed test-pieces of the alloys were used. Generally speaking, the hard drawn metal dissolved less rapidly than the annealed but is more readily attacked locally and selectively.

Aeration of the sea-water accelerates the rate of corrosion, more especially at the lower temperatures.

Corrosion in gently aerated diluted sea-water (e. g. estuary water) has been examined in some detail. The rate of solution of each alloy is diminished by diluting the sea-water, but the degree of selective corrosion is greatly increased. It is found that the rate of solution of pure copper is diminished by diluting the sea-water and is least in distilled water. That of pure zinc is greatly increased by diluting the sea-water and is greatest in distilled water.

Diluted sea-water also facilitates the formation of deposits of oxy-salts of zinc upon the surface of the metal. These oxy-salts are found to promote local selective corrosion. In diluted sea-water the phosphor bronze is the most satisfactory of the alloys considered.

The corrosion of the above-mentioned five alloys has also been examined in distilled water saturated with carbon dioxide at 30 deg. C. and 50 deg. C., and in a 0.15 per cent solution of common salt, at 30 deg. C. and 50 deg. C. Dezincification is promoted by a low concentration of salt and by a relatively high concentration of carbon dioxide.

Contact with coke is found to promote dezincification of the Admiralty metal, provided that good electrical contact exists between the metal and the coke. Under service conditions good contact is probably the exception rather than the rule.

The influence of the surface condition of the metal has been investigated and is shown to be important during the early stages of the corrosive attack. The corrosion of 70:30 brass has been compared with that of pure zinc and copper.

The report contains a section which is devoted to a consideration of the bearing of the results of the experimental work upon the practical problem.

Tin-Aluminum-Copper Alloys

Two papers were recently given before the institute, dealing with alloys of aluminum. The first, by A. A. Read and R. H. Greaves, describes a number of tests made on tin-aluminum-copper alloys containing varying quantities of tin and aluminum (up to 10 per cent of each) and led to the following conclusions:

The replacement of tin in gun metal by aluminum is of no advantage but leads to loss of strength and greatly increased brittleness, unless about three-quarters at least of the tin is replaced when the properties approximate but are inferior to those obtainable from aluminum and copper alone.

The addition of tin to the 10 per cent aluminum-copper-alloy is accompanied by a rapid increase in hardness and brittleness, while the addition of aluminum to the 10 per cent tin-copper alloy has a similar, but for small percentages, a less marked effect.

The difficulties in hot working the ternary alloys are greater than those experienced with bronzes, and very much greater than with the aluminum-copper alloys.

Corrosion both in fresh and sea-water is small, but the alloys rich in tin tend to become pitted.

The second paper, by W. H. Withey, deals with methods for the analysis of aluminum. It describes methods for the analysis of alloys of aluminum and copper, also aluminum and zinc, and gives details of a method that was used for the complete analysis of metallic aluminum. This latter method is made use of in the analysis of alloys of aluminum containing magnesium for which purpose it possesses distinct advantages, owing to the fact that large quantities of the alloy may be used in the analysis.

In this method use is made of the fact that tartaric acid is capable of preventing the precipitation of aluminum by ammonium sulphide, while at the same time zinc and nickel are quantitatively precipitated. Manganese is only partially precipitated. The filtrate left after the removal of the sulphides produced by sulphuretted hydrogen in acid solution, and by ammonium sulphide in alkaline tartrate solution is acidified and concentrated. The solution filtered from sulphur is made ammoniacal and the magnesium precipitated with sodium phosphate. The precipitate is redissolved. The precipitate is next dissolved in dilute nitric acid and any manganese, which is usually present, determined by a colorimetric method and calculated into the equivalent weight of manganese pyrophosphate which is then deducted from the magnesium pyrophosphate obtained. The manganese is separately determined in another sample.

The paper contains analyses of solutions containing aluminum and known amounts of iron, zinc, magnesium, and nickel, from 0.25 to 1.0 per cent. The results obtained indicate that the method is very reliable.

The figures obtained in the analysis of an alloy of a well known type are also in excellent agreement with those made by a standard method.

The method recommended for the analysis of the alloys of aluminum and zinc consists in adding to the solution an excess of caustic soda. The hydroxides first precipitated are thus dissolved and on passing sulphuretted hydrogen the zinc is precipitated. The precipitate is dissolved and the zinc, after the removal of traces of aluminum, is determined as phosphate.

To obtain a perfect separation certain precautions are necessary, which are fully discussed in the text.

The FORVM

USE OF TWO GEAR RATIOS IMPORTANT ELEMENT IN TESTS—BATTERIES FREQUENTLY OF TOO SMALL CAPACITY—DISPLACEMENT, GEAR RATIO AND FUEL CONSUMPTION

Using Two Gear Ratios for Official Tests

By E. H. Delling

Chief Engineer The Mercer Automobile Co.

I WAS very much interested in the speed and acceleration tests which were made on Sheepshead Bay Speedway with a Hudson stock car and, therefore, procured a copy of the report of the A. A. A., under whose supervision these trials were made. To my greatest surprise I glean from this report that two different gear ratios were used in the respective trials, namely a 4.454 to 1 gear ratio for the acceleration test, and a 3.5 to 1 ratio for the speed test. This most important fact, however, is not revealed in any of the advertisements published by the Hudson Motor Car Co., and the public is, thus, misled into the belief that any individual Hudson stock car can duplicate the performances in question. If the Hudson company desires to use for advertising purposes the acceleration that was obtained with a 4.454 gear ratio, it should also have ascertained—and stated in its advertisements—the maximum speed which its cars are capable of doing with said gear, and further give the acceleration of its cars with a 3½ to 1 ratio. In view of the fact that the Hudson company states in all its advertisements that the tests in question were made under A. A. A. supervision, I am of the opinion that the A. A. A. should compel said company to mention all facts pertaining to these trials, and not lend its name to mislead the public into a belief which gives the Hudson Motor Car Co. an undue advantage.

Facts About No-Differential Trucks

By Arthur M. Laycock

Chief Engineer Sheldon Axle & Spring Co.

THE idea of operating without a differential is not new. It has been successfully used on racing cars for a good many years, but in the commercial field, it has not been used to any great extent, particularly in the heavier sizes.

The following advantages of this type of drive must be particularly interesting to truck users at this time:

First—Positive pull on two wheels.
Second—Greater tire mileage.
Third—Less wear and tear.
Fourth—Gasoline economy.
Fifth—Dependability.
Sixth—Simplicity.
Seventh—Weight.
Eighth—Price.

Positive Pull on Two Wheels

The positive pull on two wheels can only be appreciated by the truck user himself. Nothing is more exasperating than getting in a mudhole with one wheel only and that wheel begins to spin while the other is on perfectly good ground. In order to get traction, chains are run around the tires, which in a good many instances only digs the hole deeper until finally jacks and planking have to be used in order to get the truck out. If the positive drive is on both wheels, the one wheel on good ground will invariably pull the truck through a very bad place, and this construction absolutely prevents any spinning of the wheels when starting under load.

It is a well known fact in Europe at the present time that the conventional differential on the Army Service Corps trucks will be a thing of the past. Some form of positive drive or locked differential will be called for on the various subsidy specifications. We prophesy that a little cross country work in Mexico with the United States Army Service Corps will bring about the same thing.

Greater Tire Mileage

One has only to imagine a truck operating under shell fire and extremely muddy roads and the truck becoming mired when questions of greater mileage, less wear and tear, gasoline economy, etc., are of infinitesimal value as compared to the truck getting from one place to another positively, but when the greater tire mileage, wear and tear and gasoline economy are even questionable, one really cannot see any serious objection to cutting out the differential. The conditions with the average business man are just as vital and important and almost analogous to trucks operating under war conditions.

Quite a few of our best racing cars have been equipped with solid rear axle, the claim being made that the action of the spinning of the wheel when in the air is very much more detrimental to the tires than the little slippage on rounding a corner on the racetrack. Similar conditions exist when running a solid tire in heavy truck service over rough cobblestones. Any close observer driving behind a truck under these conditions will invariably be able to see under the tires without any difficulty whatever. At the moment these wheels are in the air they must of necessity accelerate and come down on the road at a different speed from which they left, grinding off the rubber to a much greater extent than when rounding corners with a blank differential where the slippage is uniformly distributed throughout the entire periphery of the tire.

In truck service, with the limited experience we have had with the blank differential as compared to any other, it is noticeable that the temperature rise in the tires is very much less when rounding corners under severe loadings with the solid axle than the spinning action of the wheel in a mudhole with the regular differential.

The tire wear, of course, is largely a question of heat units. It is quite a common sight to see a heavy truck in difficulties with the tires smoking from the spinning action of the wheel on soft ground.

There is certainly less wear and tear with the blank differential on engine and all running gear when one wheel partially leaves the ground, due to the irregularities of the road aforementioned.

This variance is felt throughout the whole chassis, from the engine clear back to the rear axle, and in a good many instances sets up a frightful vibration, and makes it most disagreeable to negotiate cobblestone roads particularly when light in the rear. The results obtained from the blank differential as compared to the regular one in this respect are most pronounced. Riding on a truck with a solid differential the load is rarely taken off both wheels at once. When one wheel leaves the ground, the full torque is absorbed in the other wheel remaining on the ground, holding the engine down and preventing racing to a very, very marked extent.

Differential Like Steamboat

The regular differential reminds one of a steamer. Every time the propeller lifts out of the water the engine races and sets up such a vibration that in a good many instances you wonder whether the ship is going to hold together or not. Imagine what a call there would be by marine constructors for something which would absolutely prevent the propeller shaft racing. This is certainly analogous to the truck situation at the present time with the exception that the motor truck can now prevent racing, with its attendant wear and tear on all the parts affected by eliminating the differential.

Every time the propeller leaves the water on a steamer and beats the air, it is just like throwing so much coal overboard. The wheel need not leave the ground actually, but the pressure can be relieved to such an extent due to oscillation of the spring over irregular road surfaces that the wheel begins to spin and the tractive effort instead of being used for the propulsion of the truck is simply using the gasoline for no purpose. This is quite pronounced on heavy vehicles where the wide track is used. One wheel is tracking on good ground all the time while the other is slipping in soft mud. There is not a single truck designer of repute who has not been in serious difficulties at some time or other under these conditions. The writer is well aware that the tractive resistance might be double, due to the condition of the road surfaces, but on top of this, the loss due to the spinning differential is certainly quite pronounced.

Under the above conditions, it is common for engineers to consider the radiator too small — the engine not large enough—or the gear reduction wrong, when in a good many instances the differential is directly responsible, operating on extremely muddy roads with a very heavy gasoline consumption at the best, and sooner or later a solid axle will be called for more extensively on account of gasoline economy, if nothing else.

Dependability Increased

With the elimination of the differential, broken gears, differential spiders freezing fast, broken cases, etc., are a thing of the past, but one has to be extremely careful with the size of drive shafts, as the stress in these members is doubled and must be amply taken care of. The particular advantage of using semi-floating axles under these extreme conditions lies in the fact that the outer ends must of necessity be made very liberal in size due to the combined bending and torsion, and it is a comparatively easy matter to increase the inner ends of the drive shafts. If this be done there is absolutely no question of broken drive shafts and the whole axle becomes thoroughly dependable.

For example, in one of our axles where we would ordinarily use a shaft 1¾ in. across the flat of the hexagon end of the shaft where it fits our differential, we step this up to 1⅞ in., all of which change it was possible for us to make with no other complication whatever than to increase the size of the drive shaft. It was not necessary to make any change in the center of the axle construction other than to provide the "locked" differential with a broached hole 1⅞ in. instead of 1¾ in., and it was possible to do this without any change of parts whatever.

This means that a man who might have an axle in service with a conventional differential and wants to eliminate the troubles as a result of the use of a conventional differential, will simply change his drive shafts, take out his conventional differential, put in our "locked" differential and the job is finished.

Cutting out the differential ring gear and pinions with the spiders has reduced this design to its simplest possible form. Every one of these parts are going to wear with their attendant backlash. The elimination of backlash alone is almost sufficient justification for the design, but the simplicity of the construction will appeal to every one.

One of the objections at the present time to the live axle type of drive is the unsprung weight at the center of the housing. This, of course, is in the worst possible place and the more the center can be lightened the sections throughout the axle can be considerably reduced.

There is also a distinct gain in the oil capacity as compared to the full type of differential. The outside dimension of the axle housing remains the same. The space taken in the ordinary construction with gears will allow of that much more oil being carried, which is a consideration when operating under severe conditions.

Price Reduced

It is evident at a glance to the layman that there is considerable reduction in price to be made in this construction over any form of drive known at the present time, and we prophesy that this alone will give it the increased popularity it richly deserves.

Summarizing, after considering all the various points, it is well not to become too enthusiastic, as the introduction of a blank differential on the face of it is so drastic that one must of necessity move with extreme caution. The time taken in rounding a corner is only a fraction of 1 per cent of the straightaway running, and if a truck is continuously operating around a city block (eight blocks to the mile), it figures around 4 to 5 per cent of the straightaway time, but with average wheelbase and tread, and strong driveshafts, the positive pull on two wheels, greater tire mileage, less wear and tear, gasoline economy, and the extreme dependability with simplicity, weight and price in its favor, we prophesy quite a following of the blank differential.

Car Storage Batteries Are Often Too Small

By Walter LeGare

IT IS with a great deal of interest that I have been reading articles in the leading automobile publications on Magneto vs. Battery ignition, both pro and con, and while I do not lay claim to being an authority on the points involved, the article by N. J. Hart in The Automobile for March 9 compels attention, and in my modest way I beg to submit a few points along this same line.

We have to admit the present-day magneto will give a spark that is better for starting under adverse conditions than a battery system. The only talking point against the magneto is the extra initial cost, and this applies to cheap cars only; and the man who buys such a car does not expect equipment that one would get on a medium or high-priced car.

The magneto costs very little to maintain and keep in perfect condition. I estimate that the average magneto will not cost in excess of $2 a year for repairs, while the battery alone will cost not under $4.50 a year and in most cases $6 to $8 repair each year and be worthless after about two years' service, whereas a magneto will be in prime condition after two years' service, and a few dollars will place it in excellent condition and, in fact, make it as good as new.

In my argument I am not considering the attention the two systems should have but only the attention the average owner gives his car—we all know the average car receives very poor attention.

Regarding that part of Mr. Hart's article on voltage drop, I have found that in the case of a battery which is only three-quarters charged, the actual drop is more than he states with the batteries generally used. I know of only one manufacturer, the Cadillac Motor Car Co., who uses a battery that is large enough to crank the motor and give current for ignition in excess of what is needed. The average manufacturer places a very small capacity battery on their cars; they really are large enough for ignition only and should never be used for starting.

I have made a study and specialty of battery repairing, not because the battery is better than the magneto but because I can make more money repairing batteries than I can repairing magnetos.

Another, and a main point against the battery is its inability to give off high discharge rates after it has seen about a year's service. This I attribute to the fact that the positive plates will become corroded by sulphate just like rust will cover a piece of iron or steel. This is also true of the negative plates but not so noticeable.

Do you know of a battery ignition system that uses a multi-point spark plug? Practically all magneto manufacturers recommend multi-point plugs, the reason for this being that in the battery system they have a job getting a spark across a single gap; so why should they assume the extra trouble of trying to bridge two or three gaps? This is no job for the present-day magneto.

Displacement, Gear Ratio and Consumption

By F. I. Anderson

I HAVE just read, with pleasure and profit, the comment on page 509, THE AUTOMOBILE, by W. P. D., on my question on page 422 on the subject, "Piston Displacement per Mile Measures Consumption."

He states that my error in figuring mileage positively from piston displacement and gear ratio, lies in assuming that one gallon of gasoline, 70 deg. Baume, gives 25 cu. ft. of gas. W. P. D. asserts that one gallon of gasoline, 61 deg. Baume, at 60 deg. Fahr., gives approximately 240 cu. ft. of vapor, or nearly ten times as much as I assume.

I took my figures for this assumption from an article on Motor Fuels, in *Scientific American* Supplement of Dec. 11, 1915, by Prof. Vivian B. Lewes, F. I. C., F. C. S. Professor Lewes gives the following table on the volume of vapor from gasoline hydro-carbons:

	Specific Gravity	Boiling Point	Cubic. Ft. Vapor	
			Gallon	Pound
Pentane	0.626	37.6 deg. C.	31.2	4.9
Hexane	0.664	69 deg. C.	27.7	4.1
Heptane	0.700	98 deg. C.	25.7	3.7
Octane	0.719	118 deg. C.	22.6	3.1
Nonane	0.741	136 deg. C.	20.8	2.9

Doctors seem to disagree on this rather vital point. I sincerely hope that W. P. D., with his 240 cu. ft., is right, as the price of gas is still going up.

Which is right?

If, at high speeds of modern engines, 80 per cent of the gasoline drawn into the cylinders actually goes through raw and is wasted, then there is something radically wrong with the trend of engineering design in the last year or two.

Past the Maximum Efficiency Point

The modern motor attains its highest gas efficiency at between 1000 and 1200 r.p.m. At that speed, the ultimate proportion of the present-day low-grade gas is utilized.

Yet we find engineers working their motors up to 4000 r.p.m. Cars with such motors are on the market not as racing cars—where economy counts for little—but as boulevard cars. If, as seems to be the case, gas efficiency decreases almost in direct proportion to speed above a very modest point, what is the argument in favor of the modern high-speed motor?

The stock answer is that the American driver hates to shift gears. But behind this is the truth that the transmission on the average American car is the weakest point in the mechanism, so the engineers give the driver great ability on high; and the result is that the owner of a modern six or eight or twelve-cylinder motor never learns to shift properly at the rare times when it is necessary. Develop the archaic gearbox, instead of trying to blind us to its imperfections by the device of high engine speed. When someone comes along with an efficient transmission for moderate-priced cars, then the American driver will come back to gear-shifting, with his European brother; that will automatically solve the fuel problem, in a measure at least, by bringing us back to an engine that runs at economical speeds, instead of one that wastes 80 per cent of our gasoline in the exhaust.

A Gas-Electric Ideal

A gas-electric drive, that will govern within 5 per cent, like the modern isolated gasoline-electric light plant, will solve the problem. Then the gas engine can run at its most economical speed, and the dynamo transmission will automatically adjust itself to the load, and we won't have to carry a 100 per cent surplusage of inefficient power.

Vim Adds Model Designed for Postal Delivery Service

PHILADELPHIA, PA., April 15—The Vim Motor Truck Co., this city, has added a mail delivery car to its line of seven standard units. The new vehicle is called the model M and sells for $800. Some time ago the Vim company received an order from the United States Government for a mail carrier to be built according to strict specifications, and the demand which sprang up for these cars resulted in the adoption of model M as a regular model. The body has full screens all around, with doors at front and rear. There is a passenger step at the back for the use of the mail carrier and other equipment is up to Government specifications. The body, which is mounted on the standard Vim four-cylinder chassis, is designed especially to meet the requirements of post offices, mail contractors, rural free delivery routes, etc.

The new model M Vim mail delivery car listing at $800

The Rostrum

Knurling Helped Undersize Pistons

EDITOR THE AUTOMOBILE:—In making up some new aluminum alloy pistons cast in chill the machining department made the clearances a trifle too large, and as these 4-in. pistons were for special show cars and afterwards demonstrated, it was necessary that action of some kind be taken as no more castings were available immediately.

The superintendent of this plant conceived the idea of knurling these pistons and this was accordingly done with a coarse knurl running over the skirt of the piston three times and bringing the diameter of these pistons from 0.009 in. under size up to 0.003 in. under cylinder bore.

Pistons were placed in motors and run 5 hr. under full load in shop and never picked up, and when removed were in perfect condition, the depressions caused by the knurl holding oil perfectly.

You will understand that for this size piston 0.003 in. is very little clearance.

Indianapolis, Ind. W. S. R.

Calculating Motor Cylinder Displacement

Editor THE AUTOMOBILE:—Kindly tell me how to find the cubic inch displacement of any motor if the bore, stroke, and number of cylinders only are given?

2—How can I tell by the r.p.m. of a motor what horsepower it will develop?

3—What are the rules and regulations for amateur racing, for the driver and the car?

New York City. G. K.

—The rule to find the piston displacement is to follow this equation: bore × bore × 3.1416 × stroke × number of cylinders = piston displacement.

2—You cannot tell from that data.

3—Copy of the racing rules can be secured from the Contest Board of the American Automobile Assn., 437 Fifth Avenue, New York City.

Thin Mixture as Overheating Cause

Editor THE AUTOMOBIE:—I am a subscriber to your magazine, and I always read your columns with interest. In almost every number I pick up I see some mention by a subscriber of overheating troubles, and the old fallacy repeated that a rich mixture is what causes overheating. Now I beg to submit that it is an absolute physical impossibility to overheat an engine with a rich mixture, whereas a very thin mixture will cause a great excess of heat. If those who are having trouble could be advised to enrich their mixture instead of making it leaner, which only aggravates their condition, many overheating annoyances would disappear.

In case any reader is inclined to disagree with me, and entertains the belief that a rich mixture really does cause overheating, I should like to ask him to explain the following occurrences which have happened to me personally at various times in the past.

Once in 1907 in Boston one of my customers drove his car to my office with the complaint that the engine was missing. On investigating, I found that it was missing from a too rich mixture and I thinned it down and he drove the car home. In the morning he telephoned me that he could not start his engine, and on going out to his house I found that I had thinned the mixture so far that the engine did not start when cranked. I corrected the difficulty and asked him if he had experienced any other trouble. He said that while driving home the night before, which was only three miles, his engine boiled for the first time since he had had the car. Here was a case where this man's mixture had been excessively rich, so rich that it missed, and yet no overheating was caused, and yet when thinned down (and not to an excessively thin point either, for it did not pop into the carbureter) it boiled for the first time since he had owned the car.

Another time in New Bedford in 1908 a man complained to me that his engine boiled continuously and he said that every mechanic in town had tried to correct the trouble by making his mixture thinner, but it only boiled the worse. In five minutes I had his carbureter adjusted correctly so that during the two days I was in New Bedford he was unable to make his motor heat, though he tried driving at top speed for many miles in the hot sun. To correct his trouble I had enriched his mixture very considerably.

Another time in 1910 in the winter I started from Pontiac for Detroit with a car which had just been overhauled. I knew that the radiator was full, for I examined all the tanks before starting, and yet, before I had gone a mile the water was boiling furiously, even though the temperature was well below freezing. I stopped the car, refilled the radiator, enriched the mixture considerably and resumed the drive, and never once did the engine heat, even though I was driving in low speed and wallowing through deep drifts of snow for the greater part of the 25 miles.

Last summer in India, while driving a six-cylinder car between Lucknow and Cawnpur, the engine overheated in the first few miles. I instructed my companion to enrich the mixture, which he did, and although I maintained a much higher speed for the rest of the distance, which is 50 miles, there was no further sign of overheating.

I could cite many other instances similar to the above, which have come under my own personal observation. Now I should like to ask you simply as a matter of logic, if it is a rich mixture that overheats the motor, how do you explain these occurrences?

Detroit, Mich. F. R. PENDLETON.

Information on Schebler Carbureter

Editor THE AUTOMOBILE:—Will you kindly give a description of the Schebler carbureter used on the Studebaker four, 1916? In the instruction book it gives the reverse adjustments from those made by the sales agency's shop men. Would it be possible to use a leaner mixture if both hood and radiator were covered during cold weather, using a standard hood and radiator cover?

Philadelphia, Pa. O. S. W.

—To adjust carbureter turn air valve cap *A*, Fig. 1, clockwise or to the right until it stops, then turn to the left or anticlockwise one complete turn. To start engine open throttle about one-eighth or one quarter way. When motor is started let it run until engine is warmed, then turn air valve cap *A* to left or anti-clockwise until engine hits perfectly. Advance spark three-quarters way on quadrant; if engine back fires on quick acceleration turn adjustment screw *F* up, which increases tension on air valve spring, until acceleration is satisfactory.

Turning air valve cap *A* to right or clockwise lifts needle *E* out of gasoline nozzle and makes rich mixture for starting. As motor warms up, move control lever gradually back toward Air or Lean to obtain best running conditions until motor has reached normal temperature. When this temperature is reached, control lever should be at Air or Lean.

A Special Valve-Seating Tool

Editor THE AUTOMOBILE:—Herewith sketch, Fig. 2, of a valve-seating tool which helped us out of a rather difficult job. We could have put this job in a lathe, but it would have taken more time. The sketch represents a cage-in-head type motor and the tool with which the work was performed. In removing the cage it was found that it had been driven so tightly in the head that the motor could be raised from the chassis by lifting by the cage only, therefore in removing same the seat at point *C* referring to sketch was jammed so that it had to be machined smooth again. The writer used an old valve and stem as per sketch, machined it down at point *D* to a running fit at *E*, then cut it out at point *F* with hacksaw, used a set chisel at point *A*, forcing the metal down as at point *B*, then case-hardening same ground to a cutting edge, the edge *B* being about 0.010 lower than face *G*. The facing operation at point *C* in the cylinder was accomplished in about 5 min. in a 20-in. drill press, making an A-1 job in about 30 min. The 30 min. time included making the tool also.

Des Moines, Iowa. S. E .H.

Peerless Six Developed 110-120 Hp.

Editor THE AUTOMOBILE:—What is the power curve of the 60-6 Peerless later models?

2—What is a fair speed to expect from this car in good order with touring body?

3—Has the Benz concern turned out more than one machine, termed Blitzen Benz?

4—What is the bore and stroke of the Blitzen Benz which attained speed of 147 m.p.h.? I have talked with a man who now owns a Blitzen Benz, and he claims to have driven it 157 m.p.h. He says the bore is 6½ in., stroke 9 in. and that this car is the one that holds world's record. I understand from your magazine that cylinder dimensions were 7 5/16 in. by 8 in. He says this is not the car that raced the Sunbeam twelve last fall, and that the latter car was capable of only 120 m.p.h.

5—Can you give particulars as to how the Stutz works double ignition from Bosch single high-tension magneto? I understand that some such arrangement is being used by them owing to lack of Bosch double ignition magnetos.

Milton, Mass. A. D. H.

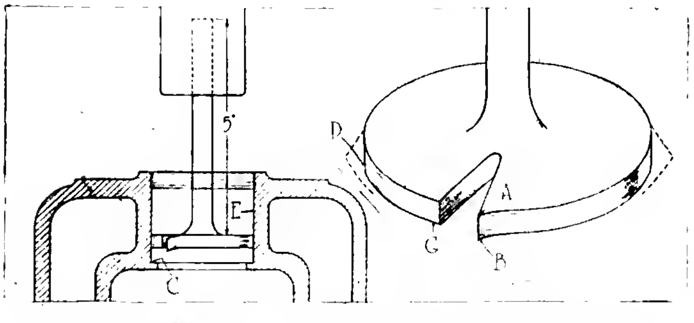


Fig. 2—Valve-seating tool developed by a subscriber and its application in a difficult job on a motor

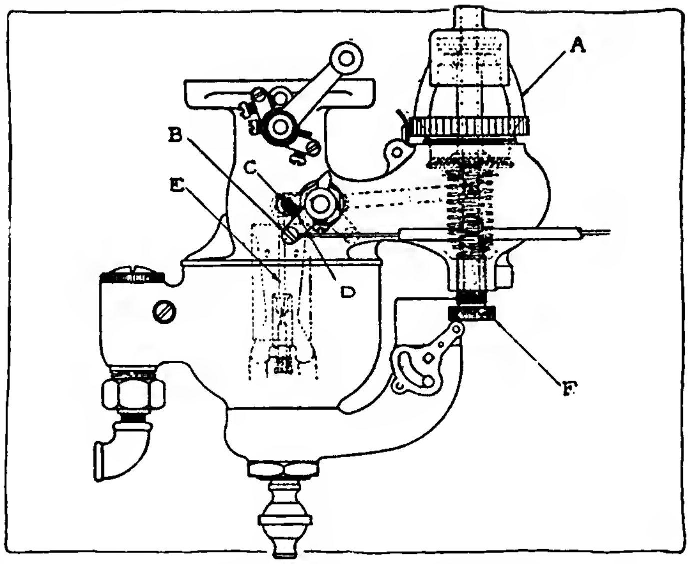


Fig. 1—Adjustment diagram of Schebler carbureter used on 1916 Studebaker four-cylinder model

—The Peerless company states that the old Peerless model 6-60 developed too much horsepower for the regular dynamometer and hence tests were carried on with a fan dynamometer to 110 or 120 hp. at 1585 r.p.m. The gear ratio on this car was 2.56 to 1 with 38-in. rear wheels.

2—Car of this model in good order should reach 70 m.p.h.

3—In all, three cars only were built of the Blitzen Benz type, the cylinder dimensions of which are 185 mm. bore and 200 mm. stroke. The world's record of one of these cars, of which two are in America, was established at Daytona Beach, Fla., April 23, 1911, by the late Bob Burman. It was the first car imported of the two here in America that was given the name Blitzen Benz, and was the record-making car.

As far as THE AUTOMOBILE has record now this car is in the hands of E. A. Moross. The other car of this type is now owned by Harry Harkness and was the second one brought to this country. It does not hold any record at the present time. The world's record for the Blitzen Benz was 1 mile in 25.40 sec.

4—Answered under No. 3.

5—This method, while not recommended by the Stutz company, has been used by some of the Stutz owners on account of not being able to secure the two-spark instrument. The method you speak of and which these users have employed is to connect two sets of spark plugs with the single ignition magneto. These might be series plugs or some other adaptation which renders this possible.

Explanation of Engine Cycle

Editor THE AUTOMOBILE:—Please explain the meaning of the word cycle, and its functions in a gasoline motor. Is each stroke a cycle, etc.?

2—Explain the firing and timing of eight- and twelve-cylinder motors.

3—Had the Marmon 32 a four-cylinder motor?

Dunn, N. C. K. F. H.

—The word cycle refers to a complete set of operations bringing the engine back to the point referred to at the beginning. We say the words four cycle, meaning it takes four strokes to complete a cycle of events in the cylinder. The correct manner of expressing this would be four-stroke cycle as each one of the strokes is only the mechanical action necessary in carrying out the cycle of intake, explosion, expansion and exhaust.

2—The timing and firing of all multi-cylinder engines is arranged to accommodate the angles at which the different cranks are set to each other. This must be done in order that the engine will balance. Regardless of how the engine is timed or the firing order each cylinder carries out its independent action as if it were a single-cylinder motor and it does not depend on any other cylinder to assist it in carrying out its cycle. The firing order naturally depends altogether on the valve timing of each cylinder since it is only a matter of exploding the charge which is compressed in the proper cylinder. The firing orders of eights are the same as fours since the action of the eight is just exactly the same as if there were two four-cylinder engines operating on the same crankshaft, which is exactly what holds true mechanically. The same relationship holds true between twelves and sixes.

3—Yes.

Mixing Gasolene and Kerosene

Editor THE AUTOMOBILE:—What is the real objection to mixing gasoline and kerosene as a fuel for motor cars? Of course, I have heard of such use of it now and then but why is it not generally so used especially since the price of gasoline has advanced so rapidly. I have a Chalmers six-cylinder and would you suppose that such a mixture as half and half would work satisfactorily?

Somerville, Mass. C. E. I.

—As a matter of fact unless you are quite fortunate you are using a mixture of kerosene and gasoline as a matter of practice in your car. It is one of the methods used to dispose of the great surplus quantities of kerosene now on hand. The action of the mixture is just what may be expected from a heavy grade of fuel. A mixture of half-and-half in your Chalmers would probably work quite well after the engine had once become warm.

Distributer vs. Magneto Ignition

Editor THE AUTOMOBILE:—What are the advantages of the distributer ignition system over the high tension magneto and also the advantages of the high tension magneto over the distributer ignition system?

2—What is the factory rating of the 1916 Hupmobile?

Niagara Falls, N. Y. P. N. P.

—In answer to your first question, would refer you to the following papers read at the winter meeting of the Society of Automobile Engineers and reported in THE AUTOMOBILE for Jan. 13:

Magneto vs. Battery Ignition by Francis R. Hoyt.
Notes on Battery Ignition by Alex. Churchward.
Battery vs. Magneto Ignition by Frank Conrad.

These give all sides of the battery-magneto question.

2—The brake horsepower of the model N Hupmobile runs as follows: 10 hp. at 400 r.p.m. and 36 hp. at 1700 r.p.m., which is the speed of maximum horsepower. These motors are purposely timed to give maximum horsepower at the speed mentioned.

Vacuum Feed Feasible for Ford

Editor THE AUTOMOBILE:—I have been much interested in your various articles about the advantages of rear tank and vacuum feed.

Would it be feasible or sensible to put this system on a Ford? If so, how can it be done in the simplest manner?

New York City. F. H. H.

—The Stewart vacuum feed can be readily installed on the Ford car, and in fact the Stewart company issues with the vacuum system a book giving directions how this should be done on different models. The method of installing on the Ford sedan is different from that on the Ford touring car but general directions apply. There are three simple things to remember; first, the top of the Stewart vacuum tank must be above the level of gasoline in the main supply reservoir when full, even when car is going down steep grades. Second, the bottom of the vacuum tank must be not less than 3 in. above the carbureter; and third, the Stewart vacuum tank must not be installed over the generator nor above any electrical terminals on which gasoline could possibly leak.

Amateur Wants Race Information

Editor THE AUTOMOBILE:—What does one have to do to enter a twenty-four-hour automobile race? I have never been in a race before.

2—What is the meaning of a stock car race?

3—How old a car may be used?

4—There is to be a twenty-four-hour race some time this year at the Bay track. Where can I find out full particulars and rules in reference to such a race?

Brooklyn, N. Y. MODERN GARAGE.

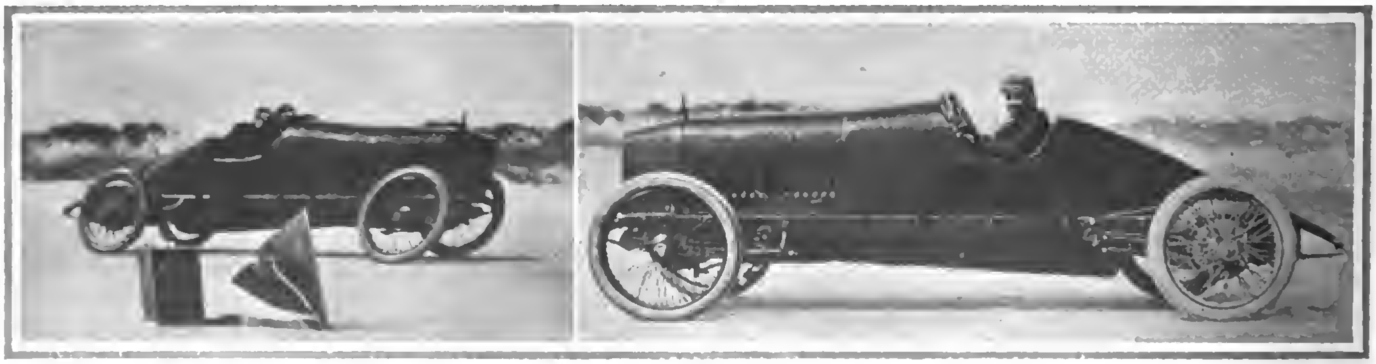
—The qualifications necessary to enter the race is simply that the driver is registered with the American Automobile Assn. and is satisfactory to the A. A. A. officials in charge of that race.

2—A stock car race is one in which the contesting cars have the same specifications as the cars sold by that concern in the open market.

3—The age of the car is immaterial.

4—Full details of all sanctioned events can be secured from the American Automobile Assn., 437 Fifth Avenue, New York City.

The Record-Breaking Hudson Super Six on Ormond-Daytona Beach



Hudson stock Super Six chassis on Ormond-Daytona beach. At the left the car is illustrated traveling at 102.5 m.p.h. and at the right after the tests were completed. On the stock chassis was mounted a special racing type body, the steering column was tilted and a radiator guard added. The chassis was geared 2 11/18 to 1. Valve timing was stock and cast-iron pistons were used, A. A. A. officials checking all specifications for stock classification.

ACCESSORIES

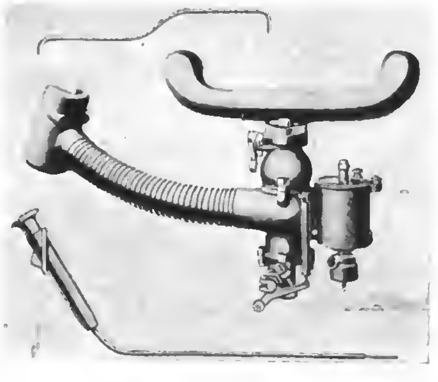
Sunderman Mouse Trap Carbureter

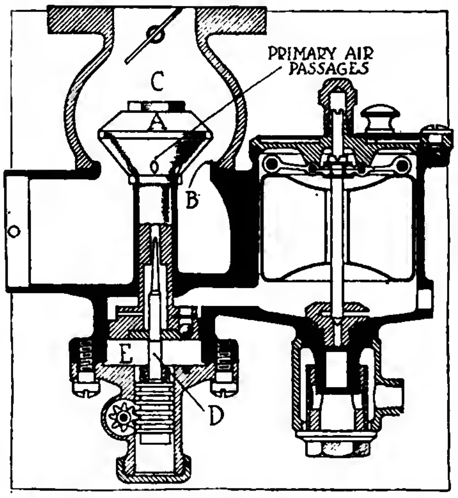
SIMPLE in construction and in adjustment, this carbureter is claimed to feed pure combustible gas from cold kerosene or gasoline to the motor without changing the adjustment, no hot air or water jacket being needed. As shown in the illustration, the rectangular float chamber *F*, fitted with a primer, is adjacent to the mixing chamber, which is simply a square passage. The fuel is admitted to this passage through the jet *J*1 for low speeds and when idling and when the speed is increased the taller jet *J* automatically comes into play so that both jets are operating at once.

Air is drawn through the valve *V*, which is regulated by the tension on the spring controlled by the adjusting collar *A*. In the illustration the air intake door is shown in the position it assumes when the motor is idling and fuel is being fed through the short jet *J*1 only. As the air rushes into the vacuum behind the intake door it sweeps the globules of fuel from the jets and the resulting vapor is further disintegrated into a homogeneous mixture by passing through the screen *S*, after which it passes the throttle *T* on its way through the manifold to the combustion chamber.

Besides an unusually high degree of fuel economy, the makers claim the carbureter gives great flexibility with consequent minimized gear shifting. The screen *S* prevents backfiring with its attendant dangers, and the elimination of a gasoline adjustment by the use of the regulating jets renders adjustment extremely simple. In fact, the makers state that when the carbureter is once set correctly, further changes will be unnecessary.

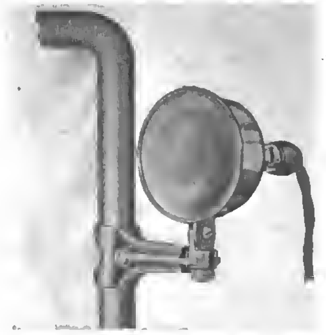
The carbureter is made in brass, iron or aluminum alloy, in ¾ in., 1 in., 1⅛ in. and 1¼ in. sizes, under the names of models A, B, F and C, respectively, and as the model Twin F for eight or twelve-cylinder cars. Model F weighs 1¾ lb. in brass or iron and 10 oz. in aluminum alloy, and is 4½ by 2½ by 1⅞ in.—Sunderman Corp., Newburgh, N. Y., maker. J. F. Renfro, Co., Inc., New York City, sole factory distributor.


Stewart carbureter for Fords, with manifold



Section through new Stewart carbureter


Fracto anti-glare lens


Culver-Stearns windshield searchlight

Fracto Anti-Glare

In this device half of the frustrum of a cone, formed of glass with specially shaped surfaces, is placed in the lamp under the bulb. The effect of the device is to project all the rays downward when the lamp is first adjusted so that the rays from the top are projected downward before the attachment is put in place. Two points of adjustment are available, one for a diffused short-distance light and the other for projection. No dimming device is employed, the principle employed being the proper collection and distribution of all the light-rays thrown out by the bulb. The device sells for $2.75 per pair.—Fracto Specialty Co., Boston, Mass.

Culver-Stearns Searchlight

This searchlight is of the windshield type, adjustable so that it can be turned in any direction for sign-reading and so forth. Though only 3 in. in diameter it throws a powerful beam of light, having an 8-cp. helical coil tungsten bulb; the makers state that signs can be read at a distance of 200 ft., a focusing device permitting exact adjustment. A switch built into the lamp eliminates the necessity for an extra switch on the dash. The bracket is substantial and clips to the edge of any type of windshield. Price, $2.25—Culver-Stearns Mfg. Co., Worcester, Mass.

Victor Spot Lamps

Made for windshield and foredoor attachment, the Victor spot lamp is equipped with 21-candlepower nitrogen bulb lamps. It can be secured to either of these two parts of the car by means of a bracket with a universal joint that allows the beam of light to be instantly turned in any direction. The swivel joint is of such construction that the friction maintains the position of the light but with sufficient flexibility that it may be easily moved in any direction by means of a handle at the back of the lamp. By the use of this lamp, side roads and passages may be inspected before turning the car and serious accidents thus avoided. The reflector is not a true parabola, but is a special shape which not only throws the parallel beam for a long distance, but also illuminates a wide field. The lamps are valuable in localities where brilliant headlights are prohibited. The price of the lamps of 6½-in. diameter is $7.50.—Victor Auto Parts Co., Cincinnati, Ohio.

Alcohol Solution Tester

Balls of various specific gravities, corresponding with the specific gravities of alcohol-water solutions for different freezing points, constitute this device. For a given solution a test is made, using the proper ball, by drawing off a small quantity of the solution from the radiator dropping the ball into it, and allowing it to remain for a minute, which is long enough to equalize the temperatures. If the ball floats more alcohol is needed; if the ball sinks there is enough. The makers state that the balls contract and expand with temperature changes at the same rate as the solutions in which they are used, so that no

Curtis 1000-lb. canopy top trailer

allowance has to be made. For a quick test the ball may be dropped into the radiator through the cap. Price, 25 cents each.—Liquid Tester Co., Lancaster, Ohio.

Curtis Trailers

The outing trailer is to provide a comfortable portable home to be drawn behind a car. The trailer carries what is in reality a little house with windows and doors in the ends. At the sides are two bunks, which form parts of the side walls when not in use. At night these are let down outwardly and canvas side walls are let down over them, making a snug little room with two beds in it. A fly is provided on each side also. The beds consist of Way sagless springs, 4 by 6 ft., 2 in. and felt mattresses; khaki covers are provided so that the beds when made up can be folded without becoming disarranged. An ice chest and a small oil stove also are furnished. Four adults can sleep on the beds, and for extra persons folding cots can be carried and set up at night under the bunks, which are 3½ ft. from the ground. A ball-and-socket coupling is provided for the attachment of the trailer to the rear of the car. Weight of trailer alone, 500 lb.; equipped for the road, 700 to 750 lb. Price, $250.

The capacity of the Curtis two-wheeled trailer is 1000 lb. The lower priced types have box or stake bodies and steel-tired wheels; more styles are built up to the special model with canopy top and side curtains, wire sides, pneumatic tires and other refinements. A special model is supplied for cradling a canoe or small rowboat. The maker lays stress on the coupling used, which allows for adjustment in all necessary directions and keeps the trailer in its proper place regardless of road conditions. Prices, $47.50 to $137.50.—Curtis Trailer Co., Minneapolis, Minn.

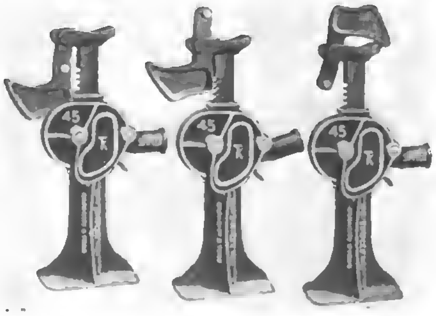
Curtis outing trailer, open for camping and closed for towing by car

Simplex Jacks

The Simplex variable lift jack is of the lever and rack type, and the construction is substantial; its advantage, however, is that on the outer face of the lifting column there are steps on which a lifting foot can be adjusted, giving seven different heights in addition to that of the head. The jack is of heavy malleable iron and the column is of I-beam section. Lifting capacity, 1500 lb.; height closed, 10¼ in.; lift, 6 in.; weight boxed, 9 lb.

The geared jack has a detachable shoe at the head, which is shown in three positions; two of the positions give less than normal height and the third gives more than normal height. When the plain head is to be used the shoe is slipped out of place. The operating pawls on the lever end act on a gear meshing with the rack cut in the lifting column. All working parts are of steel; capacity, 4000 lb.; lift, 8½ in.; available lifting heights, 9, 10½, 11¾ and 13 in.; weight, with steel lever, boxed, 13 lb.—Templeton, Kenly & Co., Chicago, Ill.

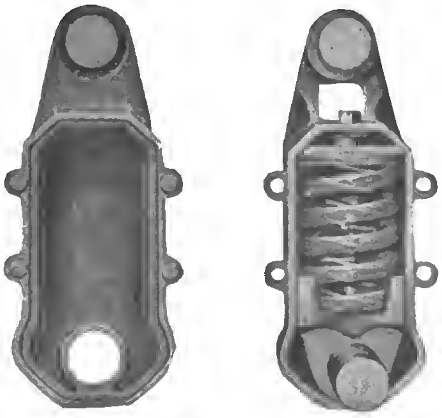
Simplex jack with adjustable foot



Simplex jack with three-position head

Savidge Steering Device

Considerable improvement has been effected in this steering device for Ford cars since it first was put on the market. The principle remains the same, however. A helical spring is carried in a casing which projects backward from the front axle, to which it is bolted; its inner end bears against a stationary cam and the outer end of the casing is attached to the cross-rod of the steering gear. When the cross rod moves in deflecting the steering wheels the casing carrying the spring is moved to one side or the other, and the spring, moving against the stationary cam, is compressed and tends to bring the front wheels back to the straight-ahead position. The object is to take the wobble out of the wheels and to prevent their being turned with dangerous suddenness and sharpness; it also takes up lost motion and absorbs shocks. Attachment is easily effected without machine work or drilling. Price, $4.90.—Meixell Co., Indianapolis, Ind.



Savidge spring steering device

Marvel-Mist Sprayer

The Marvel-Mist cleaning and polishing compound may be used in a sprayer, a light coating being sprayed on the car body and rubbed off with clean cheesecloth. The makers state that it prevents the paint from deteriorating, softens mud and removes oil, grease and road tar and that it produces a high polish on the surface that will not catch dust. A small outfit with cloth sells for $1 while a large one is $1.25. A pint can for refilling the sprayer is listed at 75 cents and the quart size $1, ½ gal. $1.75, 1 gal. $2.75 and 5 gal. garage outfit $12.50.—Marvel-Mist Mfg. Co., Brooklyn, N. Y.

Simon's Dim-A-Glare

Dim-A-Glare is a paste that is applied to the glass, and once it is put on cannot be rubbed or scraped off, it is said. Either the whole or part of the glass will be treated. It sells for 25 cents per tube. —Simons Mfg. Co., Vallejo, Cal.

The Automobile

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Accuracy in Design

ON page 711 in this issue of THE AUTOMOBILE attention is drawn to the need for taking proper precautions when adopting Hotchkiss drive. Hotchkiss drive, especially when used for trucks, may easily disturb the brake layout and the article is prompted by the discovery that several engineers have overlooked this fact altogether. The efficiency of an automobile and of a motor truck, as it is gaged by the owner, is made up of multifarious detail. The best machine in the world will not be appreciated if it has just one really weak spot.

It is by overlooking simple things like the relative motions of axles and brake connections that can make all the difference between an entirely excellent vehicle and one that is merely passable; reputations are built up upon care for the minutest details.

This particular case of Hotchkiss drive and brake connections is especially noteworthy, because there are many engineers who believe that Hotchkiss drive is the correct principle, and if users of trucks find that they are having trouble with brakes they will not stop to reason out why this is. If a man has used trucks with radius rods on which the brakes needed adjustment once a month and finds that a Hotchkiss drive truck needs adjustment once a week he is liable to blame the drive without further thought as to the why and wherefore.

Half an hour on the drafting board may easily save $10,000 worth of sales with details of this kind. Let it always be remembered that adjustment of anything is always noticed if required with frequency, and every adjustment made to a car or truck is reckoned against it by the user.

Designers are often prone to lay out the car in an unloaded condition instead of taking into consideration the position of the driving members and suspension units when under normal conditions of load. The various radii of action caused by oscillation of spring members should be carefully watched especially as regards longitudinal members such as brake connections.

The Constant-Pressure Cycle

A QUESTION which is beginning to make itself heard amidst the clamor caused by high-priced fuel, high-speed engines and multi-cylinders, is that of the possibility of cycles other than the Otto. The constant temperature cycle seems to be rejected with but little consideration, while that of constant pressure is affording considerable food for thought.

So far the constant pressure engine, or variations of it such as the Diesel, has been limited to larger units. Is this because the subject has never been vigorously attacked by automobile engineers but only by those who are more used to larger plants? It opens up an avenue of speculation which may or may not lead to a revision of many existing ideas as regards engine design.

It seems that the entire difficulty centers around the use of parts which will be light and at the same time able to sustain the high pressures necessary to admit burning fuel against compression pressures much higher than those possible in Otto cycle motors. With the high compressions the air alone must be compressed and the fuel admitted at the time of combustion and admitted successive in small quantities which will give the series of lesser impulses due to burning as compared to the single violent shock of explosion.

Low Thermal Efficiency

Mean effective pressures will have to be kept high by a maintenance of high pressure throughout the burning period, even though the theoretically constant pressure may not exactly be reached. In the Otto cycle mean effective pressure depends on having the maximum pressure as close to the beginning of the explosion stroke as possible and with the small throttle opening used in touring at speeds of 15 to 20 m.p.h., these pressures fall off more rapidly than the resulting decrease in fuel justifies. In other words, very low thermal efficiency results.

If the constant-pressure engine can be developed to give high efficiency at reduced throttle or at lower car speeds, something will have been accomplished that will be of the utmost value in the event of expensive fuels. The whole series of questions left open by the industry's pioneers may again present themselves to our engineers for solution in the light of latter-day developments.

400 Attend Detroit S. A. E. Meeting—Hear Papers by Vincent and Smith

Motors of the Air and Interpreting the Public to the Engineer Are Subjects of Two Papers of Wide Interest —Section Closes Record Year—New Officers Elected

DETROIT, MICH., April 17—To-night's regular monthly meeting of the Detroit section of the Society of Automobile Engineers was attended by about 400 members of the section and guests, who listened to two clever talks by men in widely varying fields of the automobile industry. J. G. Vincent, vice-president of engineering, Packard Motor Car Co., spoke on Motors of the Air, and Paul Smith, sales head, Chalmers Motor Co., dealt with the subject of Interpreting the Public to the Engineer.

This session marked the closing of the most successful year in the history of the local section, and the new officers who were elected for the ensuing twelve months are D. McCall White, chief engineer, Cadillac Motor Car Co., chairman; O. E. Hunt, assistant chief engineer, Packard Motor Car Co., vice-chairman; W. C. Rands, general manager, Rands Mfg. Co., treasurer; B. G. Koether, general sales manager, Hyatt Roller Bearing Co., secretary; and K. W. Zimmerschied, chief metallurgist, General Motors Co., member of the national nominating committee.

The treasurer's report for the fiscal year just closed shows a cash balance of $1,496.53, as compared with $409.11 at the end of the previous year. Membership has now exceeded the 500 mark, and in every way the section's future seems very rosy. Retiring Chairman G. W. Dunham made an appeal for a permanent home for the section, and W. H. Conant, the present secretary reviewed the progress of the year and indicated the surprising growth of the section.

Motors of the Air

Mr. Vincent showed from his talk that he has been a close student of aeroplane development since the war started, and indicated how general interest has been aroused in aeronautics due to the striking service and reliability of the aircraft in the war.

In designing their war plane engines the Germans put it up to their automobile engineers, with the result that the German machines were developed with high efficiency engines built along automobile lines, the Mercedes type being the best example. The parts are light and reliable.

In France the matter was left to the aircraft engineers, and it is therefore natural that there should be various types of French designs with the strongest tendency toward the rotary-cylinder, air-cooled type. These have great power per pound of weight, but they have proved less desirable for long flights, for when enough oil and gasoline are carried to allow them to run for long periods, the machines become heavier than the light types of automobile motors. Hence the French soon saw the advantage of the automobile type engine with fixed cylinders and developed such.

Of course, the type of fixed cylinder engine depends upon the work required. The six-cylinder is good for moderate-sized machines, but as the planes are increased in dimensions and more is asked of them in the way of carrying ammunition and passengers, the cry is steadily for more power. This has caused the development of the twelve-cylinder, V-type, as well as the eight. There is also a movement for eighteen-cylinder engines, the cylinders arranged in three sets of six around the shaft. This arrangement, however, results in too wide an engine and also makes very complicated connecting-rod lower end construction. The eight has the same objection of being too wide, since the aim is to make the wind-resisting area as little as possible. The twelve, therefore, seems to be the best answer, according to Mr. Vincent, who said further that for large planes nothing less than twelve cylinders will endure.

Another important consideration upon which Mr. Vincent touched is the matter of propeller drive—whether it should be connected directly to the crankshaft or geared down. If it is directly connected, the minimum speed has to be 1400 r.p.m., which is high. It is best to drive it as low as 900 r.p.m. sometimes. with the average speed 1200. Due to inequalities of the air through which the propeller passes, and unevenness of the weight of the wood of the blades, heavy strains are imposed upon the shaft and its mountings, and these have to be allowed for.

The Packard engineer also favors overhead valves with overhead camshafts, since the shafts in this position allow a clear mounting for the carbureters and exhaust pipes. The carbureters logically go in the V and the exhausts on the outside, this arrangement also permitting the placing of the spark plugs on the inside of the V, so that oil will drip off them, and they will be away from the hot exhaust pipes, preventing pre-ignition.

Straight cylinders seem best, and cast-iron types can be made light, reliable and cheap, although aluminum with cast-iron liners are very advantageous. Undoubtedly, Vincent said, steel cylinders are the best possible construction, although they are expensive and hard to make by Americans. The Mercedes utilizes steel cylinders. Everything considered, the aluminum cylinder will probably dominate due to its weight.

Interpreting the Public

Mr. Smith believes that the engineers should be busier refining the essentials of the cars they already have than to be springing new things constantly. It is easier to sell what the public wants than to have to push something by dint of expensive advertising and strenuous sales methods—something about which little is generally known.

The three essentials to-day are more conveniences, better looks and more accessories.

He commended the firm that builds up samples of what it believes it will turn out for the season and then ships samples to widely separated dealers and distributors for their criticism and suggestions even before it is released to the production department.

The following shows Mr. Smith's idea of the relative importance of the five most important factors in the various price divisions. These are given in the order of their importance.

$2,500 and up—Motor types—6, 8 and 12

Reliability
Appearance
Price
Performance
Economy

$1,750 to $2,500—Motor types—6 and 8

Reliability
Appearance
Performance
Economy
Price

$1,250 to $1,750—Motor types—6 and 8

Reliability
Appearance
Performance
Economy
Price

$850 to $1,250—Motor types—6

Reliability
Appearance
Performance
Economy
Price

$350 to $850—Motor type—4

Reliability
Appearance
Performance
Economy
Price

Cincinnati Lamp Concerns Merge—Capital $2,000,000

CINCINNATI, OHIO, April 14—The Corcoran Lamp Co., the Victor Lamp Co., and the Victor Auto Parts Co., all of this city, representing the Corcoran interests, have been purchased by a local syndicate. The consolidation plan is for a $2,000,000 corporation with $1,500,000 of common stock and $500,000 of preferred stock. The common is to be offered at 70 and the preferred at par.

Present indications are the withdrawal of the Corcoran family from all connection with the company. T. J. Corcoran owns the Corcoran Lamp Co.; W. J. and E. B. Corcoran own the Victor Lamp Co., and J. L. and H. R. Corcoran own the Victor Auto Parts Co.

Martine Resolution Completed

Senate Adopts Preamble to Resolution Calling for Gasoline Trust Probe

WASHINGTON, D. C., April 17—Another step in the gasoline probe was the adoption to-day by the Senate of a preamble to the resolution by Senator Martine, directing the attorney general to investigate and report whether any law is being violated by the present situation in the oil and gasoline industry. The adoption of the preamble completes action on the resolution. The preamble attacks the Standard Oil Co. This action was taken after brief debate in which Senator Martine announced the aggravated conditions in the gasoline industry.

Ohio Standard Oil May Declare 100 Per Cent Stock Dividend

NEW YORK CITY, April 18—The Standard Oil Co. of Ohio probably will declare a stock dividend of 100 per cent. There will be a special meeting May 25 to vote on a proposal which will increase the stock from $3,500,000 to $7,000,000. If the plan goes through this will be the seventeenth distribution of stock among the former subsidiaries of the Standard Oil Co. of New Jersey since the company was separated into its parts. Cash dividends paid during the first quarter of this year have been the largest of any quarter since the dissolution of the Standard Oil Co., except the initial quarter of 1913.

Four Sizes of Hall Trucks

DETROIT, MICH., April 17—The Lewis-Hall Iron Works is now producing four models of commercial vehicles as follows: Two-ton, worm-drive chassis, $2,000; 3½-ton, double side chain chassis, $2,800; 3½-ton, worm-drive chassis, $2,800; 5-ton double side chain chassis, $3,400. The company has appointed Kuehn & Metz, 1926 Broadway, its New York representative, and plans to locate distributing agencies on the Pacific Coast.

Four Cylinders Subject of Joint Meeting

NEW YORK CITY, April 19—A joint meeting of the Metropolitan Sections of the Society of Automobile Engineers and the American Society of Mechanical Engineers will be held in the auditorium of the Engineering Societies Building, April 20. The subject of the meeting will be four-cylinder engines and papers have been prepared by F. E. Watts, chief engineer of the Hupp Motor Car Co., and F. R. Porter, president of the Finley Robertson Porter Co., and formerly chief engineer of the Mercer Motor Car Co.

Over 6500 invitations have been sent out to this meeting, to members of the above organizations and to the Institute of Electrical Engineers and the Aeronautical Society. The meeting will be preceded by an informal dinner.

Continental Motor Co. to Issue $1,000,000 Notes

DETROIT, MICH., April 14.—The Continental Motor Co. is to issue $1,000,000 in 5 per cent notes to be retired in five years. The money is to be used in connection with further enlarging the plant and also for the further financing of the concern for the next few years.

246 Reservations for S. A. E. Trip

DETROIT, MICH., April 15—Two hundred and forty-six reservations for the 1916 summer cruise of the Society of Automobile Engineers have been made on Ss. Noronic, which carries the party from Detroit, June 12, on its four-day trip. At the present rate at which reservations are being made the capacity of the boat will be well taxed by May 1, the date on which the first allotment of staterooms will be made.

Those who have signified their willingness to date to present papers and their subjects are:

C. F. Kettering, Dayton Engineering Laboratories Co.—Future Scientific Development of the Automobile.

H. L. Horning, Waukesha Motor Co.—Motors for Trucks and Tractors.

Arthur B. Brown, designer of Brown carbureter, and Herbert Chase, A. C. A. chief engineer—Constant Pressure Internal Combustion Engines.

W. R. McCulla, Packard Motor Car Co.—Mechanical Transport Under War Conditions.

Howard Coffin, Hudson Motor Car Co. and member of Naval Consulting Board—Preparedness.

J. E. Hale, Goodyear Tire & Rubber Co.—Straight-Side vs. Clincher Type Tires.

C. H. Eason, Hyatt Roller Bearing Co.—Engines for Farm Tractors.

H. D. Church, Packard Motor Car Co.—Motor Trucks.

E. A. Nelson, mechanical engineer—Pressed Steel Construction in Automobiles.

Maxwell Sends Longwell to Orient

DETROIT, April 13—The Mawell Motor Co. is sending W. T. Longwell, its special representative, on an extended business investigation trip to the Orient. Leaving this country April 22, Mr. Longwell will visit Japan, China, Java, Sumatra, India and Ceylon. If the war should end by next February, Mr. Longwell will then continue his investigation through Egypt and then through Europe, expecting to return to Detroit in April, 1917.

Newlin Maxwell Supervisor

DETROIT, MICH., April 17—Howard Newlin, former traffic manager of the Pennsylvania Steel Co., has been appointed supervisor of traffic and transporation for the Maxwell Motor Co. here.

Industry To Aid War College

Railroad Officials and Automobile Men Study Transportation Preparedness

WASHINGTON, D. C., April 17—Military preparedness received a decided impetus to-day when an important conference between representatives of the automobile industry and railroad interests and members of the War College division of the Chief of Staff of the army took place at the War College. The conference, which was of a preliminary character and which was not open to the public, will be followed by meetings of a like nature during the next few months. Alfred Reeves, general manager of the National Automobile Chamber of Commerce, is reported to have informed the army officers of the work that has already been started in the way of compiling information as to the number of privately owned motor trucks throughout the country. Coker F. Clarkson, general manager of the Society of Automobile Engineers, and Russell Huff also are reported to have given the army officers valuable information that will be of aid in working out the transportation problem in case of emergencies.

Others who participated in the conference were Howard Coffin, S. D. Waldron, Henry Souther, George C. Diehl, A. G. Batchelder, S. A. Miles, John M. Wilson, B. Sweet, Fairfax Harrison, president Southern Railway, W. G. Beseler, president Jersey Central Railroad, and R. H. Aishton, vice-president, Chicago & Northwestern.

The conference was presided over by General Macomb and the other army officers present were Colonel Treat, Colonel Kennedy, Lieutenant-Colonel Johnston, Lieutenant-Colonel Cameron, Lieutenant-Colonel Martin, Major Jones, Major Connor, Major Lochridge, Major Moses, Major Pierce, Major Van Deman, Major Palmer, Captain Kerth and Lieutenant-Colonel Howell.

171,977 New York Registrations

ALBANY, N. Y., April 15—Registrations in this State to date amount to 171,977, as compared with 142,576 last year. Receipts amounted to $1,477,363, as against $1,194,439 last year. In the New York City zone this year's registration is running more than 18,000 over the first two and a half months of 1915.

Krake Studebaker Div. Traffic Mgr.

DETROIT, MICH., April 17 — H. G. Krake, who was manager of the traffic bureau of the St. Joseph, Mo., Commercial Club, has become division traffic manager for the Studebaker Corp.

New Mitchell Cars Are Longer

Wheelbase Increased 2 In.—Passenger Space Increased —Prices $75 Higher

RACINE, WIS., April 15—Announcements have been made of the new Mitchell line and show that for next season a considerably refined car as compared to the Six of Sixteen will be put on the market. Mechanically, the only changes are increase in the dimensions of parts made necessary by a 2-in. increase in wheelbase to 127 in.

Accessibility Is Improved

The principal refinements are in the nature of increased passenger space and a beautified exterior appearance. Along with these improvements there has been a price increase of $75, making the five- and three-passenger cars $1,325 and the seven-passenger $1,360. The five-passenger touring car and the seven are exact in every particular except for the disappearing auxiliary seats which may be added to the five at any time at an additional cost of $35.

The mechanical changes have increased accessibility in some degree. The single-unit starting system which was used on the former model has been replaced by Westinghouse two-unit operating through a Bendix gear for the starting motor and eliminating the silent chain which was a part of the starter generator drive. The engine-driven tire pump has been raised to a more accessible position and is now mounted immediately behind the fan and driven by a gear from the fanshaft. The motor design has been changed but little although the cylinder casting has been altered to allow the waterjacket space to extend further down the side, giving a greater reserve of waterjacket area.

Underslung Springs Continued

Now that the wheelbase has been increased 2 in. it has a total of 127 and this has been met by lengthening the cantilever springs 2 in. The number of leaves in the springs has also been increased and the underslung mounting maintained. The principal specifications include a 3½ by 5 motor of L-head design with the cylinders cast in a single block and in unit with the crankcase. The gearbox provides three speeds and the equipment is unusually complete. An example of this is in the glove compartment in the instrument board and the tonneau light in the back of the forward seat.

Borderland Tire Mfg. Co. Formed

LAS CRUCES, N. M., April 13—The Borderland Tire Mfg. Co. has been formed in this city to manufacture automobile tires and tubes. Its capital is $150,000. The officers are as follows: President, W. B. Mandeville of the Union Bank; vice-president and manager, J. T. Ward of Denver; secretary, J. O. Miller of the First National Bank; treasurer, F. W. Campbell of the Bowman Bank and Trust Co. The directors are G. H. Totten, J. T. Ward, J. L. Burnside, Gustave Manasse, J. O. Miller, W. B. Mandeville and F. W. Campbell.

Winton Prices Raised $200

CLEVELAND, OHIO, April 15—The Winton Co., this city, will on May 1 raise the price on the 33 Winton Six $200. The increase, which is 8¾ per cent, will bring the prices up to the following:

Five-passenger touring	$2,485
Seven-passenger touring	2,535
Six-passenger touring	2,635
Four-passenger touring	2,485
Roadster	2,485
Sedan	3,700
Limousine three-quarters	3,450
Limousine, fore-door	3,700
Limousine-landaulet	3,700
Coupe	3,400
Coupelet	2,800
Chassis only	2,200

McFarlan Increases Prices $210—To Discontinue Series T

CONNERSVILLE, IND., April 16—The McFarlan Motor Co., this city, will discontinue the manufacture of the series T roadster and touring car, selling at $2,830 and $2,680. On and after May 1, the McFarlan touring car will be built in series X only. All models under this series will be increased in price $210. The touring car will sell at $3,200 as will the roadster. The sedan will receive the same increase in price and will sell at $4,210. Two limousines, one a seven-passenger, and the other a six-passenger, will sell at $4,410 and $4,210, respectively. A seven-passenger berline has also received this $210 increase, and will sell at $4,510.

Canadian Chalmers Price Unchanged

WINDSOR, ONT., April 15—For the present the price of the Chalmers Six-30 will not be changed in Canada and will remain $1,475 for the touring car and roadster and $1,090 for the cabriolet, duty paid f.o.b. Windsor. This cancels this company's former announcement of the price increase on the Six-30 as affecting Canada. Through its foresight in establishing itself in Canada this company is able at least for the time being to sell cars in Canada without increasing the price. This is in line with the recent decision of the Chalmers company to build Chalmers cars in Canada and is one of the first advantages offered Canadian motorists because of this plan. The price of the Chalmers Six-40 remains at $1,950 f.o.b Windsor.

Will Manufacture Ben Hur

Racers To Be Stock Chassis of Series for Sale on Regular Market

CHICAGO, ILL., April 15—The Ben Hur cars which are being built to represent the Chicago speedway during the 1916 racing season, will be the first models of a series which will be produced for the regular market. While of course they cannot be advertised as such, it is stated that these cars will be stock models so far as the chassis and engine are concerned; that is, the regular production of the factory will be the same in design and manufacture as the cars which will make their début on the tracks this summer.

David F. Reed, president of the Speedway park association, while admitting that leading members of the association were interested in backing a team of racing cars to represent Chicago, states that these cars will not be owned by the Speedway park association proper or campaigned by them. It has been decided to campaign the team under the title of the Ben Hur Racing Assn. which is organized under the charter as not for profit. No dividends will be declared; the initial capital being subscribed by fifty or 100 members of the Speedway park association.

Any returns in the form of prize money, etc., accruing to the Ben Hur racing association will remain in the treasury of the association for the purpose only of research work and development of motors and cars.

According to Mr. Reed, the Ben Hur racing association will not build a special or individual motor for the sake of winning a prize or for commercial publicity, but any motor used in any one of its racing cars must be identical with that offered in the standard passenger car. It is the expectation to have the team ready for its initial bow at the Indianapolis Memorial Day races.

Beecroft to Study Car Market in South America

NEW YORK CITY, April 19—With the object of investigating the automobile selling field in South America for cars, trucks and tractors, David Beecroft, directing editor of THE AUTOMOBILE, sails on April 29 for an extended business trip in Brazil, Uruguay, Argentina and Chile. Mr. Beecroft goes as a member of the Latin-America Return Visit Committee, which goes at the invitation of the Government to investigate into and report on various lines of industry.

The possibilities of the South American field have been under investigation by several American makers for some years, but it is only since the present European war that the matter has received increased attention, and since then the large home consumption has held back the export business to that country.

South America is a land of wonderful distances and naturally a place well suited for power vehicles of all kinds. One country—namely, Brazil—is larger than the entire United States. The great farming country of Argentina is larger than all of the United States east of the Mississippi River. Chile on the map of South America looks like a small strip of country, yet it is longer than from New York to San Francisco.

A Consumer Market

South America offers many chances as a consumer market for motor vehicles. In Argentina the farmers till large areas and have plenty of money to buy trucks and cars. The lack of roads has hampered the movement. The entire country is as level as a table, and in that sense is ideal for motor transport; but it lacks stone to build roads, and up to the present has not seriously undertaken any progressive road policy.

Throughout South America are many fruitful fields for motor transportation. Such industries as coffee, wine, sugar, cotton, rice, lumber, agriculture, mining, etc., will require motor trucks in great quantities as soon as the road movement gets under way. At present there are many trucks in use, but the European governments have done most of the pioneering work. The city of Rio de Janeiro, Brazil, has for many years been a great truck city. The streets are well paved, as are practically all large cities in South America. Italy and France have had a large hold on the Rio truck trade.

K. & S. Tire Enters Field

GUELPH, ONT., April 14—The K. & S. Canadian Tire Co., Ltd., which introduced the Kelly-Springfield tire into Canada, is now manufacturing at its Guelph factory K. & S. tires, which are guaranteed for 7000 miles on Ford cars and 6000 miles on other cars.

Autocar Adds 85,000 Sq. Ft.

ARDMORE, PA., April 14—The Autocar Company, this city, is to erect another factory on Greenfield Avenue, directly oposite the present road testing plant. This new building will have 85,000 sq. ft. of floorspace and will be devoted entirely to the manufacture and painting of Autocar bodies and the final assembly of body and chassis. It will be two stories high, with a main building, two L extensions, a boiler house and blacksmith shop. The building will be divided into zones, each one a complete plant in itself.

Car to Have Beijer Transmission

Hydraulic Device to Be Feature of New Car—To License Others

STEVENS POINT, WIS., April 13—The Beijer Hydraulic Transmission Co., organized in the spring of 1915 at Stevens Point, Wis., by Arthur Beijer, a Swedish engineer, will complete the first model of car employing the Beijer patented transmission about May 1, and after road tests and further experimentation will build the car for the market and license other manufacturers on a royalty basis.

The Beijer transmission has been built into a 50-hp. touring car at the Stevens Point Garage Co.'s plant. The new form of transmission operates on the same principle as the hydraulic jack. A three-cylinder rotary pump is attached to the flywheel of the motor and pumps columns of oil through pipes to motors on each wheel of the car, front and rear. Thus a form of four-wheel drive is attained. The device makes it possible to eliminate clutch, gearbox, universal joints, differential and other expensive parts of the present-day car.

The new system is under the observation of engineers of note in all parts of the country, as well as the government. The same principle is adaptable to the system of control of turrets on battleships and coast defenses and any type of transmission.

Mr. Beijer is an expert on transmissions and has experimented with the hydraulic transmission for many years.

To Make Harroun Kerosene Carbureter in Pittsburgh

PITTSBURGH, PA., April 13—The Kerosene Carbureter Co., this city, has secured the patent and other papers necessary for manufacturing carbureters using kerosene instead of gasoline.

The carbureter manufactured by this company is the invention of Ray Harroun, formerly chief engineer of the Maxwell Motor Co., and now manufacturing aero motors.

Thomas Auto Truck Co. Formed in New York City

NEW YORK CITY, April 14—The Thomas Auto Truck Co. has been formed to build trucks in this city at 639-641 West Fifty-first Street. The line will consist of a ¾, 1, 1½, and 2-ton chassis, and complete bodies and also a line of taxicabs.

The personnel of the company is as follows: C. K. Thomas, president and founder, was for three years previous vice-president and general manager of the Federal Motor Truck Co., of New York. Cloyd Marshall, the secretary and treasurer, was formerly with C. W. Hunt Co., this city. W. S. Thomas, a director, has been prominent in engineering work for a number of years, and was formerly with J. M. Guffey & Co., Pittsburgh, Pa. O. S. Platt, another director, is the owner of the Platt Pattern and Machine Works, Bridgeport, Conn. P. F. Donohue, also a director, is general advertising expert and treasurer of Tammany Hall. G. E. Whitney, M. E., of Bridgeport, Conn., is acting in the capacity of advisory engineer. M. D. Herron, the sales manager, formerly occupied the same position with the Federal Motor Truck Co., this city. W. A. Jones, the chief engineer, has been identified in a mechanical way with the automobile industry for fourteen years. He has been associated with Amplex, Packard and Fiat.

$3,865,000 Record Business for Chalmers in March

DETROIT, MICH., April 17—The Chalmers Motor Co. reports that during the twenty-seven working days of March the value of cars shipped was $3,865,000, indicating the greatest year's business in the history of the concern. On March 31, there were $300,000 worth of Chalmers machines shipped, the record day since the formation of the company. Although new sales and production records have been established in the past three months, Sales Manager Paul Smith says that Chalmers entered the month of April with $8,400,000 worth of orders on its books. Chalmers dealer representation has also rapidly increased, more than 1000 cities and towns in the United States now claiming a dealer for this make of car.

Chalmers Gets Canadian Plant

FORD, ONT., April 15—The Chalmers Motor Co. of Canada, Ltd., which was recently organized with a capital stock of $1,000,000 has leased for a period of five years the factory of the Tate Electric Car Co., and will thus be able to start manufacturing here in Canada within a few weeks.

Duesenberg Motor in New Plant

CHICAGO, ILL., April 17—The Duesenberg Motor Co. moved to its new plant at 2259 Oakdale Avenue, this city, on April 15. The new factory gives the company greatly increased facilities, as compared with its St. Paul plant.

Pullman May Expand Plant

YORK, PA., April 13—The Pullman Motor Car Co, this city, is contemplating building a new plant on a 40-acre tract at Grantley Station. The matter will be presented before a meeting of the board of directors to be held in the near future.

The present quarters are inadequate. The company is very busy at the present time. The past month's output was 900 cars, and it is expected that next month's production will number 1000.

If it is decided to build a new plant, it will be started at once. The old plant will be gradually transferred to the new one, and in about a year, it is believed, the entire Pullman establishment will be located at Grantley.

Willard Builds 1,000,000 Batteries

CLEVELAND, OHIO, April 14—On Saturday, April 8, the total production of automobile lighting and starting batteries by the Willard Storage Battery Co., this city, reached the total of 1,000,000. Production in the company's new plant has increased rapidly during the past year, while over 725 Willard service stations are in operation in all parts of the country. The company reports that its plan of giving free inspection once a month to any car owner, regardless of the make of battery he used, has worked out very successfully.

Hupp Production Gains 69%

DETROIT, MICH., April 15—According to Lee Anderson, commercial manager of the Hupp Motor Car Corp., March was the biggest business month in the concern's history. Production was 69 per cent larger than in March, 1915. During the first three months of 1916 business was 70 per cent ahead of what it was during the first quarter of 1915. Prospects for a continued increase of business are reported by the Hupmobile dealers and distributors.

Pathfinder Reports Big Gain

INDIANAPOLIS, IND., April 15—The Pathfinder Co., this city, reports that sales are now running 100 per cent ahead of production, which is now at the rate of 200 per cent over the same period in 1915. The number of cars shipped since Jan. 1 increased 400 per cent in January, 270 per cent in February and 226 per cent in March over the corresponding periods of 1915.

New Era Spring Gets Plant

DETROIT, MICH., April 15—The New Era Spring & Specialty Co. has acquired the plant of the National Shock Absorber Co., Grand Rapids, Mich., which had been making shock absorbers and bumpers for the New Era company. The offices of the company will remain in Detroit.

Columbia Axle Adds 75 Per Cent

Production Increased 100 Per Cent—200 Men Added to Force

CLEVELAND, OHIO, April 15—The plant of the Columbia Axle Co., this city, has recently added 75 per cent more floorspace and with the new equipment installed the production of axles immediately jumped 100 per cent over the former capacity.

A feature of the new factory building is a sound-proof testing room. Specially constructed walls shut out all sound from this room. The floors and testing racks are of concrete with very solid foundations. Each axle before it receives the final O. K. is tested in this room under the supervision of trained inspectors. The axle is connected to an electric motor and the slightest noise is instantly detected and corrected before the axle is shipped.

Two hundred new men have been added to the factory force. The Columbia company manufactures both front and rear axles for passenger cars and supplies Cole, King, National, Monarch, Daniels, Davis, Auburn and others.

Crow Business Gains 100 Per Cent Over 1915

SOUTH BEND, IND., April 17—Automobiles reaching a total valuation of $155,700 were built and shipped by the Crow Motor Car Co., of Elkhart, Ind., during the month of March. This represents a 100 per cent increase in business over the same period last year, and places the Crow company among the leaders of Indiana automobile manufacturers in point of production. By the end of the year a company official estimates that fully 3000 cars will have been built and sold by the firm. The Crow company has at present 241 people on its payroll. Since Nov. 1, 1915, the company has expended $40,000 on buildings and factory extensions and another new building 60 ft. wide and 100 ft. long and two stories in height is to be built soon.

Spicer to Increase Capacity

PLAINFIELD, N. J., April 14—The Spicer Mfg. Co. is at present busier than ever before and is finding its capacity taxed to the utmost in order to keep pace with the demands of automobile manufacturers. The present output exceeds 500,000 universal joints per year and this will be increased to 65,000 a month as soon as new machinery is obtained. A large amount of new plant has been on order for months past and deliveries are expected very shortly. The bulk of the Spicer business is done with six sizes of joint, though there are small variations within each size, to take care of different methods of attachment required for different transmissions and axles. C. W. Spicer reports that axle and gearbox makers are rapidly adopting the S. A. E. standard tapers for their shafts, and that the variations in design are thus being cut down greatly; the special patterns are mostly for chassis of older design.

Republic Truck to Expand

ALMA, MICH., April 15—The Republic Motor Truck Co., will erect an addition, 60 by 500 ft., to its plant, thus increasing the total floorspace by 30,000 sq. ft. The working force, which is now about 700 men, will be greatly increased, as will production, which is now at the rate of 30 trucks a day.

Saxon Ships 1086 Cars First Nine Days of April

DETROIT, MICH., April 17—For the first nine working days of April, the Saxon Motor Corp. shipped 1086 cars, making an average of 120 per day. As the record month so far was March with 2604 shipped, it seems more than likely that this record will fall before the April total, which would be over 3000 cars if the present rate continues during the entire month. In January, 1556 Saxons were shipped, and 2231 in the following month.

Fire Fails To Stop Silvex

NEW YORK CITY, April 17—Despite a fire which considerably damaged the factory of the Silvex company, there has been no interruption in the company's business. Arrangements have been completed for the use of a neighboring building and there will be no delay in deliveries. When final arrangements are completed manufacturing facilities will be considerably increased.

Two New Members for M. and A. M.

NEW YORK CITY, April 15—The Detroit Gear & Machine Co., Detroit, Mich., maker of transmissions, clutches and transmission gears, and the G. Piel Co., Long Island City, maker of Long horns and muffler cut-outs, have become members of the Motor and Accessory Manufacturers, this city.

To Make Accessories Invented by Buick

JACKSON, MICH., April 13—The rights to manufacture a number of automobile parts and accessories invented by David E. Buick, have been secured by a corporation, soon to be announced, which will begin manufacturing them here. A new carbureter is to be one of the first things to be placed on the market.

February Exports Show Gain of 138.7 Per Cent Over February, 1915

7714 Motor Vehicles Shipped Abroad in That Month —Total Comprised 5651 Passenger Cars Valued at $4,063,429 and 2063 Trucks Worth $6,170,367

WASHINGTON, D. C., April 15—There was a large increase in the exports of automobiles and parts in February last, as compared with the same month of last year. According to figures compiled by the Department of Commerce, the exports in February last were as follows: Commercial cars, 2063, valued at $6,170,367; passenger cars, 5651, valued at $4,063,429; parts, not including tires and engines $2,173,409. For the month of February, 1915, the exports were 1002 commercial cars, valued at $3,022,482; passenger cars, 2230, valued at $1,785,330; parts, not including engines and tires, $564,976.

A Huge Gain

For the eight months' period ended February, 1916, the increase in exports was even greater than during the month's period. During February last, the exports of commercial cars reached the number of 14,467 machines, valued at $38,729,721, while the exports of passenger cars reached a total of 33,256 cars, valued at $25,534,507. The exports of parts, not including engines and tires, were valued at $14,965,360.

The exports for the same period of 1915 look insignificant in comparison with the above figures, the shipments of commercial cars amounting to only 4974 machines, valued at $14,011,924, while the exports of passenger cars totaled 9134 cars, valued at $7,593,429. The value of the parts exports, not including engines and tires, was $3,354,222.

The warring countries in Europe are largely responsible for the large gains that have been made in the automobile export trade. Russia is branching out as a buyer of American machines, 335 of them, valued at $1,514,729, having been shipped there in February last, while during the eight months' period of 1916, the shipments reached a total of 4568 vehicles, the value of which was $14,338,776. Russia did not figure in the export tables last year.

Naturally, the United Kingdom continues to head the list of countries importing American cars. The figures show that in February last 1169 cars, valued at $1,763,079 were shipped there while during the eight months' period the number was 14,740 and the value $20,377,746. This is a big gain over the figures for the same periods of last year, when 1183 cars, valued at $1,688,313, were exported in February and 4631 cars, valued at $6,447,015, during the eight months ended February.

France, too, continues to receive large shipments of American cars, 1027, valued at $2,804,931, being exported there in February, 1916, as against 412, valued at $1,389,599, shipped in February a year ago. For the eight months' period the exports rose from 2436 cars, valued at $6,407,087, in 1915, to 4199 cars, valued at $10,798,226, in 1916.

16 Cars to Germany

There were no shipments of cars to Germany in February last or during the eight months' period of this year, but during the eight months of 1915 there were sixteen cars, valued at $17,364, exported to that country. Italy is purchasing few American cars, only twenty-three, valued at $18,558, being shipped there in February last, as against sixteen, valued at $11,390, in February a year ago, while during the eight months' period the shipments rose from forty-two cars, valued at $35,112, in 1915, to 207 cars, valued at $146,144, in 1916. Little Denmark, which is just beginning to figure in the export tables, took twenty-seven cars, valued at $18,468, in February, while during the eight months' period of this year the number was 469 and the value $314,905. Other European countries imported 281 cars from this country in February last, the value being $301,082, as against 131 cars, valued at $406,368, in February a year ago, while during the eight months' period the exports amounted to 832 cars, valued at $2,300,646, in 1915, and 940 cars, valued at $975,010, in 1916.

Canada Still Gains

A big increase is noted in the shipments to Canada, 947 cars, valued at $593,492, being shipped there in February last, as against 349 cars, valued at $345,733, exported during the same month of last year. The figures for the eight months' period are even more impressive, no less than 4287 cars, valued at $3,033,808, being shipped across the northern border during the eight months of this year, as against 1727 cars, valued at $2,236,426, exported during the corresponding period of last year.

The West Indies and Bermuda are becoming good customers for American cars and this is a market apparently worth cultivating. Five hundred and thirty-eight cars, valued at $366,188, were exported there in February last, this

Exports of Automobiles, Trucks and Parts for February and 8 Previous Months

	February				Eight months ending February			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Commercial	1,002	$3,022,482	2,063	$6,170,367	4,974	$14,011,924	14,467	$38,729,721
Passenger	2,230	1,785,330	5,651	4,063,429	9,134	7,593,429	33,256	25,534,507
Total	3,232	$4,807,812	7,714	$9,233,796	14,108	$21,605,353	47,723	$61,264,228
Parts (not including engines and tires)	.....	564,976	.....	2,173,409	......	3,354,222	......	14,965,360
Total	.....	$5,372,788	.....	$12,407,205	......	$24,959,575	......	$79,229,588
BY COUNTRIES								
Denmark	.....	....	27	$18,468	......	....	469	$314,905
France	412	$1,389,599	1,027	2,804,931	16	17,364	......	....
Germany	.....	....	.....	....	4,199	10,798,226	2,436	$6,407,087
Italy	16	11,390	23	18,558	42	35,112	207	146,144
Russia	.....	....	335	1,514,729	......	....	4,568	14,338,776
United Kingdom	1,183	1,688,313	1,169	1,763,079	4,631	6,447,015	14,740	20,377,746
Other Europe	131	406,368	281	301,082	832	2,300,646	940	975,010
Canada	349	345,733	947	593,492	1,727	2,236,426	4,287	3,033,808
Mexico	10	6,347	57	70,210	49	54,774	226	238,526
West Indies and Bermuda	183	98,630	538	366,188	651	439,642	2,708	1,712,084
South America	132	66,767	.....	....	603	337,452	......	....
Argentina	.....	....	380	214,325	......	....	2,635	1,199,860
Brazil	.....	....	34	23,465	......	....	144	89,521
Chile	.....	....	54	35,295	......	....	540	373,389
Venezuela	.....	....	24	14,010	......	....	301	198,185
Other South America	.....	....	78	43,236	......	....	332	190,070
British East Indies	.....	....	230	170,158	......	....	1,859	1,400,401
British Oceania	526	451,706	598	597,661	1,880	1,536,591	4,005	3,403,917
Asia and other Oceania	131	197,433	1,564	497,523	814	1,443,677	3,291	867,727
Other Countries	159	145,526	348	187,386	427	349,567	2,272	1,605,933
Total	3,232	$4,807,812	7,714	$10,233,796	14,108	$21,605,353	47,723	$64,264,228

being a considerable gain over the figures for the same month of last year, which were 183 cars, valued at $98,630. The gain during the eight months' period was much greater, the exports increasing from 651 cars, valued at $439,642, in 1915, to 2708 cars, valued at $1,712,084, in 1916.

Heretofore it has been customary to group all the exports to South America under one head. The increase in the shipments to those countries has justified the Department in giving separate enumeration to the various countries, and it is interesting to note that while the combined exports in February a year ago were only 132 cars, valued at $66,767, Argentina alone in February last imported 380 cars, valued at $214,325. Again, during the eight months' period the combined exports to South America amounted to 603 cars, valued at $337,452, while Argentina during the same period of this year imported 2635 cars, valued at $1,199,860. Shipments to other European countries during the eight months of this year were as follows: Brazil, 144 cars, valued at $89,521; Chile, 540 cars, valued at $373,389; Venezuela, 301 cars, valued at $198,185; other South American countries, 332 cars, valued at $190,070.

East Indies Buy Many Cars

The British East Indies are also looming up large as buyers of American cars, 230 of them, valued at $170,158, having been shipped there in February last, while during the eight months of this year the number was 1859 and the value $1,400,401. British Oceania took 598 American cars in February last, the value being $597,661, while during the eight months' period the number was 4005 and the value $3,403,917. Other Asia and Oceania figured in the export trade to the extent of 1564 cars, valued at $497,523, in February last, while the shipments during the eight months of this year reached a total of 3291 cars, valued at $867,727.

The detailed figures, by countries, for comparative periods, appear in the accompanying tabulation.

S. F. Bowser Honored

FORT WAYNE, IND., April 15—S. F. Bowser, head of the Bowser Oil Tank and Pump Co. of Fort Wayne has been elected president of the Erie & Michigan Deep Waterways Assn.

Prof. Morton Joins Ambu Maker

CHICAGO, ILL., April 13—Professor Morton of the Armour Institute has joined the engineering staff of the American Bureau of Engineering, which at the present time is manufacturing a device for detecting and locating trouble in the electric starting and lighting systems of automobiles, called the Ambu Electric Trouble Shooter.

Dept. of Justice To Investigate?

May Undertake Gasoline Price Probe Independent of Trade Commission's Action

WASHINGTON, D. C., April 14—With Congress in receipt of the preliminary report of the Federal Trade Commission on the gasoline situation, as set forth in last week's issue of THE AUTOMOBILE, there is a persistent rumor afloat in Washington that the Department of Justice is preparing to institute an investigation of the subject apart from the investigation being made by the trade commission. Color is given this rumor by the action of Attorney General Gregory in declining to give the Senate information sought in the Kenyon resolution regarding the results of the investigation of the working of the supreme court's Standard Oil decree. The attorney general maintains that it would not be compatible with the public interest to give out the desired information.

The belief that the Department of Justice is going to delve further into the gasoline situation is further strengthened by the fact that department officials recently have been in frequent consultation with Charles B. Morrison of Chicago, who took part in prosecuting the dissolution suit against the Standard Oil Co., and is said to have conducted investigations since the dissolution of the trust, on behalf of the department, to determine whether the so-called subsidiaries have violated the anti-trust law since the decree was entered. The department's investigations are said to have disclosed that the so-called Standard Oil companies are not competing and that the stock ownership of the companies has not materially altered. Inasmuch as the decree permitted an unchanged ownership, present officials of the department have confined their efforts largely to determining whether any new violations of law were involved by the company.

A. C. A. May Test Water Fuel

FARMINGDALE, N. Y., April 18—Louis Enricht, of this town, who announced a few days ago that he had discovered a chemical which when mixed with water gives a fuel superior to gasoline, states that he has been experimenting for three years on chemicals which when added to water would produce a fuel and about three months ago discovered the compound which would produce the desired result. Up to within a few days ago his experiments have been performed upon his own three cars and those of neighboring garages. He then announced his discovery and made demonstrations to all who called until visitors became so frequent that it was impossible to satisfy them all. He has now decided that he will either sell the secret to the United States Government to dispose of as it wishes or to the automobile industry.

In explaining his compound to a representative of THE AUTOMOBILE, Mr. Enricht stated that the preparation could be made in either powdered or liquid form. In the form in which he used it it was prepared in a liquid solution, of which 4 oz. is enough to treat 5 gal. of water. The chemical, he states, remains in solution with the water in the tank until the water reaches the carbureter, at which time it is separated into hydrogen gas and oxygen. The hydrogen is used for combustion and the oxygen combines with the chemicals introduced. He also says that it is a peerless carbon remover and has more power than gasoline. It can be used in any needle valve carbureter, according to Mr. Enricht, but on a jet carbureter requires a larger nozzle. The cost figues at 1½ cents per gallon of mixture. He intends making a private test at the Automobile Club of America, but claims to be afraid of analysis of his fuel, which he says is simple.

Chemists and fuel experts have received the story of the new fuel with much reservation, pointing out that the energy necessary for the dissociation of water is as great as that secured by the recombination of the gases. They state that they know of no chemical which could possibly produce any such effect as described.

Motorzine—Another Gasoline Substitute

ST. LOUIS, MO., April 15—Motorzine, a substance invented by W. H. Stevens of St. Louis, to supply a cheaper substitute for gasoline, has been given exhaustive tests during which it is stated that an average of 27 m.p.g. was made. When mixed with crude oil or coal oil, the new fuel clarifies it at once, and the heavier oil does not carbonize, according to reports. The inventor claims it will be possible to make it for about 3 or 4 cents a gallon in 1,000,000 gal. lots.

E. V. A. A. To Standardize Lamps

CHICAGO, ILL., April 17—Suggestions on the question of standardizing lamps for electric vehicles were sought at a meeting of the Chicago section of the Electric Vehicle Assn. to-day, the information so obtained to be used by the standardization committee in preparing recommendations soon to be submitted. W. F. Bauer, chairman of the committee, explained several points which are in debate and must be disposed of to accomplish the committee's purpose. The standardization of charging devices will be undertaken at a later date.

N. E. Feels Freight Embargo

Increased Rates a Result of Freight Car Shortage—Some Cars Expressed

BOSTON, MASS., April 15—Increased freight rates for the buyers of automobiles is the latest thing that some of the purchasers of cars in New England face now and have been facing for a few weeks. The freight embargo presented a new angle when some of the Boston dealers were told that the railroads would not route their machines through to Boston and other New England cities direct.

They were told that New York and Albany would be the limit because of the need of cars, and also to insure, probably, that the freight cars would not be held too long in New England. Some of the dealers had to accept the inevitable and route their cars to Albany or New York. At those points the machines had to be transferred from the Western lines to cars of the New York, New Haven and Hartford, Boston & Maine and Boston & Albany railroads.

That necessitated hiring men there to make the shift. In some cases fenders had to be taken off to get the cars into smaller freight cars that had no end doors. When the machines reached Boston there was the work of putting the cars together again. On some of the machines the freight charges have represented about $20 more. Some of the dealers did not feel like adding this to the cost and so they cut it in two, standing half of it themselves. Others paid the entire excess freight over the normal. The dealers do not like to talk about it because they feel prospective buyers will be scared away. The cars that come on the gondola flat cars provided with canvas covers and frames are costing some of the dealers a little more, in some cases the cost of the covers being charged to them, but when they are returned they are allowed a rebate. In a few instances buyers have agreed to pay express charges to get cars quickly, but they are very few.

Stover Mfg. & Engine Co. To Be Capitalized at $3,000,000

FREEPORT, ILL., April 15—The Stover Engine Works and the Stover Mfg. Co., this city, will be merged into a new corporation to be known as the Stover Mfg. & Engine Co. The new corporation will be capitalized at $3,000,000.

This concern will manufacture the Stover tractor, the first model of which was turned out the latter part of March. This company expects to turn out about 100 of these tractors this year. One of the features of this tractor, is the use of cross cleated wheels in the rear. When the tractor is used in sod or stubble plowing, extra spurs are furnished, twenty-four to each wheel, which contribute to the footing of each wheel. The four-cylinder motor is rated at 40 hp. A Bennett carbureter and air cleaner is part of the equipment.

May Lower Freight Rates from Milwaukee to South

MILWAUKEE, WIS., April 15—Material reductions in the freight rates on pressed steel frames and other automobile parts from Milwaukee to southern points are in prospect as the result of the appeal of the Dorris Motor Car Co., St. Louis, Mo., to the Interstate Commerce Commission. The A. O. Smith Co., Milwaukee, Wis., recently shipped 202 automobile gear frame side bars, loose, weighing 23,000 lb., from North Milwaukee to St. Louis. The first class rate of 49.3 cents per 100 lb. was charged. The commission held the rate to be unreasonable and changed the rate to third class, amounting to 31.5 cents per 100 lb. Future shipments will take that rate.

American Rubber & Tire Co. Organization Completed

AKRON, OHIO, April 15.—The American Rubber & Tire Co. has been organized here and has purchased and succeeded to the business of the American Tire & Rubber Co. The new company is composed of experienced rubber men and the officers are: Fred. H. Snyder, president; Chas. Dietz, vice-president; Geo. W. Kratsch, secretary and treasurer; Henry L. Houk, general manager and assistant treasurer, and J. W. Rock, factory manager.

A two-story addition to the plant is in course of construction, and the company is making a complete line of tires and accessories, including American Indian red tubes, 5-min.-cure vulcanizing cement, repair materials and accessories.

McEvoy Heads American Top

JACKSON, MICH., April 13—The American Top Co. has been reorganized and J. A. McEvoy, of New York, has become president and general manager, while G. H. Quennard, who was president, has sold out his interest and retired from the company. E. G. Odette, who was secretary, treasurer and general manager, has also withdrawn from the company.

Anti-Friction Lubricant Co. Formed

ST. JOSEPH, MICH., April 12—The Anti-Friction Lubricant Co. has been formed with a capital stock of $20,000 to make all kinds of lubricants. A factory has been secured.

Steamers Relieve Freight Tie-Up

Situation Somewhat Improved to Points in Ohio—Otherwise Unchanged

DETROIT, MICH., April 17—With the opening up of navigation on the Great Lakes, the freight car situation will be relieved to some extent. Steamers of the Detroit and Cleveland Navigation Co. have been operating daily between this city and Cleveland now for one week, and there is a great traffic in cars to that city. Thus the distribution to Ohio points from Cleveland is now practically independent of the rail lines. The same will be true of cars for Buffalo and adjacent points when the boats begin operating from Detroit to Buffalo. The regular schedules to Buffalo will probably go into effect within two weeks.

There seems little change in the freight car situation this week so far as the automobile shippers are concerned. It may be that there is a slightly easier feeling, but even if a greater number of freight cars are available due to the lifting of embargoes by some of the eastern roads, the steadily increasing output of the factories quickly absorbs the greater supply of freight cars so that there is practically as great a shortage as ever, when the number of cars needed is considered. Makers are still shipping large numbers of machines on flats and gondolas with tarpaulins and board superstructures over them.

A meeting of the traffic managers of the various factories was held at the Board of Commerce here on April 13, and the present status of the situation was discussed at length. One factor which works against an adequate supply of the right kind of cars is the misuse of the automobile equipment by southern rail lines and shippers who are in the habit of appropriating the automobile cars for other lines of shipping. It is hoped to relieve this situation by conference with officials of these roads by a sub-committee appointed at the meeting of April 13. This conference will be held at the meeting on April 20 in Atlanta, Ga., of the Southern Assn. of Car Service Officers.

Demurrage Rates Higher

By a regular campaign among their dealers a great many of the manufacturers are seeking to prevent tie-up of cars at their destinations due to the tardiness of some dealers in unloading the automobiles. This is having a very good result generally. Although the demurrage rate was increased on April 1 to $2 a day after five days, the railroads are seeking to have a temporary rate of $5 per day to prevent holding cars.

Mexican Oil Fields Are Active

Tampico Exports Heavier—Two Plants May Adopt Rittman Process

TAMPICO, MEX., April 14—The flurry of excitement that was caused a few weeks ago by the invasion of Mexico by the American punitive expedition is subsiding and oil development operations are being resumed in the different fields situated adjacent to Tampico. Many of the American drillers who gathered in Tampico immediately after the Villa raid upon Columbus, N. M., have returned to their work. Oil exportations, both through this port and Tuxpam, are heavier than for several months. This is due largely to the additions that have been made to the different fleets of oil tank steamers. The refineries here are running full time. It is reported that the Rittman process of manufacturing gasoline will be installed by the Pierce Oil Corp. and the Eagle Petroleum Company in their Mexico refineries. It is claimed that experiments show that this process is specially suited for obtaining much larger quantities of gasoline from Mexican crude oil than is now to be had under the existing distillation method. The refinery of the Pierce Oil Corp. at Tampico will be equipped with fifty Rittman stills, and the plant of the Eagle Petroleum Company with twenty-five Rittman stills, it is stated here on reliable authority.

Many Mexican Concerns

One of the interesting features of the oil development situation in this region is the large number of native Mexican companies that have recently entered the industry. While for the most part these new concerns have comparatively small capital, they promise to become quite a factor in oil production here.

International Profits $661,118.98

NEW YORK CITY, April 15—Profits of $661,118.98 were made by the International Motor Co., this city, in the fiscal year ending Dec. 31, 1915, equaling 18.3 per cent on the $3,600,000 preferred stock. The gross earnings from operations for 1915 were $1,390,073.72, while the selling, administration and general expenses amounted to $728,954.74. The company's deficit balance of $3,118,197.73 on Jan. 1, 1915, has been reduced to $2,457,078.75.

Rubber Goods Elects Directors

JERSEY CITY, N. J., April 13—At the annual meeting here to-day of the stockholders of the Rubber Goods Mfg. Co., the retiring directors, with the exception of C. A. Hunter, were re-elected. The board now stands at ten instead of eleven, as follows: W. S. Ballou, N. F. Brady, S. P. Colt, F. W. Eddy, J. B. Ford, Ernest Hopkinson, Lester Leland, R. B. Price, H. E. Sawyer and E. S. Williams.

Edward V. Hartford, Inc., New Name

JERSEY CITY, N. J., April 13—The Hartford Suspension Co., this city, will change its name to Edward V. Hartford, Inc. This will not mean any change in the personnel or ownership of the company.

Rubber Lower—Copper Higher

NEW YORK CITY, April 18—A further recession in rubber and another increase in copper prices occurred last week. Upriver Para has dropped to 73 cents a pound, while Ceylon First Latex is now quoting at 83. Electrolytic and lake copper added ¾ cent more to its price this week, closing yesterday at 29½. Aluminum, antimony and lead declined. Aluminum closed yesterday at a lowering of 1 cent at 58; antimony dropped 2 cents to 41½; and lead closed at $7.75 per 100 lb. at a loss of 13 cents.

Though gasoline prices in this city remained unchanged last week, the situation according to oil men is still serious and a further rise is predicted. Stocks are said to be practically exhausted and the demand is far in excess of the supply. A factor adding to the tension in this market is the fact that great quantities of kerosene and other refinery products are piling up, and storage tanks throughout the country are well filled with the kerosene which has been refined from crude oil in the manufacture of gasoline. The problem of refining sufficient gasoline to meet the demand is not the only one the refiners have to face. Recent supply and demand statistics show that there are approximately 80,000 more barrels of crude oil consumed each day than are produced.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.59	.59	.58	.58	.58	.58	— .01
Antimony	.43½	.43½	.41½	.41½	.41½	.41½	— .02
Beams & Channels, 100 lb.	2.67	2.67	2.77	2.77	2.77	2.77	+ .10
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28¾	.29½	.29½	.29½	.29½	.29½	+ .00¾
Copper, Lake, lb.	.28¾	.29½	.29½	.29½	.29½	.29½	+ .00¾
Cottonseed Oil, bbl.	10.40	10.50	10.50	10.50	10.45	10.50	+ .10
Fish Oil, Menhaden, Brown	.54	.54	.54	.54	.54	.54	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.96	.96	.96	.96	.96	.96	...
Lead, 100 lb.	7.88	7.88	7.75	7.75	7.75	7.75	— .13
Linseed Oil	.76	.76	.76	.76	.76	.76	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.74	.73½	.73½	.73	.73	.73	— .01
Rubber, Ceylon, First Latex	.85	.86	.85	.84	.83	.83	— .02
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	53.00	54.00	53.50	53.50	53.50	53.00	...
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Hydraulic Pressed Steel Declares 50 Per Cent Stock Dividend

CLEVELAND, OHIO, April 15—The capital stock of the Hydraulic Pressed Steel Co., this city, has been increased from $1,000,000 to $1,500,000 and a special stock dividend of 50 per cent has been declared. The dividend will be payable to shareholders of record as of April 20.

It is stated that over 60 per cent of the outstanding stock has been optioned by Vice-President J. H. Foster at $540 a share on the $1,000,000 basis and $360 a share on the $1,500,000 basis. If the option is exercised, shareholders will be entitled to turn in their stock at the $540 figures.

An eastern syndicate has been formed to take over control of the company, provided present plans go through. It is understood that it is proposed to merge the company with an unnamed steel company with plants in the Pittsburgh district.

Dividends Declared

Packard Motor Car Co.; 1¾ per cent on common, payable May 1 to holders of record April 15.

Duplex Truck 10 Per Cent Dividend

CHARLOTTE, MICH., April 11—The Duplex Power Car Co., which makes the Duplex trucks, has declared a dividend of 10 per cent. The company's business is growing constantly and it is expected that enlargements will soon be made.

Last Dividend for Grabowsky Creditors

DETROIT, MICH., April 15—A final dividend of 2.6 per cent, equivalent to about $10,700, is being mailed by the Security Trust Co., trustee, to the creditors of the defunct Grabowsky Power Wagon Co. It brings up the total distributed to the creditors to about $174,900. All told, 61 per cent has been paid to creditors.

R-C-H to Pay Final Dividend

DETROIT, MICH., April 15.—A final dividend of about 7½ per cent is to be mailed soon to the creditors of the bankrupt R-C-H Corp. for which the Security Trust Co. has been trustee. The amount involved is about $37,000 and will bring up the total paid to secured claims to

$194,000 and to $211,000 on unsecured claims, since November, 1913. The concern failed in October, 1912. All told about 65 per cent of the approved claims of those creditors who extended credit will have been paid, while about 12½ per cent will have been paid to those who did not sign the extension agreement. The debts of the R-C-H Corp. totaled $1,800,000.

Toledo Machine and Tool Capital Now $3,000,000

Toledo, Ohio, April 13—The capital stock of the Toledo Machine and Tool Co. has been reduced from $6,000,000 to $3,000,000. This is $1,800,000 more than the original capitalization which was $1,200,000, prior to Dec. 22, last. It was then increased to $6,000,000 when eastern capital became interested in the plant.

Saginaw Company Capital Is $100,000

Saginaw, Mich., April 13.—The Saginaw Motor Car Co., with a capital stock of $100,000, has been organized and will make the Yale eight, to sell at $1,285. The officers of the company are: John A. Cimmerer, president; J. Will Grant, vice-president; W. C. Wiechmann, secretary; Harry E. Oppenheimer, treasurer; L. J. Lampcke, general manager and engineer.

Standard Co. Has $1,000,000 Capital

Dover, Del., April 13—The Standard Car Construction Co., with a capital of $1,000,000, has been formed to manufacture automobiles and trucks. The incorporators are all from Philadelphia and include F. R. Hansell, G. H. B. Martin, and S. C. Seymour.

Tire Securities Are Strong

Goodyear, Firestone, Miller Rubber and Portage Show Large Gains

New York City, April 18—Much strength was shown by the tire issues last week and as a result a majority of the issues closed on Saturday with large gains. Tire issues were very buoyant while the others were dull. Goodyear, Firestone and Miller Rubber, chalked up gains ranging from 30 to 35 points, while Portage Rubber rose 5 points. The strength of these and other tire stocks is said to be due to a certain extent to the large automobile production this year with the consequent demand for tires and the fact that the price of crude rubber has had another decline.

Automobile issues were less in demand last week with a consequent drop in prices. General Motors featured the decline with a 20-point drop on its common; Chalmers went down 9 points; Chevrolet after a 21-point rise the previous week, dropped 6 points; Studebaker dropped 3 points, Maxwell common ⅝ points, the first preferred ½ point, and the second preferred 2⅜ points; and Willys-Overland dropped 2 points.

Maxwell is being purchased by professionals on a rumor that the common stock is to get a 10 per cent dividend soon and the second preferred 6 per cent. All the back dividends have been disposed of by the recent distribution of 14¼ per cent in non-interest bearing warrants.

Apropos of the increased demand in tire issues this week, reports of large earnings by the tire companies have no doubt been the cause of much activity in these stocks. It is stated that earnings by the Ajax Rubber Co. this year are running far in excess of any previous year, and earnings of between $800,000 and $1,000,000 are being predicted. This company will increase its production to three times its present capacity.

Auburn Ignition Increases Capital

Auburn, N. Y., April 15—The Auburn Ignition Mfg. Co., Inc., this city, manufacturer of spark plugs, valve lifters, etc., has increased its capital from $25,000 to $60,000, in order to secure more efficient manufacturing facilities and working capital. The management of the company will continue with S. M. Kitchen, general manager; C. A. Frank, production manager; and H. G. Kitchen, sales manager.

Chelsea Screw Co. Reorganized

Chelsea, Mich., April 11—The Chelsea Screw Co. has been reorganized. Its capital stock is now $50,000 instead of $18,000. A new large addition is to be put up and a number of automobile parts are to be produced.

To Boom N. E. by Abolishing Motor Law Restrictions

Boston, Mass., April 15—If the plans now under way here are brought to a head, and there is no reason to doubt their success, many thousands of dollars will be spent to boom New England which will result in drawing thousands of motorists to the section. At a meet-

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	67½	69	—2
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	78	87	87	90	— ½
Chalmers Motor Co. com	93	98	150	160	—9
Chalmers Motor Co. pfd	89	91	97	100	—1
Chevrolet Motor Co.	..	..	185	187	—6
Electric Storage Battery Co.	51¼	52½	60	62	—1½
Firestone Tire & Rubber Co. com	453	460	800	814	+35
Firestone Tire & Rubber Co. pfd	110	112	114	115	+1
General Motors Co. com	143	144½	430	450	—20
General Motors Co. pfd	101	102	115	117	— ½
B. F. Goodrich Co. com	49	51	76¼	77½	— ¼
B. F. Goodrich Co. pfd	101½	102½	115	117	— ¼
Goodyear Tire & Rubber Co. com	240	245	370	390	+34
Goodyear Tire & Rubber Co. pfd	104	106	114	116	+1
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	13	15	13	17	—4
International Motor Co. pfd	32	34	25	35	—5
Kelly-Springfield Tire Co. com	136	137	72½	73	— ½
Kelly-Springfield Tire Co. 1st pfd	136	138	96	98	..
Kelly-Springfield Tire Co. 2d pfd	..	..	..	..	..
Maxwell Motor Co. com	52	54	72⅛	72⅝	— ⅝
Maxwell Motor Co. 1st pfd	86	86½	84⅝	85	— ½
Maxwell Motor Co. 2d pfd	39	40	54⅛	55	—2⅜
Miller Rubber Co. com	185	190	265	..	+30
Miller Rubber Co. pfd	101	103	113½	114½	+1½
New Departure Mfg. Co. com	..	..	181	184	—1
New Departure Mfg. Co pfd	..	..	111	..	..
Packard Motor Car Co. com	86	..	165	175	..
Packard Motor Car Co. pfd	93	..	100	104	..
Paige-Detroit Motor Car	..	..	750	850	..
Peerless Motor & Truck Corp	..	..	25½	26½	— ½
Portage Rubber Co. com	34	36	75	77	+5
Portage Rubber Co. pfd	85	95	108	109	+2
Regal Motor Co. pfd	..	..	18	25	+3
*Reo Motor Truck Co.	13	14½	28	30	..
*Reo Motor Car Co.	32	34	39	40	+3¼
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	68	70	87	89	+1
Studebaker Corp. com	66	67	138	140	—3
Studebaker Corp. pfd	99	100	112	114	..
Swinehart Tire & Rubber Co	90	95	84	86	—4
Texas Co.	142	144	189	191	—6
U. S. Rubber Co. com	71	73	53	54	+1½
U. S. Rubber Co. pfd	107	108	108	109	—2
Vacuum Oil Co.	208	210	240	243	..
White Motor Co. (new)	..	..	49	52	—1
Willys-Overland Co. com	128½	129½	228	230	—2
Willys-Overland Co. pfd	101	102	104	105	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co.	..	..	31½	..	+ ½
Chalmers Motor Co. com	90	93	..	164	+2
Chalmers Motor Co. pfd	92	95	97	99	—1
Continental Motor Co. com	170	180	..	38	—1
Continental Motor Co. pfd	..	..	9½	10¼	..
Ford Motor Co. of Canada	600	..	..	405	..
General Motors Co. com	146	150	410	450	—30
General Motors Co. pfd	104	107	113	116	— ½
Maxwell Motor Co. com	47	49	71	74	+ ½
Maxwell Motor Co. 1st pfd	84	86	83	86	— ½
Maxwell Motor Co. 2d pfd	39½	41½	53½	56	+ ½
Packard Motor Car Co. com	86	..	165	175	..
Packard Motor Car Co. pfd	93¼	..	..	103½	— ½
Paige-Detroit Motor Car Co.	..	..	..	850	..
*Reo Motor Car Co.	32¾	33¼	38¼	39¼	+4¼
*Reo Motor Truck Co.	13	14	28⅝	29½	+2
Studebaker Corp. com	67	69	136	140	—2½
Studebaker Corp. pfd	100	103	111	..	..

INACTIVE STOCKS

*Atlas Drop Forge Co.	..	26	..	40	..
Kelsey Wheel Co.	195	..	320	365	..
*W. K. Prudden Co.	19	20½	29½	33	..
Regal Motor Car Co.	12	20	15	22	+3
Stewart-Warner Speed. Corp. pfd	102	105	109	..	..

*Par value $10.

ing here, there were 200 men representing the six States who agreed that the time had come to advertise their locality properly, and the master minds said that at least $250,000 and if need be $500,000 will be spent annually for the next five years to tell the glories of New England.

One of the first things that the organization will be asked to do is to wipe out all the existing provisions in the present motor laws which place restrictions upon motorists as it is recognized that there are now some bad sections in them.

Parrott Tractor Specifications Announced

JACKSON, MICH., April 15.—The specifications of the Parrott tractor which is being made by the Parrott Tractor Co., have been announced. The power plant will be a four-cylinder bloc motor, 3¼ by 4¼; carbureter, Schebler; ignition, Dixie; storage battery, Willard; roller bearings, Hyatt; radiator, Candler; wheels, Hayes; tires, Kelly-Springfield dual block tires; a two-unit starter and lighting system. Wheels of different width will be furnished according to the special work the tractor is destined to perform. It is planned to make 3000 tractors within the next twelve months.

Beeman Garden Tractor in Minneapolis

MINNEAPOLIS, MINN., April 17—Another concern is to join the large local colony of tractor factories. The Beeman Garden Tractor Co. has been incorporated by E. R. Beeman, P. J. Lyons, A. G. Furber, P. H. Knoll and R. C. Brewsaugh. It will make a gasoline-driven garden cultivator, operated on foot. Beeman, manager of the Monitor Drill branch of the Moline Plow Co., and P. J. Lyons, president of the Bull Tractor Co., are the inventors.

Can't Cover Road With Tar

BOSTON, MASS., April 15. — Governor McCall has signed the bill put in by the Automobile Legal Assn. and passed by the Legislature prohibiting contractors on roads from spreading oil and tar across the entire width of a highway at a time.

To Dim Headlights at Portland

PORTLAND, ME., April 15—The city council is framing an ordinance to prevent the use of glaring headlights within the city limits, and also to prohibit the use of muffler cut-outs.

To Continue Dealers' Contest Assn.

NEW YORK CITY, April 19—The Motor Dealers' Association Contest Assn. has voted against dissolution.

The former officers were re-elected as follows: W. C. Poertner, president; Emanuel Lascaris, first vice-president; E. E. McShane, second vice-president; J. C. Nichols, treasurer, and E. F. Korbel, secretary.

Canada Buys 22,070 New Cars

Registrations Show Good Record for Past Year—17,570 Are Fords

OTTAWA, ONT., April 15—Recent statistics show that of all automobiles licensed in the nine provinces of the Dominion of Canada during the past year the Ford car was chosen in a proportion of four times to one of all other makes combined. There were 22,070 cars sold in Canada in these twelve months. Of this number 17,570 were Fords, leaving a balance of 4500 cars of other makes. The number of Fords in the Dominion will be increased by nearly 40,000 by Aug. 1, 1916.

Several of the dealers report their sales up to date this season to be treble what they were at the same time last year, but hardly expect that this exceptional increase will be maintained throughout the season. They all agree, however, that 1000 cars will be well within the mark.

At an average of $1,000 each this means an investment of a million dolares in cars in the district of which Ottawa is the center.

Out of 8616 licensed automobiles in Manitoba for 1915 there were 3452 Fords, 1004 McLaughlin-Buicks and 622 Overlands. In Saskatchewan, there are 3514 Fords, 742 McLaughlin-Buicks and 304 Overlands. In Alberta 5586 cars bear license plates; of this number there are 2695 Fords, 583 McLaughlin-Buicks and 312 Overlands.

To Enforce Boston Laws

BOSTON, MASS., April 15—Police Commissioner O'Meara has sent word to the automobile people and garages that he has instructed the police to see that some of the motor laws that have not been enforced are lived up to from now on. One of the laws relates to allowing cars to stand on streets unattended for various periods, and without the motors shut off. The other law relates to smoking in garages.

Technically, Law Bars Non-Resident Motorists from Bay State

BOSTON, MASS., April 15—According to W. A. Thibodeau, general counsel for the Automobile Legal Assn. of Boston, and an authority on motor laws, it is illegal for the residents of any other State, New Jersey excepted, to enter Massachusetts without registering despite the fact that there is a reciprocity law on the statute books. In fact it is because of the reciprocity law that non-residents are legally not entitled to enter, and as a matter of fact, although Mr. Thibodeau does not say so outright, every non-resident who last year entered the State, except New Jersey motorists, did not do so legally. He calls attention to the fact that the blame for this is due to the Massachusetts Highway Commission. And also that it is not a serious matter, for no new legislation is needed, merely a meeting of the commission and a promulgation stating what States grant reciprocity and the length of time their motorists may stay in the Bay State.

Owners' Licensing Bill Passes Assembly

ALBANY, N. Y., April 19.—The Cromwell-Kelly bill, compelling owners who operate their cars in New York City to obtain licenses similar to a chauffeur's, passed the Assembly last night. It is expected that it will pass the Senate tomorrow. The license fee is $1 for the first year and 25 cents for renewal.

Brown Bill Passes N. Y. Senate

ALBANY, N. Y., April 13—Half of the automobile registration fees in New York State will go to the municipality in which they are paid, according to the Brown automobile registration bill which passed the Senate yesterday. This year New York State will spend $16,000,000 for roads upstate, and 68 per cent of it will have to be paid by New York City. About $10,000,000 is to be spent for new roads, $4,000,000 for highway maintenance and $2,000,000 for State aid.

To Lessen N. Y. Light Glare

ALBANY, N. Y., April 13—The Hewitt resolution seeking a legislative investigation to provide means to lessen the glare of automobile lights was adopted to-day by the Senate. The desired appropriation of $5,000 for expenses was cut to $4,000.

Tibbitts 19 Years with Goodrich

AKRON, OHIO, April 17—E. C. Tibbitts is celebrating the nineteenth anniversary of his appointment as advertising manager for the B. F. Goodrich Co. Tibbitts is the only advertising manager the Goodrich company has ever had.

Detroit Radiator to Sell Starter

DETROIT, MICH., April 14—The Detroit Radiator and Specialty Co., this city has taken over the sales of the B-B mechanical starter, formerly handled by the Detroit Auto Accessory Co. The Detroit Radiator and Specialty Co., is also marketing the More Speed gears for Ford cars.

O'Donnell Wins Ascot Derby

His Duesenberg Averages 65.4 M.P.H. in 150-Mile Speedway Race

ASCOT SPEEDWAY, LOS ANGELES, CAL., April 15—*Special Telegram*—Eddie O'Donnell, in the Duesenberg won the 150-mile Ascot Motor Derby to-day, repeating his victory of Corona and ending his western racing engagements. His time was 2:17.09, or at an average speed of 65.4 m.p.h. Pullen, in a Mercer, was second in 2:17.27 4/5; Hughes, in the Omar, was third in 2:18.24 1/5; Waterman in a Gandy Special was running in fourth place when flagged; Tahis, in the Grant Special, was flagged when the crowd overran the course; Joe Thomas, in a Mercer, went out with a cracked cylinder in the fifth lap and Lou Gandy, in a Gandy Special, broke his oil line in the fiftieth lap. Lloyd, in an Oakland Special, stripped his timing gear at the start. R. C. Durant, who was to have driven the Cyclone, and Tetzlaff, who was to have driven the Durant Special, failed to appear.

Wheeler Resigns as Twin City Speedway President

INDIANAPOLIS, IND., April 13.—Frank H. Wheeler of Indianapolis has resigned as president of the Twin City Motor Speedway Assn. H. E. L. Habighorst of St. Paul, vice-president, will be temporary head. Meyers & Gates, attorneys of Indianapolis, have begun civil action against Mr. Wheeler in the Ramsey County District Court for $24,334.50 attorneys' fees in connection with settlement of the Speedway's financial troubles last year. Mr. Wheeler said regarding the speedway that he is through with it.

Patterson Makes Fast Time

CHICAGO, ILL., April 10—E. C. Patterson, driving a Cadillac, made the best time yesterday in the trials at Speedway park for the non-professional drivers' race to be held May 20. Patterson averaged 74½ m.p.h. for ten laps, or 20 miles. Seven other entrants in the event were giving their cars workouts and making speeds in the neighborhood of 73 and 74 m.p.h. The cars out included Mercers, Cadillacs and Packards.

Sinsabaugh on Contest Board

NEW YORK CITY, April 15—C. G. Sinsabaugh, editor of *Motor*, has been appointed a member of the contest board of the American Automobile Assn. Another addition is A. G. Waddell, of California. Mr. Sinsabaugh served two terms as chairman of the contest committee of the Chicago Automobile Club.

The A. A. A. contest board consists of the following members: Richard Kennerdell, chairman; R. W. Smith, Colorado; C. I. Ryan, Georgia; David Beecroft, New York; F. A. Croselmire, New Jersey; F. G. Webb, New York; Clifford Ireland, Illinois; H. W. Knights, Massachusetts; P. D. Folwell, Pennsylvania; R. W. Carr, Texas; F. M. Fretwell, Washington; C. G. Sinsabaugh, New York, and A. G. Waddell, California.

Coatalen a Sheepshead Entry

NEW YORK CITY, April 19—The Sheepshead Bay Motor Speedway Corp. has received by cable the entry of Louis Coatalen in a Sunbeam for the opening races at Sheepshead Bay May 13.

A. E. Wood, who has been driving Stutz cars, on the Pacific Coast, is returning to the East for the Sheepshead opening and it is probable that he will appear at the wheel of one of Harry Harkness' Delage team.

Sheepshead Speedway Moves Offices

NEW YORK CITY, April 8—The Sheepshead Bay Motor Speedway Corp. to-day moved its offices from 17 Battery Place to the second floor of the Eley Bldg., Forty-ninth Street and Broadway. The sale of tickets for the opening meet on May 13, will begin April 24, the McBride ticket agency handling the sale in New York City and Abraham & Straus in Brooklyn. Reservations of sections will be made for any automobile clubs which desire them.

Birmingham Speedway Started

BIRMINGHAM, ALA., April 14—The formal breaking of ground for the new speedway to be built in this city by the Birmingham Motor Speedway Co. will take place to-morrow.

Atwater Kent Ignition on Hupmobile

PHILADELPHIA, PA., April 15—The Atwater Kent Mfg. Works, this city, reports that the Hupp Motor Car Co., Detroit, Mich., has renewed its contract for Atwater Kent ignition on its 1917 cars.

Splitdorf Equipment for Lawson

NEWARK, N. J., April 17—The Splitdorf Electrical Co., this city, has contracted to supply the Lawson Mfg. Co. with Dixie 40 magnetos, spark plugs, high-tension switch and cables and electric lighting and starting outfits for the Lawson 1-ton truck.

Willys-Knight Adopts Adco

MILWAUKEE, WIS., April 15—The Willys-Knight 1916 series will use Adco coil spring shock absorbers, made by the Auto Device Mfg. Co., this city, as standard equipment.

Milwaukee Display a Success

Showroom Exhibition Sales Are Double Those Made at Indoor Show

MILWAUKEE, WIS., April 15.—A cumulative effort to stimulate retail car buying at the very opening of spring and the touring season best sums up any description of the second annual Dealers' Showroom Automobile Display conducted under the auspices of the Milwaukee Automobile Dealers, Inc., on April 11, 12 and 13. All Milwaukee and the territory for 50 miles around, served by interurban lines from Milwaukee, went motor shopping. While no actual figures of sales are available, dealers declare the display to have been a greater success than the first one, lasting but two days, in April, 1915. There were many visitors, of course, who were only sightseers, but compared with an indoor motor show, the showroom display sales record is better by two to one.

Prospects made at the Auditorium show of the M. A. D. in the middle of January were turned into purchasers at the three-day show this week. A better brand of weather could not have been served than that of the first day.

Each showroom was uniformly decorated, simply but elegantly, with Alabama smilax, palms, potted plants and cut flowers. The M. A. D. looked after the decorations. Some dealers augmented the scheme, and in the case of Harry Newman, Inc., Chalmers agent, a great deal of money was expended for auxiliary decorations on exterior and interior.

Chicago Used-Car Show Postponed

CHICAGO, ILL., April 15—The used car show, which was planned for this spring by the Chicago Automobile Trade Assn., has been postponed for probably one year. On account of the shortness of time after approval was given by the National Automobile Chamber of Commerce it was thought that it would be unwise to attempt to stage the show in May of this year.

100 Cars at Danville Show

DANVILLE, ILL., April 15—The first automobile show by the dealers of Danville and eastern Illinois, was held in the Chambers Building on April 12, 13 and 14. One hundred cars were on exhibition, together with a complete line of accessories.

Fifty Cars at Seattle Show

SEATTLE, WASH., April 14—With fifty representative cars on display, Seattle's third annual automobile show was held in the Arena, and proved a stellar attraction for hundreds of automobilists and prospective car owners from the Pacific Northwest. Many of the visitors came from nearby Canadian cities and Portland, as well as from cities in the State.

The first automobile that ever traveled the streets of Seattle was ranged alongside one of the very latest models.

The steady increase in the price of lumber in the Northwest, coupled with the boom in shipping and other large business interests generally mean a big increase in business for the Seattle dealers, who will profit from the show.

Velie Buyers in Special Train

MOLINE, ILL., April 15—The Velie Co. chartered a special train from Iowa City, Iowa, Saturday, April 15, met 150 guests with a band at Davenport, Iowa, and escorted them via automobile to the Velie plant for a tour of inspection. A dinner was served for the guests at the Manufacturers' hotel in Moline and following the purchase of thirty new cars the owners drove back to Iowa City, taking with them the remainder of the party. In addition to the sale of the thirty cars the company shipped forty-two other cars on the same day.

Chevrolet Salesmen in Annual Meeting

NEW YORK CITY, April 14—The annual meeting of the Chevrolet Salesmen's Assn. was held at the factory of the Chevrolet Motor Co., West Fifty-seventh Street and Eleventh Avenue, this city, Friday April 7. The following officers were re-elected: Honorary president, W. C. Durant; honorary vice-president, W. C. Sills; president, W. A. Sellon; vice-president, H. Lauterbach; treasurer, M. C. Reeves; secretary, W. J. Owens.

Nation-Wide Tire Show This Week

NEW YORK CITY, April 17—During the week beginning to-day the concerns selling the United States Rubber Co.'s line of "balanced" tires will have special exhibitions and a corps of experts to explain exactly what "balanced" means and how the balance between fabric, carcass and rubber tread adds to the life of the tire.

Micatite Is New Pittsfield Plug

NEW YORK CITY, April 14—The name Micatite has been selected as the winner of the $25 in gold offered by the Pittsfield Spark Coil Co., Pittsfield, Mass., for its new spark plug, which incorporates in its construction gas and air tight features. The name was suggested by F. L. Brown, 9400 Edmunds Avenue, Cleveland, Ohio. Over 5000 names were submitted.

Studebaker Tests Owners' Cars

To Teach Methods of Increasing Economy—Corrects Owners' Faults in Driving

DETROIT, MICH., April 17—In order to convince owners that they could operate their cars with greater gasoline economy if they would but handle them more intelligently, the Studebaker Corp. has recently carried on a number of tests in all sections of the country among owners of Studebaker cars. The idea has been worked out not with the thought of making tests primarily, but mainly to show owners how to get the greatest possible mileage per gallon.

In actual operation, the Studebaker plan has been carried out in somewhat the following manner: An expert calling upon an owner who is not getting maximum mileage, first disconnects the regular gasoline supply and attaches an auxiliary tank containing 1 gal. The owner then takes the wheel and drives a few miles, the expert at his side making mental notes the while. At the end of this run, the amount of gasoline used is measured.

The expert from the factory then relieves the owner at the wheel. Before starting out he adjusts the carbureter, and any other things that may need adjusting, in order to obtain greatest economy in operation. The expert then drives the car and drives it properly, explaining the owner's faults to him as they go along.

Reports indicate that in most instances the owner did not have the carbureter adjusted to best advantage. In other cases he might have had a tendency to leave the motor running while away from the car for a considerable length of time. In still other instances his fault might be in speeding up the motor and slipping the clutch when a shift of gears would have been the logical thing to do. Possibly spark plugs might have influenced the economy. At any rate, the factory expert is doing some great missionary work, and the Studebaker Corp. likes the idea immensely.

Movies for Traffic Safety

DENVER, COL., April 14—A plan to promote traffic safety in Denver by means of motion pictures is being worked out by Commissioner of Safety Alexander Nisbet. He intends to prepare a special film showing how the most common accidents are caused, illustrating the purpose of the most important traffic rules, showing the right and wrong way for both vehicles and pedestrians to deal with the main features of traffic conditions and requirements, and to furnish this film to all the moving picture theaters in the city. This method of spreading traffic knowledge is planned as an addition to a campaign of education now being conducted by the Department of Safety through printed rules and suggestions and through explanations given personally by traffic officers where occasion demands. There were 272 arrests of motorists during the month of March for violating traffic laws, and Commissioner Nisbet is seeking to remove causes for arrest by educating the public to work together for law observance and proper carefulness in general.

New York Eisemann Station in New Hands

NEW YORK CITY, April 13—The magneto service station in this city of the Eisemann Magneto Co. has been discontinued, the Auto Electric Service Co. taking over the stock, machines, etc. The latter company will continue at the same address, 245 West Fifty-fifth Street, and will act as service station for New York City proper, also Long Island City, Bronx, and Westchester and Rockland counties in New York State, and Bergen, Hudson, Essex and Union counties in New Jersey. The owners of the Auto Electric Service Co. are Henry Berlinghof, for the past three years service manager of the Eisemann Magneto Co., and George Strasser, for the past ten years foreman of the Eisemann repair department. W. B. Clowes succeeds Mr. Berlinghof as service manager at the company's plant in Brooklyn.

Johnson Detroit Gibney Manager

DETROIT, MICH., April 17—Following the resignation of Detroit branch manager H. L. Winter of the Gibney Tire & Rubber Co., O. S. Johnson has been appointed to manage the Gibney interests here. Mr. Johnson was formerly a district manager for the United States Tire Co.

Gramm-Bernstein in New York

NEW YORK CITY, April 14—The Gramm Worm-Drive Motor Truck Co. has leased 1204 sq. ft. of floorspace in the new Brokaw Building, in the Times Square district here, to act as eastern branch of the Gramm-Bernstein Co., Lima, Ohio.

Hess Is Firestone Cleveland Mgr.

CLEVELAND, OHIO, April 15—J. D. Hess, Jr., for three years a salesman in the Detroit branch of the Firestone Tire & Rubber Co., has been promoted to the management of the Cleveland office of the company.

Factory Miscellany

Canadian Regal to Build—The Canadian Regal Motors, Ltd., East Toronto, Ont., will build a factory costing approximately $18,000.

Acme Rrbber to Build—The Acme Rubber Co., Brampton, Ont., is contemplating building a plant at an estimated cost of $30,000.

Houk to Build—The Houk Mfg. Co., Buffalo, N. Y., is completing plans for an addition at Elmwood Avenue and the New York Central Railroad.

Sparks-Withington to Build—The Sparks-Withington Co., Jackson, Mich., has completed plans for a new plant the same size as its present factory.

To Manufacture Tires—C. C. Coddington, Charlotte, N. C., and others, are interested in the establishment of a corporation capitalized at $500,000 for the manufacture of automobile tires.

Buys Lexington Co. Plant—The Waller Mfg. Co., furniture manufacturer, Lexington, Ky., has purchased the former Lexington Automobile Co.'s plant.

Prudden's New Plant—The W. K. Prudden Co., Lansing, Mich., has awarded the contract for its new factory, 70 by 685 ft., three stories, to cost approximately $100,000.

Hupp in Canada—The Hupp Motor Car Corp. has been granted permission to carry on a manufacturing business in Ontario with a capital stock of $100,000.

Kleiber Truck's New Assembling Plant—The Kleiber Truck Co., San Francisco, Cal., has plans for a new motor truck assembling plant to be built at Fosom and Eleventh Streets, that city.

Kainer Adds—The Kainer Mfg. Co., Chicago, Ill., maker of automobile parts and pumps, has moved to 761 West Mather Street, where a brass foundry has been added to its facilities.

Dayton Body Co. Formed—The Dayton Body Co., Dayton, Ohio, has been formed with $100,000 capital to manufacture automobile bodies. A factory will be constructed, 64 by 384 ft., four stories, of brick. J. D. Art is general manager.

Aluminum Goods to Double Size—The Aluminum Goods Mfg. Co., Manitowoc, Wis., has broken ground for a new shop addition, to be five stories high, 85 by 350 ft. in size, and contain the executive offices. It will require about five months' time to complete the building. The capacity of the plant will thereby be doubled.

Kero Carbureter Formed—The Kero Carbureter Co. has been formed with a capital of $15,000 by Milwaukee interests to manufacture fuel vaporizing devices for internal combustion engines. The incorporators are R. N. Van Doren, J. J. McJeskey and W. G. Gehrs.

Goodyear Issues Tire Repairing Manual—The Goodyear Tire & Rubber Co., Akron, Ohio, has issued the new Goodyear Manual of Tire Repairing. It is primarily a manual discussing the material, equipment and methods of application, necessary to the complete success of the tire repairman. The manual is illustrated.

Spoke and Wheel Factory Enlarges—The Bimel Spoke & Wheel Co., Portland, Ind., is extending its plant by the addition of six large kilns for the final seasoning of spokes and felloes. This will provide sufficient capacity for a daily production of 400 sets of pleasure car wheels and fifty to 100 sets of truck wheels.

The Automobile Calendar

April 24-29.......Bangor, Me., Show.
April 26-May 6...Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn.
April 29.........Fresno, Cal., Road Race, Raisin Classic Trophy Assn.
May 6...........Sioux City, Iowa, Speedway Race, Sioux City Speedway Assn.
May 9-12........Hot Springs, Va., N. A. A. A. J. Meeting, The Homestead.
May 13..........New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 14-20.......Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.
May 20..........Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 25..........Pennsylvania's Second Good Roads Day.
May 26-27.......Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30..........Des Moines, Iowa, Iowa Derby, 20 Miles; Des Moines Special, 10 miles.
May 30..........Tacoma, Wash., 100-Mile Speedway Race, Tacoma Speedway Assn.
May 30..........Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn.
May 30..........Indianapolis Speedway 300-Mile Race.
May 30..........Minneapolis, Minn., Speedway Race.
June 4..........Sheepshead Bay Speedway, 30-Mile Race, American Liberty Day Committee.
June 8..........New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphan's Automobile Day Outing Assn.
June 10.........Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 12-16.......S. A. E. Summer Trip on Great Lakes.
June 16-17.......Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.
June 20.........Galesburg, Ill., Track Race, 100 miles.
June 28.........Des Moines, Iowa, Speedway Free-for-all, 300-mile race.
July.............LaGrande, Ore., Track Race, LaGrande Motor Club.
July 2-6.........Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4...........Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4...........Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4...........Minneapolis 300-Mile Speedway Race.
July 4...........Sioux City Speedway Race.
July 15..........Omaha, Neb., Speedway Race.
July 15..........North Yakima, Wash., Track Race, Riegel-Hiller Co.
July 17-21.......Dallas, Tex., Tractor Demonstration.
July 24-28.......Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4....St. Louis, Mo., Tractor Demonstration.
Aug. 5...........Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 7-11........Fremont, Neb., Tractor Demonstration.
Aug. 11-12.......Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12..........Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 14-18.......Cedar Rapids, Ia., Tractor Demonstration.
Aug. 18-19.......Elgin Road Race, Chicago Auto Club.
Aug. 21-25.......Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1...Indiana Tractor Demonstration.
Sept. 2-9.........Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 4...........Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4...........Indianapolis Speedway Race.
Sept. 4-5.........Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 4-8.........Madison, Wis., Tractor Demonstration.
Sept. 11-16.......Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16..........Providence Speedway Race.
Sept. 29..........Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30..........New York City, Sheepshead Bay Speedway Race.
Oct. 7...........Philadelphia Speedway Race.
Oct. 7...........Omaha Speedway Race.
Oct. 14..........Chicago Speedway Race.
Oct. 19..........Indianapolis, Ind., Race. Indianapolis Motor Speedway.
Nov.............Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in

the Industry

Jandorf Opens Accessory Shop—The Jandorf Automobile Co., New York City, has made another extension to its business by opening a new tire and accessory store at 1761 Broadway. In addition to the other Broadway quarter at 1759, this company occupies a building at 303 West Fifty-ninth Street with its body department. The factory and service shops are located at 239 West Fifty-sixth Street.

Pittsburgh Apperson in New Hands—The Apperson branch in Pittsburgh, Pa., has been sold to the E. A. Myers Co., 5977 Center Avenue. This company has at present under construction a new building at the corner of Louisa Street, Penant way and Girts way. It is 61 by 110 ft., five stories and fireproof. The company will move into it about June 1.

Philadelphia Packard Making Changes—Extensive changes are being made by the Packard Motor Car Co., Philadelphia, to its branches in the East. In Bethlehem a new showroom and service station, 55 by 100 ft., and one-story high, is being erected at Linden and Spruce Streets; a one-story building, 50 by 100 ft., is being erected at the corner of Mulberry and New Streets, Lancaster. Changes are also being made in Harrisburg, Wilmington and Reading. A showroom is building at Front and Market Streets, Harrisburg; a service station and showroom, 35 by 100 ft., at Ninth and Tatnall Streets, Wilmington, Del., and a service station in Reading for motor trucks exclusively.

N. Y. Timken Offices Moved—Beginning May 1, the New York offices of the Timken-Detroit Axle Co. and the Timken Roller Bearing Co. will be moved to room 713, United States Rubber Bldg. G. L. Bitting will remain in charge as eastern representative of the companies.

Takes Over B-B's Starter Sale—The Detroit Radiator & Specialty Co., Detroit, Mich., which handles the More Speed gears for Ford, has taken over the sales of the B-B starter, formerly handled by the Detroit Auto Specialty Co.

Twin City News—P. Knight, 1608 Crystal Lake Avenue, Minneapolis, will erect a one-story concrete block garage at 4101-3 Bryant Avenue S.

A. Barth, 537 Rice Street, St. Paul, has opened an automobile top and trimming shop. known as the St. Paul Auto Top Works.

L. M. Hick, St. Paul, will erect a story garage and storerooms at Sixth and Exchange Streets to cost $17,000.

Trade Happenings

Macrae Heads Windsor Saxon—K. W. Macrae has been appointed manager of the Saxon branch in Windsor, Ont.

Spray Joins Timken—J. W. Spray is now connected with the sales force of the Timken Roller Bearing Co., Canton, Ohio. He was until recently sales representative in the Middle West of the Diamond Chain Co., Indianapolis, Ind.

Smith Leaves Winnipeg Maxwell—S. Smith of the Maxwell Motor Co., Winnipeg, Man., has severed his connection with that company to take a position with the head office of the company in Detroit.

Geary Joins McGraw Tire—F. S. Geary, formerly with the Kelly-Springfield Tire Co., New York City, has joined the McGraw Tire & Rubber Co., East Palestine, Ohio, as manager of its Newark branch, succeeding W. P. Fraley.

Sleght Heads Toronto Overland—F. J. Sleght, formerly manager of the Elyria factory of the Willys-Overland Co., has been appointed general manager of the Toronto, Ont., plant of that company.

Seaman Joins Knight Tire—L. I. Seaman, formerly associated with the Ajax Rubber Co., has joined the Knight Tire and Rubber Co. of N. Y., New York City, in the capacity of district representative in the western and northern portions of New York State.

Boston Trade Items—H. G. White, well known in oil circles, has joined the Pennsylvania Rubber Co., as New England traveling representative.

A. H. Allen, for the past seven years identified with the Packard factory at Detroit, is now assistant salesmanager for Alvan T. Fuller, the Packard dealer.

Homer Goodrich, who took on the Enger in Boston some months ago, has retired from the agency, and W. B. Fletcher is now president, with S. L. Bickford, treasurer, of the reorganized company.

Denver Men in New Roles—H. G. Peters, formerly treasurer of the Boss Rubber Co., Denver, is now president of the Peters-Tucker-Hay Rubber Co., 1513 Cheyenne Place.

E. A. Johnson, formerly traveling salesman for the United States Tire Co. and later with the Knight-Campbell Music Co., Denver, is now sales manager for the Hupp Motor Sales Co., 1260 Broadway, Colorado and Wyoming distributors for the Hupmobile and Locomobile.

E. M. Tucker, formerly store manager for the Quick Service Tire Co., Denver, is secretary-treasurer of the new Peters-Tucker-Hay Rubber Co., 1513 Cheyenne Place.

H. P. Federspiel, formerly with the Ford and Maxwell branches in Denver, is manager of the Colorado Motor Car Co., 1520 Broadway, Cole, Saxon and Reo distributor for Colorado and Wyoming.

R. E. Hay, formerly with the Boss Rubber Co., Denver, is vice-president of the Peters-Tucker-Hay Rubber Co., 1513 Cheyenne Place.

Washington Trade Items—The Auto Appliance Co. has opened in Tacoma with R. W. Cady, president, and associated with him are H. C. Lemagie and C. F. Powell. This firm handles the Federal and Goodyear tires and a well-selected line of accessories.

The H. L. Olive Co., Spokane, distributor of Overland machines, announces plans for the construction of a large addition to its home, which when completed will give it a floor space of 36,750 sq. ft.

C. C. Fagan has been appointed manager of the Pierce-Arrow service station in Portland, Ore.

The H. L. Mann Motor Co., Portland, Ore., has acquired the Oregon State agency of the Mercer, which he will handle in addition to the Haynes line.

Columbus News Items—The Broad-Oak Automobile Co., located at 622 Oak Street with a branch at 170 North Fourth Street, which has handled the Chalmers in central Ohio since that car has been on the market, has given up the agency and taken the Chandler in fourteen counties in central Ohio. The Chalmers agency in Columbus will be handled by a branch of the Fischer Auto & Service Co. of Cincinnati. The Columbus branch is located at 137 East Gay Street. A. G. Fischer will be the Columbus manager.

D. W. Short has been appointed Columbus representative of the Ohio-Metz-Elcar Co. of Cleveland, the Ohio representative of the Metz and Elcar. Columbus headquarters have been opened at 211 North Fourth Street.

The G-M Service & Specialty Co. has moved from its former location, 275 North Fourth Street, to 179 East Naghten Street.

E. T. Paul, who has been doing a tire repair business at 123 Parsons Avenue, has added a full line of automobile accessories.

O. G. Roberts & Co., 933 East Gay

Street, which has handled the Overland in central Ohio territory for about eight years, has given up the agency to become effective some time previous to July 1.

California Items—A. W. Maxwell, formerly manager of the Studebaker Corp.'s interests in Arizona, has been appointed manager of the newly organized Studebaker commercial car branch in southern California, with headquarters at Los Angeles. The new Arizona manager is R. Robinson, formerly of Los Angeles.

Col. C. L. Hewes, formerly manager of the Oakland, Cal., Pacific Kissel Kar branch, has been appointed manager of the Kissel interests in Los Angeles. Colonel Hewes has been connected with the motor car industry in Oakland and San Francisco for many years and is well known throughout California. O. B. Henderson, former manager of the Los Angeles house and vice-president of the Pacific Kissel Kar branch, has retired from active work in the industry.

Mountain Retail—The Peters-Tucker-Hay Rubber Co., a new $10,000 concern, has opened an agency for Knight and Blackstone tires at 1513 Cheyenne Place, Denver, and also a filling station in connection.

The Headington Auto Co., 1636 Broadway, Denver, Metz, Enger and H. A. Lozier distributor for Colorado and Wyoming, has been appointed official service station for the Master carburetor.

M. M. Rubner, Rawling, Wyo., Cadillac, Chalmers and Hupmobile dealer, has moved from Cedar Street, at the edge of town, to a more central location at 412 Lincoln Highway, where he has larger quarters for garage and salesroom.

The L. E. Kelton Motor Car Co., 1616 Broadway, Denver, Haynes distributor for Colorado and Wyoming, has secured the distributing agency for the Patterson for the same territory.

Mulnix & Rarie, 35 East Colfax Avenue, Denver, Grant and Pathfinder distributors for Colorado and Wyoming, have secured the agency for the Little Giant truck for the same territory.

The Maines-Hough Motor Co., 439 Broadway, Denver, Chevrolet, Monroe and Mitchell distributor for Colorado and Wyoming, has opened a branch salesroom in a more central location, at 17 East Colfax Avenue, with William R. Beattie in charge.

A. L. Davis, Arvada, Col., Chevrolet dealer, is putting up a $15,000 building at Wadsworth Avenue and Grandview for salesroom, garage and extra offices. It will be 40 by 140 ft., of steel, concrete and brick construction, with two stories and a fireproof basement. The top floor will be rented for office use. The building will be finished the middle of April.

Wisconsin Trade Items.—F. J. Chlupp, for ten years associated with the Burroughs Adding Machine Co., has taken the position of manager of the Motor Car Sales Co., 136 Mason Street, Milwaukee, a large territory distributor of the Marmon and Oakland. The company is occupying temporary quarters and will soon move into its new garage and service station on Milwaukee Street, near Mason Street.

The Rice Lake Motor Car Co., Rice Lake, Wis., has taken occupancy of its new garage and repairshop, which, being 66 by 132 ft. in size, is one of the largest buildings devoted to garage purposes in any small city of Wisconsin.

The Olson-Pauly Automobile Co., Manitowoc, Wis., has taken the Wisconsin State agency for the Ross 8 and will appoint agents in Milwaukee and other parts of the territory.

The Kern-Hughes Co., 955 Thirtieth Street, Milwaukee, has taken the State agency for Wisconsin of the Troy motor truck trailer. The Milwaukee Gas Light Co. has purchased a 5-ton trailer, one of the largest in use in Milwaukee.

The Hay Motor Sales Co., organized recently at Stevens Point, Wis., has been appointed district representative of the Elgin Motor Car Corp. A salesroom has been established in the Mansur Building on Strongs Avenue, and service station will be provided as soon as possible.

The J. J. Dougherty Co., 803 Grand Avenue, Milwaukee, accessories and supplies, has established a branch warehouse and salesroom at 398 Kenilworth Place, opposite the new branch plant of the Ford Motor Co. The concern specializes in material for Ford owners.

The Stutz Motor Co. of Milwaukee, headed by E. J. Weller, has been organized to handle the State agency for the Stutz in Wisconsin. Headquarters have been established at 115 Sycamore Street.

W. G. Schultz, for six years associated with the Reeke-Osmond Motor Car Co., Milwaukee, representing the Jeffery, has resigned to resume a connection as special traveling representative of the Thomas B. Jeffery Co., Kenosha, Wis. Mr. Schultz was with the Jeffery company before being transferred to the Milwaukee agency.

The Hilgendorf Hardware Co., 303 Third Street, Milwaukee, has taken the district agency for the Champion, the State agency for which is held by J. E. Murray, Wausau, Wis.

The Burd Piston Ring Sales Co., 424 Jefferson Street, Milwaukee, has moved its offices and warehouse to 813 Grand Avenue. The company represents the Burd product in Wisconsin and upper Michigan. P. C. Christman is general manager.

The Opsato Motor Plow Co., organized at Eau Claire, Wis., in the spring of 1915 to manufacture a gas plow and general utility farm tractor, has been reorganized as the Eau Claire Mfg. Co., and is now ready to begin a large production. The company has completed its plant and installed the equipment. Officers have been elected as follows: President, R. B. Gillette; vice-president, J. P. Norrish; secretary and chief engineer, M. S. Opsato; treasurer, Charles Keller.

The Mechanical Appliance Co., 123-133 Stewart Street, Milwaukee, a large manufacturer of electric motors, generators and similar devices, is so rushed with orders that it has been found necessary to build a new shop, to be 30 by 130 ft. in size.

The Lemke Electric Co., 509-513 Cedar Street, Milwaukee, has been appointed official service and supply station for the Bijur Motor Lighting Co. The Lemke company is also official station for the Bosch, Simms and Mea magneto companies, Splitdorf Electrical Co., Rushmore Dynamo Works and Gray & Davis, Inc., and acts as official distributors for Wisconsin and northern Michigan.

The Ros-Wel Co., 112 Miller Building, Milwaukee, motor car specialties, is now marketing a new anti-freezing solution, trademarked "Uneeda." A large production is being undertaken in preparation for the coming cold weather season.

The big Arcadia Building, 615-625 Wells Street, Milwaukee, scene of some of the most important pugilistic bouts fought in this country in the last twelve years, is about to give way to the march of progress and will be rebuilt into a garage, which will be one of the largest in the Northwest in point of ground floor space. The big structure was originally known as the Hippodrome and was erected at a cost of $100,000. Frank Mulkern, Milwaukee's millionaire newsboy and taxi operator, has held the building under lease for several years and is behind the project to transform it into a large downtown garage such as Milwaukee has long needed. In this building was held the first motor show in Milwaukee, the Milwaukee Automobile Club having promoted the first exhibition in March, 1908, before the now largest exposition building in Milwaukee, namely, the Auditorium, was completed.

The Badger Auto Body Co., Milwaukee, the incorporation of which was recently noted, is establishing a large shop at Lisbon Avenue and the Milwaukee road tracks, and will devote its efforts exclusively to the production of delivery bodies for automobiles, specializing in styles adapted to Ford chassis.

The Wadhams Oil Co., 215 National Avenue, Milwaukee, one of the largest distributors of oils, greases and motor fuels in the Middle West, will add another filling station to the list of stations in the city of Milwaukee. Plans have been prepared for a fireproof tank house, offices and drive at Ivanhoe Place and Prospect Avenue, one of the most prominent corners in the elite residence district of the east side of Milwaukee.

The Hoppe-Hatter Motor Co., 539 Broadway, Milwaukee, agent for the Buick and State agent for the R. & L.-Baker electric and Owen magnetic, will move about June 15 to new and larger quarters now being erected for the firm on Milwaukee Street, just north of Oneida Street, in the heart of the east side motor district of Milwaukee. The building will be 50 by 120 ft. in size and contain a large service station. The present quarters of the Hoppe-Hatter company will be used by the Bartles-Maguire Oil Co., which has shared the big structure with the Buick agent for several years.

The Jefferson Automobile Co., Jefferson, Wis., district agent for the Ford, Buick and Oakland, is building an addition which will provide space for one of the largest and most completely equipped repairshops in any small city of Wisconsin.

Streator Co. Making Truck Bodies—The Alliance Manufacturing Co., Streator, Ill., which for many years was engaged in the construction of wagons and buggies, has gradually adjusted its business to changed conditions and is now devoting its attention largely to commercial truck bodies. As this business has reached a large scale, it has been decided to add hearses. The Alliance company will manufacture the bodies and the Barley company, also of Streator, will furnish the chassis. The "waste" or by-product of the Alliance company is being utilized in making wagon boxes for Montgomery & Ward of Chicago, the latter firm placing more orders than the Alliance plant can provide for.

Iowa Trade Items—J. F. Ochsner of Fort Madison, Iowa, has become agent for the Oakland.

The R. M. Tharp Auto Co., Waterloo, Iowa, is erecting a modern fireproof garage building and will take possession June 1. The firm handles the Jackson, Hupmobile and Allen cars.

The Hoover Auto Co., Oskaloosa, Iowa, has leased an adjacent building as an auxiliary garage. It will be used to store new cars.

J. S. Benson of Iowa City, Iowa, is to erect an automobile service station at Lynn and College Streets.

W. O. Campbell has purchased the Altmeyer Co. agency at Cedar Rapids. He will continue to handle the Studebaker.

H. F. Bierkamp and H. H. Horn have opened a garage at Milton, Iowa. A full line of accessories will be carried. William Broders has established a vulcanizing and tire repairing shop at Durant.

Jack Altmeyer of Cedar Rapids has been appointed general agent of the Dodge Bros. Co., for twelve counties. Headquarters will be in Waterloo.

The Iowa Motor Truck Co., Ottumwa, is working overtime manufacturing truck frames and assembling. The trucks are being manufactured at the plant of the American Mining Tool Co. The company reports many orders on the books.

W. W. Maish has resigned as assistant cashier of the Citizens National Bank, Des Moines, and has bought an interest in the States Auto & Supply Co., of which he will be secretary and treasurer.

Dubuque has been established as a distributing point for the Cadillac in Dubuque County and adjacent territory. W. L. Wallace will be resident manager and will establish a Cadillac service station.

Joseph A. Eisele of Davenport has bought out the Union Motor Co. of that city and has made a contract for the handling of the Chevrolet in this territory. He will also conduct a complete garage and repair establishment.

The Mercantile Warehouse Company of Waterloo has secured an admirable garage site on Commercial Street, near the Russell-Lamson Hotel, and plans the erection there of a new and up-to-date garage, 40 by 140 ft. One of the oldest residences in the city, built in 1850, will be torn down to make way for the new garage.

A new branch of the Studebaker Corp. is to be established immediately in Des Moines. It will supply parts to Studebaker owners and dealers in Iowa and adjacent territory in other States. The local branch will be in charge of J. A. Haskell, formerly assistant manager of the Studebaker branch at Cleveland, Ohio. A $100,000 stock will be handled here, a force of fifteen men employed, and 5000 cars handled annually through this branch. A new building is to be erected to house the new branch. G. L. Willman, Studebaker sales manager, is here to help start the branch. He says Iowa should have twice as many cars.

Louisville Items—J. J. Pontius of Cincinnati has been appointed sales manager of the Oldsmobile Sales Co., 931 South Third Street, Louisville, Ky.

The Paige Motor Sales Co., 725 Third Street, agent for the Marion and Grant, has been appointed Haynes distributor in this territory.

The J. P. Hudson's Sons Co., 1046 East Main Street, well known to Louisville people and farmers of practically every county in Kentucky and southern Indiana as horse and mule dealers for the last twenty years, has acquired the agency for the Lippard-Stewart motor trucks, and would take in part payment for commercial vehicles horses, mules, wagons and harness. Being prepared to find a quick market for them, the Hudson firm then will sell the animals through its regular channels.

Adamson Vulcanizer to Add—The Adamson Mfg. Co., East Palestine, Ohio, is starting work on an addition to its plant to be 50 by 150 ft. and three stories high, total 22,500 sq. ft. of floor space. The new building will be of brick and glass construction, and will be used for increased production of Adamson vulcanizers and new patented devices. Work will be rushed so that the new plant can be occupied some time in June.

Piston Ring Co. Formed—The plant of the Piston Ring Co., Muskegon, Mich., will be doubled and the production, which is now at the rate of 27,000 piston ring castings a day, is to be increased to 50,000 or more a day. One addition to the plant will be a building 52 by 112 ft., while another addition will consist of a building, 119 by 112 ft. At least $75,000 will be expended for additions.

Shakespeare Carbureter to Enlarge Plant—William Shakespeare, who manufacturers the Shakespeare carbureter, will enlarge his factory in Kalamazoo, Mich., and is making provisions to enable a production of 20,000 carbureters, beginning next July.

Beechler Succeeds Goldie—R. G. Beechler, who was chief engineer of the metal products branch of the Timken-Detroit Axle Co., Detroit, Mich., has been appointed works manager, succeeding R. J. Goldie, who resigned.

Auto Body Takes Over Brewing Co.—The Lansing Brewing Co. has been taken over by the Auto Body Co., Lansing, Mich. Negotiations have been pending for some time, but it is said that the brewing company's stockholders did not wish to close up their business until indications were such that the State wide prohibition movement seems certain to make it very difficult for many breweries to keep on doing business in Michigan.

Warehouses for Automobiles—The Mason City Mfg. & Warehouse Co. has taken possession of the Colby plant at Mason City, Iowa, and expects soon to open an automobile warehouse for distribution purposes. The buildings are fireproof. An inclosed chute will lead to the railroad tracks. This will enable dealers in northwestern Iowa and southern Minnesota to buy their cars in larger numbers and will insure prompt deliveries to customers.

Spalding Lansing Foundry Mgr.—F. D. Spalding, Lansing, Mich., has been appointed manager of the Lansing Foundry Co. He was formerly assistant sales manager of the New-Way Motor Co.

Minor in Charge at Frisco—H. W. Minor has been put in charge of the San Francisco office of the American Bureau of Engineering and will push the sale of Ambu Electric Trouble Shooter in that territory. His address is 17 Powell Street.

The AUTOMOBILE

Vol. XXXIV
No. 17

NEW YORK, APRIL 27, 1916

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Three dollars a year

Suggestion No. 13

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Vol. XXXIV New York—Thursday, April 27, 1916—Chicago No. 17

The Automobile

The Case for the Four

Resume of Situation and Ideas of Two Engineers Who Present Four-Cylinder Side of the Matter—Possibilities of Well-Defined Field for Each Type and Displacement

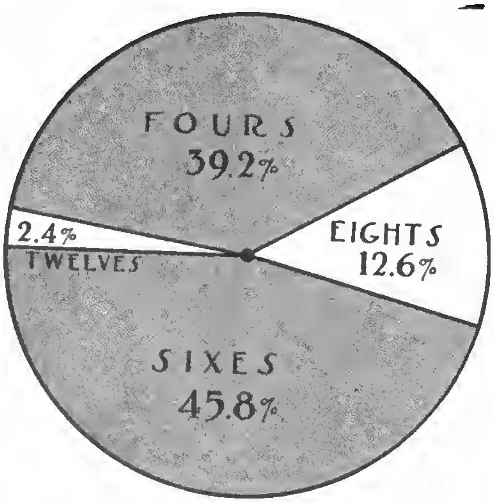
By J. Edward Schipper

FOUR-CYLINDER manufacturers as a body have been placed in the position of a defendant in the courtroom. The plaintiff, in the form of manufacturers of six-, eight- and twelve-cylinder engines, has stated his case and presented his arguments. The defendant must have an opportunity to answer before the case goes to the jury, which is in this case of considerably more than twelve men since it consists of the entire automobile-buying public. The judge who charges the jury and passes upon the points of law in this trial of fours vs. multis is the body of engineers which passes upon the technicalities involved.

In a way it is almost a foregone conclusion that the jury will disagree in this case. That this is true can be seen from the fact that the jurors themselves are largely guilty of prejudice, favoritism or some other quality which would render them ineligible to serve. This partiality on the part of the jury is evidenced by the fact that its various members are riding about in cars in which the cylinder numbers vary between four and three times that number.

In opening a legal case in order to secure the greatest possible dispatch it is customary for both sides to concede points upon which they are agreed. This avoids the necessity for arguing upon facts on which there is no difference of opinion. There are several of these facts that are agreed upon by both the fours and the multis and before the defendants' case is reviewed these facts should be noted.

There is no such thing as the ideal car. On the contrary, there is a different ideal for every set of requirements. It is this condition that stimulates automobile manufacture and renders it possible that there be such a large variety of makes and models. It is also this possibility which renders it permissible or even possible to make cars having a varying number of cylinders. The point, however, to be made by the defendants of the four-cylinder motor, is whether or not fours are suitable for every class of work or whether they have a well-defined field which embraces a greater part of the possible requirements of the motoring public with the other part open to builders of sixes, eights and twelves.



Standing of the cylinders by models listed for the 1916 season

This condition of varying requirements is one of the conceded points. The others are largely along the lines of what individual owners demand in their cars. Taking the average owner, he is found to be the possessor of a five-passenger touring car of which he demands the following qualifications:

1—*Flexibility*—From 5 to 50 m.p.h. on high gear without choking the motor and with smooth application of power.

2—*Acceleration*—The ability to make a quick getaway from a standing start or to increase rapidly from one speed to another on both the high, low and intermediate gears.

3—*Comfort*—Absence of vibration and jolting due to the motor or to road inequality.

4—*Power*—Ability to climb hills, to pull through heavy roads and to travel under adverse conditions on high gear.

5—*Economy*—To be light on tires and to consume relatively small quantities of fuel and oil in consideration of the distance traveled.

All these qualities are demanded by the average owner. They are not, however, demanded by every owner. The possessor of a closed car which is to be driven about the city streets

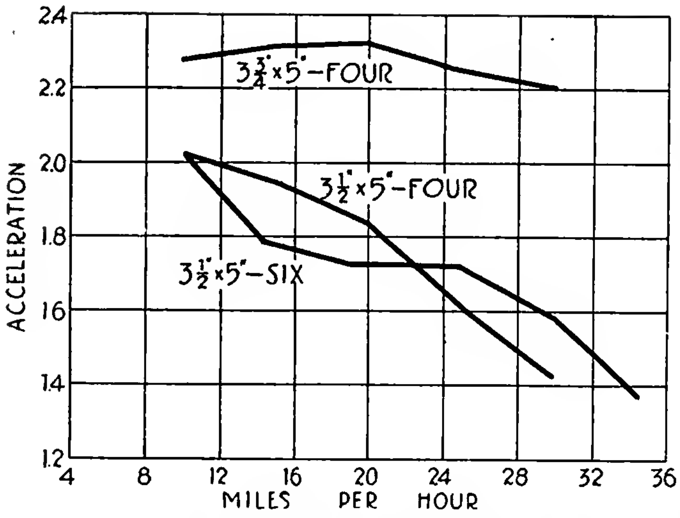


Fig. 1—Curve of acceleration on 3½ by 5 six-cylinder motor
Fig. 2—Curve of acceleration on 3½ by 5 four-cylinder motor
Fig. 3—Acceleration curve on a 3¾ by 5 four-cylinder motor

may insist that his driver never go above 20 m.p.h. On the other hand the college youth in his raceabout who has an indulgent father to pay the tire bills may scorn anything less than breakneck speed. The average owner, though, will ask for the five qualities above outlined, and if the four-cylinder can answer these better than any other type of car it will have gone a long way toward successfully defending its position.

At a joint meeting of the Metropolitan sections of the Society of Automobile Engineers and the American Society of Mechanical Engineers held in New York on the evening of April 20, two prominent engineers presented papers giving the four-cylinder side of the matter. It will be interesting to first study the broad view of the cylinder proposition and then to note what these engineers say in answer to the claims of the multi-cylinder manufacturers who have been classed as the plaintiff in this case.

The concessions have been made and each side is agreed largely as to what is demanded by the average car user. To go further into the matter than this brings the argument directly into the field of dispute, and directly into the part of the question which the jury, the buying public, must decide; for, after all, the public creates demand as rapidly as the engineer creates improvements.

Four-Cylinder Engine Is Simple

It must be conceded that the four-cylinder engine is simpler than engines having more cylinders and, if all the advantages included in the latter can be given by four, there would be no advantage in using a greater number. Again, if the advantages to be secured were only theoretical but did not work out in practice, the four would be still more desirable from the standpoint of simplicity. Therefore in studying the matter of cylinders it must be remembered that engines having more than four cylinders must show an advantage over the four in some practical respect before they are justified.

It would also be of value if it were possible to divide the entire range of automobile activity into a number of fields and then to state exactly what type of engine is most suited for that given field. There is no doubt but that a large number of automobile purchasers buy cars which are not economically the best for their purposes. They are carried away by some detail which appeals to their fancy, causing them to buy a car which is, to say the least, not adapted to their uses. It does not take 66 hp., for instance, to operate a town car over asphalt pavements with no hills at an average speed of 12 m.p.h.

As far as power is concerned, it is not necessary to go very much above 300 cu. in. to secure it. This is shown by the performance of racing cars on the speedways during the past year. On the other hand with large displacements per cylinder the stress on individual connecting-rod and main bearings is greater, and, where it becomes necessary to carry a fairly heavy car over hilly country and rough roads at high speeds, the question is one which is open to considerable doubt.

Better Acceleration on Four?

As regards the matter of acceleration, it will be noted in one of the following papers that the author claims better results for the four than for engines of more cylinders, basing his claims upon the showing of accelerometer curves and explaining them by the difficulties of carburetion in multi-cylinder engines where the gas stream is divided into a number of sub-streams running in different directions, as compared to the four where the intake stream lines are comparatively simple. Overlapping intake valve opening has been the subject of considerable engineering discussion and has had much to do with intake manifold design and also has been one of the factors in the cylinder debate. As an important consideration in acceleration and one of the reasons why the four can be made to perform as well as the multi-cylinder engine, it opens an interesting line of thought. This is particularly so because it attacks the multi-cylinder engine on one of the particular points where supremacy is claimed.

Greater Thermal Efficiency

The claim of higher theoretical thermal efficiency for the four than for the multi-cylinder engines is hardly discussed, although it is advanced by one of the engineers who presented papers on this subject. It would be possible to go back to the one-cylinder engine and show that it has a higher inherent thermal efficiency than the four. The statements regarding increased complications in multi-cylinder engines are also met in the same way, and this again brings us into the field where the jury composed of automobile-buying citizens must decide.

Piston displacement per cylinder is a theory of action which, like a blanket, may be spread to cover the ideas advanced by all parties, but it is not satisfactory as a complete answer to all those concerned. If it were true, then well-defined fields for each number of cylinders would be created by simply arranging logical divisions in piston displacements. The trouble is that the fields of the present motors overlap to a very large degree, leaving certain areas of debatable ground where the battle rages with marked and continuous severity.

The summing up of the four-cylinder case by two engineers who have clung to this type of design through all the attacks made by the promoters of cars having a greater number, is of interest, and it is particularly worthy of note to find that in many instances the attack is made on the very points in which the multi-cylinder engine has claimed superiority.

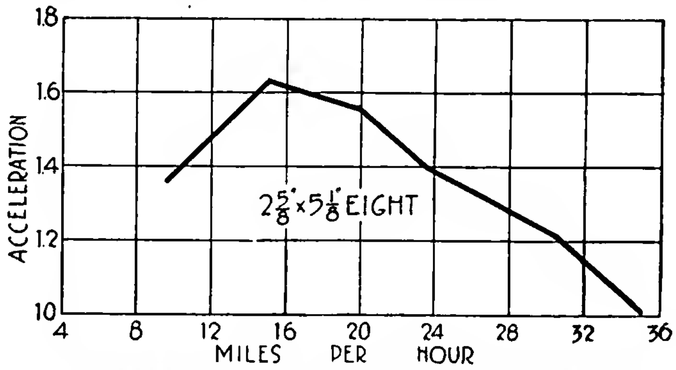


Fig. 5—Acceleration curve of eight-cylinder 2⅝ by 5⅛ motor

Automobile Applications of Four-Cylinder Motors

Paper Read Before the Metropolitan Section of the S.A.E. in Joint Meeting with the A.S.M.E.

By F. E. Watts*

THE considerations which determine the motive power for passenger automobiles differ in many respects from those which govern the selection of prime movers for any other purpose.

In the older applications of power, the problem was usually reducible to a dollars and cents basis: given such factors as work required, location, possible fuel supplies, etc.

The automobile power problem is not so definite.

During the past year numerous excellent papers have been read dealing with the technique of modern types of automobile motors. Torque variations, unbalanced forces, periodic vibrations, etc., have been called to our attention repeatedly in these papers. Most of this matter is not new; it may be found in the admirable works of Dalby, Clerk, Guldner, Lucke, Marchis and Sharpe, most of which have been available for ten years past and which are, I am afraid, lying covered with dust on our shelves.

It seems to me that much of the matter which has been presented is not pertinent, because little attention has been given as to the effect which the forces described have upon the passengers.

In this paper, therefore, I will consider briefly the applications of motors to automobiles, and will try to show why the four-cylinder motor is used on the majority of the motor cars produced to-day.

As practically all commercial vehicles, both freight and passenger, have four-cylinder motors, I will confine the discussion to pleasure automobiles.

To still further simplify the question, I will consider only the present types of four-cycle poppet valve motors.

The question to be considered then is: What is an automobile motor required to do? In other words: What is its job?

Experience gained in the building of some 50,000 cars, which are now running in all parts of the world, has convinced me that the majority of automobile owners expect their cars to perform about as follows:

To run steadily and pleasingly on high from 5 to 50 miles an hour over smooth roads.

To carry them over the rougher roads as fast as they can ride with any degree of comfort.

To pull through deep sand, mud or snow easily and without overheating.

To climb any ordinary hill where there are traveled roads, on high.

To get away from a standstill about as quickly as their neighbors' cars.

To do all these things as cheaply as possible, and without skilled care and constant attention.

Naturally the motor's part in securing this performance is important, but I think that anyone will grant that the average automobile owner is not greatly interested in the construction or performance of his motor except as it affects the performance, durability and maintenance cost of his car.

Let us consider these three factors in the order mentioned.

Performance

The horsepower required to give the performance just outlined depends of course quite largely upon the loaded weight of the car. This in turn depends upon the passenger capacity and the comfort desired.

In a practical way it is generally understood that the comfort of the passengers is increased as the ratio of sprung to unsprung weight is increased, and as the ratio of sprung weight to each passenger's weight is increased. I have never seen any mathematical proof of this proposition, but with equal quality of design and workmanship I think it is the general experience.

On this basis we may divide cars carrying from five to seven passengers roughly into three classes: First, cars of toleration, having a shipping weight of less than 1800 lb. Second, cars of comfort, having a shipping weight of from 1800 to 3000 lb. Third, cars of luxury, with a shipping weight of more than 3000 lb. There are, of course, notable exceptions to this classification. All cars of the first class manufactured in quantity have four-cylinder motors, and there appears to be little doubt but that they will continue to use this type.

It is in the second class that the controversy as to the proper type of motor to use is most active at the present time. Cars of the second class include quite a range of vehicle sizes. As the horsepower required varies with the loaded weight we find motors in cars of this class which vary from a little more than 20 hp. to a maximum of somewhat more than 50 hp. Most of the motors are included in the range between 25 and 40 hp.

However, the horsepower of a motor is not always an indication of its availability for automobile use. Often the maximum torque and the range of this torque are the determining factors. The maximum torque of the motors which I have just mentioned will usually run between 1250 and 2000 pound-inches. I say that the maximum horsepower does not always decide the availability of the motor for use in ordinary pleasure cars for the reason that the speed of these cars should be limited to from 55 to 60 m.p.h., and if the maximum horsepower of a motor is obtained at such a high

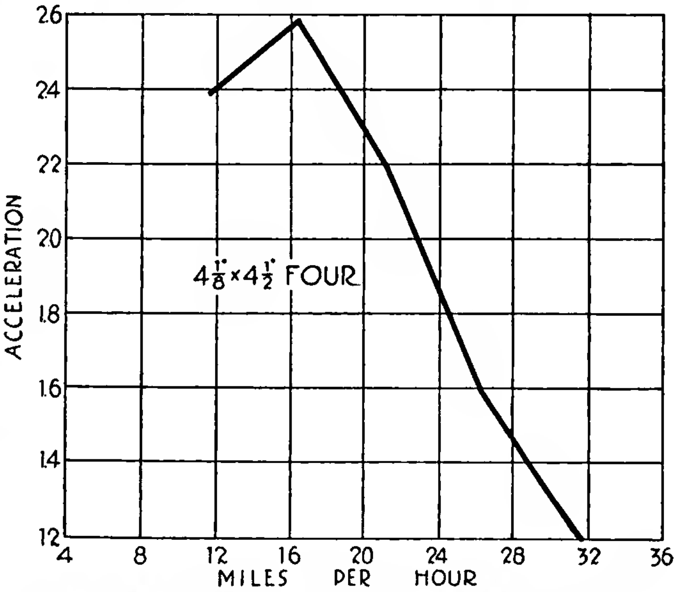


Fig. 4—Curve of acceleration plotted for 4⅛ by 4½ four-cylinder

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*Chief Engineer Hupp Motor Car Corp., Detroit, Mich.

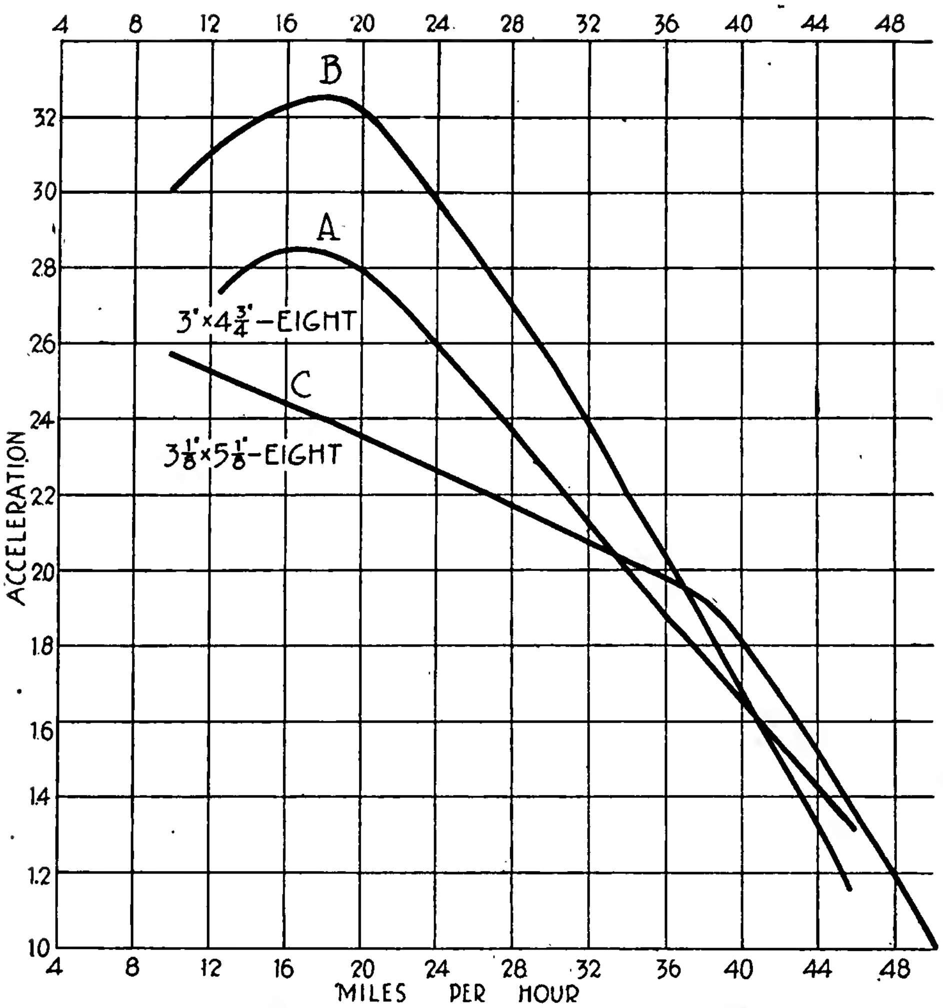

Fig. 6—Comparative curves of acceleration on two eights and a four

number of revolutions that it will not be usable at this car speed with a practical rear axle ratio, it is not of any practical value.

Acceleration Ability Increased

At the present time the horsepower required is quite often determined by the acceleration demanded. Within the last year there has been a tendency to greatly increase the ability for acceleration in motor cars. This has been due partly to the advent of eight- and twelve-cylinder cars, and to rather extravagant claims of salesmen as to the ability of these cars. I believe it is also partly due to the increasing congestion of traffic in our large cities and upon our principal highways, or to other traffic conditions which make a quick get-away very desirable.

It may be desirable in this connection to show some curves taken with the Wimperis accelerometer.

Fig. 1 shows the acceleration curve of a very popular six-cylinder car, 1915 model. You will note that the acceleration at 10 m.p.h. is slightly over 2. This car was considered very satisfactory at the time it was built and was sold in large quantities.

Figs. 2, 3 and 4 show acceleration curves of well-known and popular makes of four-cylinder cars, also 1915 models. These show accelerations which, while slightly greater than the six-cylinder mentioned are very closely comparable with it.

Fig. 5 shows the acceleration curve of a well-known eight-cylinder European car, which was built especially for city work. The acceleration of this car is noticeably low, but it must be remembered that it is the custom abroad to change gears much more frequently than in this country, and this car was fitted with a transmission having four forward speeds.

Fig. 6 shows a comparison of three more recent cars. Cars *A* and *C* have eight-cylinder motors and car *B* has a four-cylinder motor. I believe that the acceleration of car *B* at ordinary driving speeds is about as great as is obtained with any stock car fitted with standard gear ratio, at the present time.

Fig. 7 is a test of the same car as *B* in Fig. 6, but in this test the second speed gear was engaged. The rear axle ratio, however, was 4 to 1, whereas with the standard car this ratio is 4.64 to 1.

A considerable experience in acceleration tests of stock models of American cars purchased in the open market leads to the following conclusions: At the present time the best acceleration, and by this I mean the most available for use in traffic conditions, is obtainable from four-cylinder motors. The acceleration of other types of motors at the slower speeds is not usually as quick or as powerful as the acceleration of the four. At speeds of from 15 to 20 m.p.h. and above the different types become very nearly equal, and at speeds of more than 30 m.p.h., motors having a large number of cylinders are better than the four. This is particularly true of six-, eight- and twelve-cylinder motors having single carbureters, which are apt to be rather uncertain in very low speed action when picking up quickly. The result often is that the more cylinders a motor has the more frequently one is required to use the gearshift lever for city driving. I do not believe that this is fundamentally necessary. It is probably due to imperfect carburetion and poor distribution of gas, and will in all probability be remedied.

The next point which should be discussed in comparing the performance of cars with the different numbers of cylinders is the question of smoothness of operation.

Fours Are Greatly Improved

For very rapid acceleration cars having four-cylinder motors are not quite so smooth in action as those in which the power impulses are more frequent. But recent changes in four-cylinder design, the remarkable lightening of reciprocating parts, the more rigid construction of revolving parts, and above all the very much greater rear axle gear ratios, which the use of spiral-bevel gears has made practical, have entirely revolutionized the performance of modern four-cylinder motors as compared to those built even one or two years ago.

At the present time, while the difference between a four and a six, eight or twelve can be detected on rapid acceleration: it can be detected by the average driver only if he is really trying to detect the difference. It is not noticeable to the average driver, unless he is especially looking for it, at any rate of acceleration he will care to pay for. I believe that the desirable limit in acceleration has about been reached, for we have already reached a point where the wear upon tires and the consumption of gasoline is excessive, and I do not believe that the public will long continue to pay for such high activity.

The next point in comparing smoothness of operation is the comparison of low-speed running. In this respect the manufacturer of a modern four-cylinder car having a rear axle gear ratio greater than 4.50 to 1 need have no hesitancy whatever in comparing his product with any car made. Cars having six-, eight- and twelve-cylinder motors will give a better performance at low speeds when the motor is suitably adjusted and carefully tuned for the test, but it is the almost universal experience of car owners that it is difficult to keep the ultra-multicylinder motor tuned to the point where it will give a demonstrating low speed performance. It is only upon the cars whose owners take exceptionally good care of them, or which are driven and cared for by unusually good chauffeurs that the low-speed advantage of many cylinders becomes apparent. A great deal has been written regarding over-lapping power impulses of six-, eight- and twelve-cylinder motors, without taking into consideration the fact that before these impulses are transmitted to the driving mechanism of the car they are absorbed by the flywheel, and that by suitably proportioning the flywheel great smoothness at slow speeds can be obtained with few cylinders.

High-Speed Possibilities

Going from one extreme of the motor performance to the other, let us compare the high-speed possibilities of the different types. It would seem that in this direction motors of a great number of cylinders should be pre-eminent, but up to the present time at least they do not appear to have proven so. Apparently the most efficient high-speed motors made up to the present time are the multi-valve four-cylinder motors having four valves per cylinder placed in the head. I have had no personal experience with motors of this type, and can judge only from published records of track performance. In touring car motors, however, the high-speed possibilities of the four appear to be well beyond all ordinary requirements. Reciprocating parts of touring car motors have decreased in weight remarkably within the past few years. Several years ago I found the reciprocating weights in pounds per square inch of piston area to be about 0.4 lb. At the present time they have been reduced to about 0.2 lb. As the formula for inertia forces due to reciprocating weight is $\frac{F}{a} = .00034\frac{W}{a}N^2r\,(Cos\,\theta + a, Cos\,2\,\theta)$* the inertia forces of the average motor have been reduced 50 per cent for an equal number of revolutions. Internal forces due to speed have been reduced proportionately and the possibilities for high speed are apparent.

Improved lubrication has also done wonders, and quite recently the matter of counterbalancing crankshafts, which practice has long been followed abroad, has been brought forward prominently in this country. Though considerable friction reduction may be possible in complicated forms of crankshafts, such as are used in many of the six- and twelve-cylinder engines, but little is accomplished by applying counterweights to four-cylinder crankshafts for ordinary touring car speeds.

Friction Tests

Friction tests of four-cylinder motors show no marked improvement below 2500 r.p.m. At very high speeds there is a probability that counterweighted crankshafts show up to better advantage, but such high speeds are not encountered in practice on ordinary touring cars.

Fig. 8 shows the relation of car speeds in miles per hour and engine speeds in revolutions per minute with 5-to-1 rear axle ratio and 32-in. tires. At the present time I do not believe it is desirable for large quantity production to go much beyond a 5-to-1 rear axle ratio even with spiral bevel gears. If the ratio is carried beyond this point, either the diameter of the driving gear must be increased so that the road clearance is reduced below what is desirable, or the size of the pinion becomes so small and the unit pressure on the teeth so high that it is difficult to obtain adequate lubrication of the teeth. This means rapid wear in districts where the cars are subject to hard service, as they are in some of our western states, and it also means that an unduly large number of axles must be turned back for re-adjustment, or for lapping of gears. Or the gears must be rejected altogether on account of noise. The only alternative, if the gears are made large, is to increase the diameter of the tires, which partly nullifies the effect of the increased gear ratio.

At the present time worm-driven rear axles are out of the question for large quantity production, as the cutting of successful worms has not yet reached the large quantity production stage. I believe therefore that a well built L-head four-cylinder motor of standard design is still plenty fast enough for touring car work.

It is, however, at medium speeds of running that the question as to whether or not a motor has objectionable vibra-

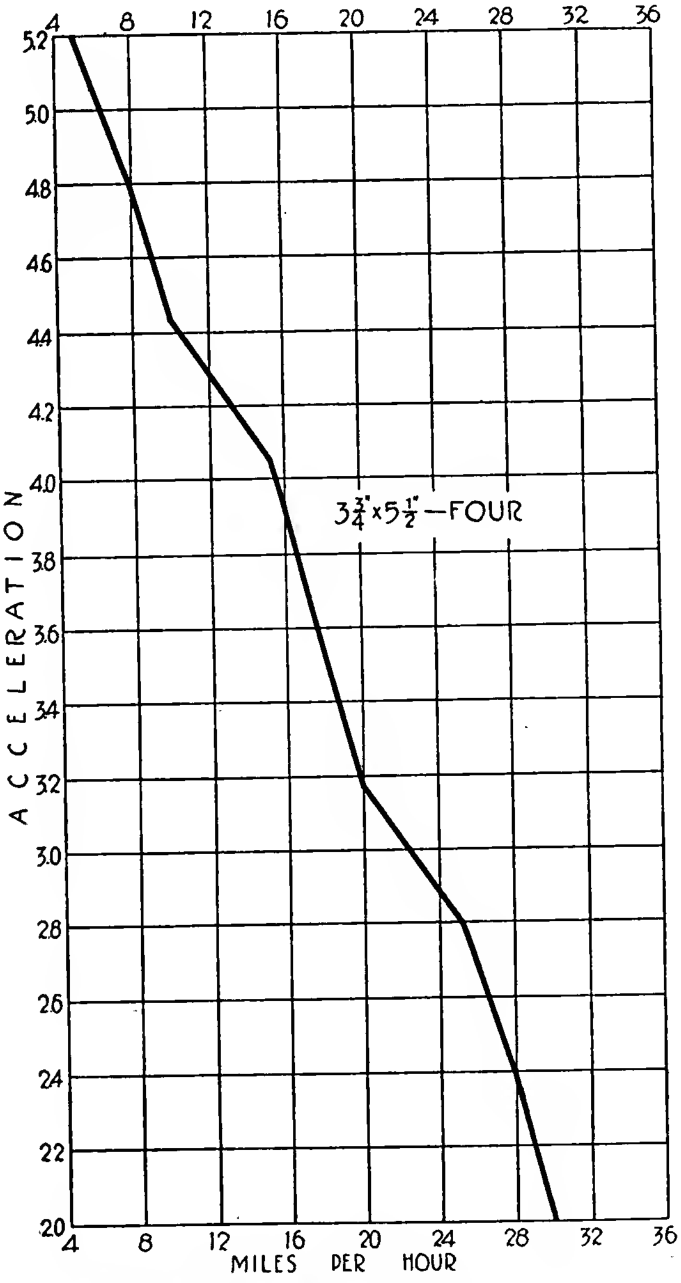

Fig. 7—Second speed gear acceleration curve on a 3¾ by 5½ four

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*For derivation of formula see "Gas Engine Design," by C. E. Lucke, p. 82.

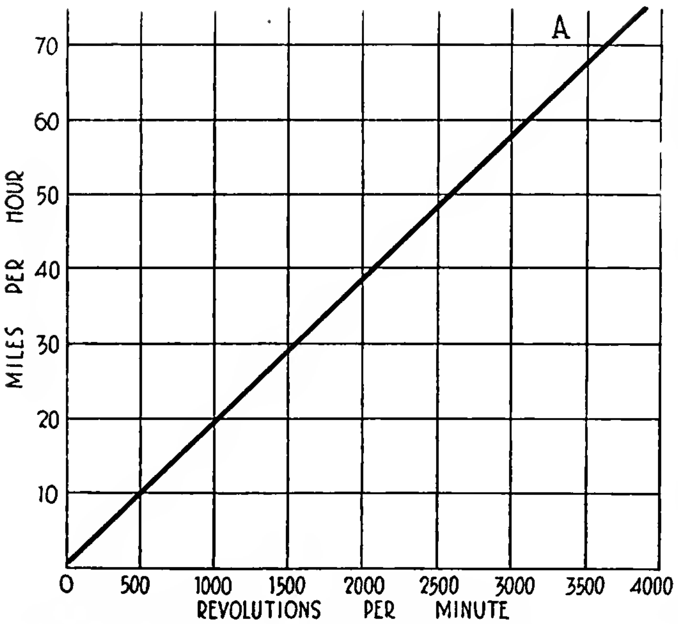

Fig. 8—Curve of m.p.h. against r.p.m. for 32-in. wheel at 5 to 1 ratio

tions becomes most important. Motor car vibrations which affect the passengers' comfort may be divided into two classes: First, those caused by the road surface; second, those caused by the motor. The former are of course the most disagreeable, and unfortunately they are also the least controllable. Vibrations due to the motor are largely controllable by the design of the car. It is, I think, almost universally recognized that the vibrations caused by a well-designed four-cylinder motor with light reciprocating parts are negligible at slow speeds. It is not however generally recognized that it is possible to reduce the vibrations at any speed so that they are comparable to the vibrations at slow speeds. However, the fundamental formula for the vibrations of a four-cylinder motor is: $D = C\frac{rw}{W}$

Where D = Displacement of engine from its normal position.
C = a constant.
r = crank radius.
w = weight of reciprocating parts.
W = total weight of the engine.†

It will be noted that the speed does not enter into this formula. This is due to the fact that while the forces which cause vibrations increase with the motor's speed, the time in which these forces act in a given direction to produce vibration decreases directly with the speed, hence the decrease of the time factor exactly offsets the increase in the force factor, and leaves the tendency for the motor to vibrate exactly the same regardless of speed. This theoretical consideration would be true in practice if all the parts of the motor were perfectly rigid, if it were mounted upon a rigid support, and if the time of vibration of the support did not synchronize with the motor vibrations at any speed. In practice, neither of these assumptions is quite true, but it is possible by making the reciprocating parts light, the crankshaft and other revolving parts rigid, and by suitably proportioning the frame and spring supports, to reduce the vibration of a four-cylinder motor very remarkably. Then, too, the synchronous vibrations are not by any means limited to four-cylinder motors. They are likely to be even worse in six- and twelve-cylinder motors on account of the more complicated forms of their crankshafts. Sixes, eights and twelves are likely to give more trouble from vibrations of the higher periods than are fours, and these vibrations are likely to manifest themselves unexpectedly in parts of the chassis which are distant from the motor. Means of overcoming such high period vibrations are the subject of study at the present time.

It is not fair to compare the running of a modern multi-cylinder motor with an old style four as is so often done. When they are compared with fours of recent design, little difference will be detected.

Durability

The question of durability may be divided into two parts: First, the durability of the motor; second, the durability of the running gear, body, etc.

As to the motor, each part can be made as ample for its work in one type of motor as in another, but the four-cylinder motor should have a longer life than the other types, for it is primarily more accessible and easier to care for, hence it gets the better average attention.

The efficient life of a good motor is much longer than that of the average chassis on American roads. Ordinarily, springs wear out first, then the body, and the other sheet metal parts, then the frame, then the axles, and last of all the motor. The effect of the type of motor on the life of the remainder of the chassis is debatable. The different motor types have not been in use long enough so that we can be sure as yet. We do know that many chassis stresses increase substantially as the square of the car speed, so high speed naturally tends to wear a car out fast. This is the strongest argument for limiting the maximum speed of the car to what I have mentioned. Given equal maximum speeds, road shocks, dirt, and weather effects are the all important factors in chassis wear, so far as I can determine. The slightly greater vibration of a good four-cylinder motor does not seem to be factor enough to be worth considering.

The effect of the greater shocks possible to the driving mechanism from the inertia of the heavier flywheel of a four-cylinder engine can be modified to any extent desired by a suitable clutch design. I believe therefore that a car with four cylinders is as durable as one with more, and that the motor is more durable.

Maintenance Cost

It is an axiom in all mechanical work that the less complicated a machine is, the lower must be its maintenance cost. Now where is this more apparent than in the comparison of the four-cylinder motor with other types? It is more accessible than other types. It has fewer parts in proportion as it has fewer cylinders. Repairs required are not only less frequent than in other types of motors, but they are less costly to make. There are less valves to grind; less cylinders to decarbonize; less spark plugs to clean; less ignition wires to watch for leaks, breaks, short-circuits and static effects; less ignition contacts to synchronize; less work of all sorts to do. Of course this greatly decreases the maintenance cost to the owner, or the time he has to spend in getting his motor in condition if he does the work himself.

As to fuel consumption, the four-cylinder motor is fundamentally superior to other types. In any type of fuel distribution used in motor cars to-day, the division of the gaseous steam decreases efficiency. The single cylinder is the most economical type; and the fuel efficiency decreases as the number of cylinders increases. The public is often misled by certified tests which are made on carefully tuned and adjusted cars, but the result in the hands of the owners is the only thing that will count ultimately. Naturally the rising cost of fuel has caused extravagant statements as to fuel economy, which are made in many advertisements, but unfortunately, for the most part these statements are not borne out in every day practical experience.

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†For derivation of this formula see: Horseless Age, Vol. 21, p. 513, or "The Balancing of Engines," by Archibald Sharpe.

The designers of ultra-multi-cylinder motors are now busily at work on much smaller motors, utilizing very high compression, and it will be interesting to see what they can do in this direction. This matter of increased compression was tried out about ten years ago, and finally abandoned, but with the increased technical skill available at the present time, and the smaller cylinder sizes, it is possible that something may be accomplished. It is, however, doubtful just how much can be done with our present motor car fuel, for at the present time the gasoline available tends to partake more and more of the nature of kerosene, and does not lend itself exceptionally well to high compression.

Fig. 9 shows a recent test along these lines. The lower curves marked *A* and *B* are compression curves taken from the same motor using two different sets of pistons. The corresponding upper curves show the brake mean effective pressure obtained from the two tests. It will be noted that it takes a considerable increase in compression to get a slight increase in mean effective pressure, particularly at the lower speeds. It was also found that the motor with high compression did not operate as smoothly as the motor with the lower compression. I believe that motors having very high compression, while they may show better fuel economy on the dynamameter and in the hands of careful users, will not prove satisfactory for the use of the general public. Possibly however, other methods of using liquid fuels will solve this problem.

Summary

For cars of the first and second classes I do not believe more than four cylinders are desirable, because in the hands of the average user a modern four-cylinder car will do anything he requires, as pleasantly as any other type, and will do it cheaper. This being so, more than four cylinders are not justified.

In cars of the third class, however, a different condition arises. Here the demand for luxurious appointments and high-speed possibilities make the cost of the motor a much smaller percentage of the total cost of the car. The operating cost also is not so important. And as the weight to be moved is greater, the ultra-multi-cylinder motor has its place. This is its only proper field of automobile application, and I venture to predict that five years from to-day 75 per cent of the money being spent for pleasure cars will go for the purchase of four-cylinder machines.

This is of course a mere matter of opinion. The buying public is the final judge. Their verdict will not depend upon technical arguments but will be based upon practical performance. What it will be is not a question for calculation but rather for the application of common sense.

Internal Combustion Motors

The Four-Cylinder Motor of To-day and Future Possibilities

By F. R. Porter*

TO keep a discussion of the internal combustion motor within the scope of this paper and still have it interesting and instructive seems quite a task. Available data is so varied and conflicting as to the object in view, that it becomes almost worthless for a matter of comparison. From this volume of apparently haphazard experimental data however, we have established a few facts that are now common knowledge, some of which stand out as unconquered points, resulting in hundreds of failures, while others represent confirmation of well-directed research work.

The subject of the Otto cycle motor, like most others of a basic nature, was really beyond the inventor; while he established a point of superiority in motive power, he had no conception of the scope of his subject.

Early experiments soon established limiting factors that controlled the power output of a single cylinder, and made the duplication of units necessary. The apparent possibilities together with the extremely interesting side of the subject produced a demand in advance of the art, resulting in more duplication of units; at the same time attracted the attention of metallurgists and chemists, with the result that the limiting factors assumed new values; some of them, as a result of better material and more appropriate accessories being developed, disappeared almost entirely.

Limiting Factors Are Few

To-day, the limiting factors so far as mechanical ability is concerned are very few and as a rule are well understood. The one that comes nearest to determining the possible power output of a single cylinder is the matter of piston areas.

The extreme heat conditions that pistons are subjected to limit the amount of area exposed to the amount that can be kept down to the proper temperature by heat flow to the cylinder walls. While this factor varies according to the m.e.p., it has been pretty well established at about 16 sq. in., which represents a bore of 4½ in.

Piston speeds are apparently governed by the ability of bearing metal to withstand the inertia forces. While different materials may be employed to decrease these forces, surface friction becomes a considerable factor at very high speeds, so that the practical speed in feet per minute has been established at approximately 3000. Bore to stroke ratio is purely a matter of choice, but is generally accepted as more conducive to thermal efficiency as the ratio increases; two to one, however, seems about the limit.

Compression pressures close to the point of pre-ignition are had almost universally when extreme power output is needed. While the volumetric efficiency controls somewhat the possible ratio of clearance to displacement, five to one is generally accepted, and represents approximately 100 lb. gage.

M.e.p. follows volumetric efficiency almost in direct proportion, the absolute being about 40 per cent above the com-

(*Continued on page* 791)

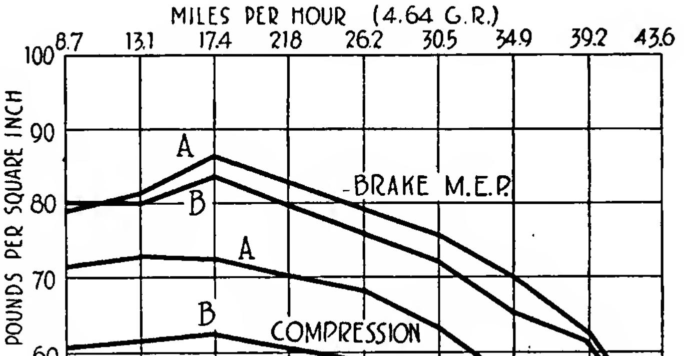

Fig. 9—Brake mean effective pressures and compressions for two piston lengths

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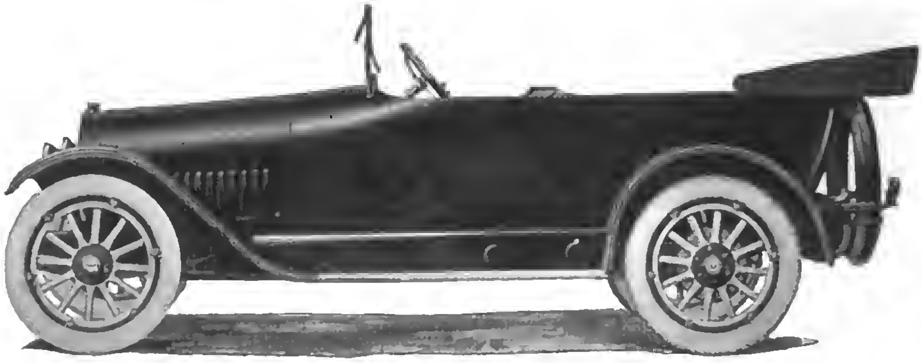
*President Finley Robinson Porter Co.

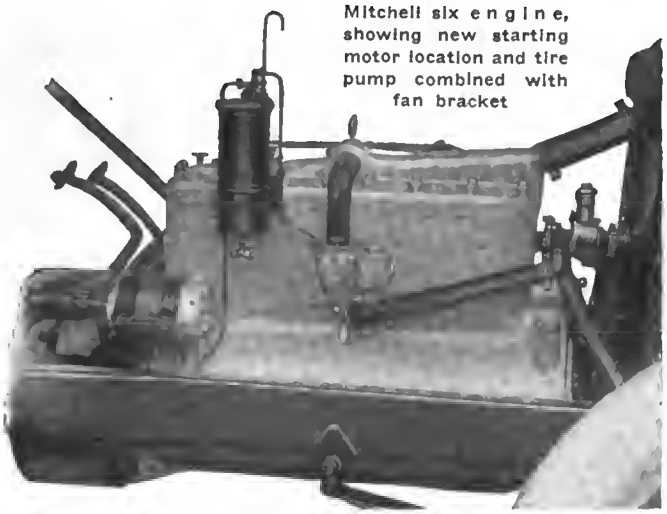
Better Bodies in Mitchell New Six

Lines Improved by the High Radiator—Engine and Chassis Refined

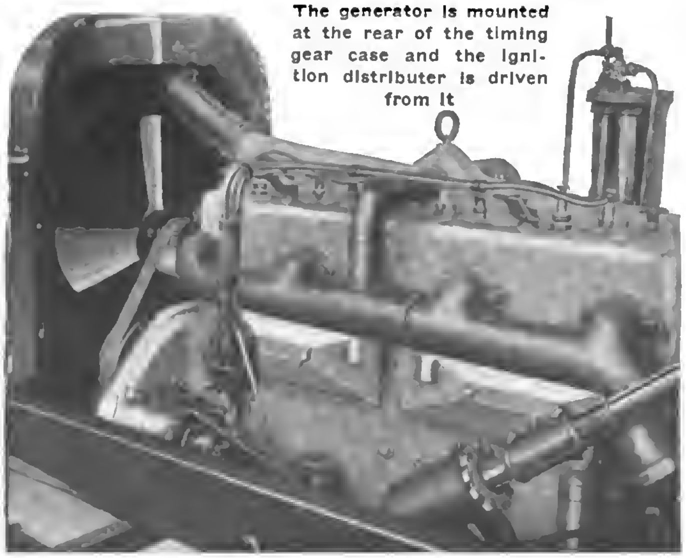


AS announced in THE AUTOMOBILE last week, the new model of the Mitchell Six, built by the Mitchell-Lewis Motor Co., Racine, Wis., is larger, roomier and more attractive in appearance than its predecessor, the Six of '16. The wheelbase has been increased 2 in. to 127 in. by increasing the length of the rear cantilever springs and changing other dimensions to correspond, the waterjacket of the 3½ by 5-in. high-speed block motor has been carried lower on the cylinders, accessibility has been improved and numerous other detail refinements have been made. Some of the most interesting developments, however, are in the body design.

In appearance, the new Mitchells are exponents of the latest in body design, having a high, narrow radiator and smooth, sloping hood, which is well rounded at the top, the rear part having suggestions of boat lines, together with a defined cowl at the back of the front seats. Accompanying the improvement in appearance and increase in the size of the car there has been an increase in price of $75, making the five and three-passenger $1,325 and the seven-passenger $35 additional.



Mitchell six engine, showing new starting motor location and tire pump combined with fan bracket



The generator is mounted at the rear of the timing gear case and the ignition distributer is driven from it

A feature that will be appreciated is that, like some other cars of its class, the five-passenger touring car in every respect is a duplicate of the seven except for the addition of the two spare seats, so that should the purchaser wish to increase the capacity of the five-passenger car he can obtain a seven-passenger in every respect like factory production by the installation of the additional seats which may be obtained later for $35. These seats, by the way, are the disappearing type and fold completely out of sight.

The forward seats, while having no space between them, are divided by a small arm which forms a shoulder rest for both occupants but does not interfere with entrance or exit to the driver's seat. Two little items which indicate the extent to which comfort has been considered are the glove compartment in the instrument board and the tonneau light on the back of the forward seat. Within the instrument board there is fitted a new compartment in which small traveling requisites may be carried and which is locked by the same key that operates the ignition lock. The tonneau light is provided with a push switch which can be operated by the tonneau passenger.

Engine Jacketing Improved

In the design of the block 3½ by 5 in. motor there has been but little alteration. The chief one is the extension of the waterjackets to a very much lower point on the cylinders, giving the engine a more symmetrical appearance as well as providing cooling surface, or water surface for more excessive demands than previously.

The engine is designed to be of the high-speed type and with this end in view special pains have been taken in balancing and lightening the reciprocating parts. The pistons are drilled to decrease weight, and also are provided with piston rings in the two lower grooves, which are made up of four special steel rings, to eliminate loss of compression. The top ring is of the ordinary iron construction. Small holes drilled through the machined oil grooves around the pistons allow the surplus oil to flow back into the crankcase.

The cylinders are L-head, cast in block and integral with the crankcase. This is designed to give rigidity to the motor and reduce vibration. The cylinder head is a one-piece casting, held in place by means of three rows of bolts and a leak-proof fit is assured by the use of a one-piece, copper-asbestos gasket. The cylinder heads can be removed without disturbing any other part of the engine. The crankcase is of the barrel type, the lower half being formed by a light, seamless, steel stamping, which is divided into two compartments, the upper fitted with overflow openings, and troughed for the connecting-rod spoons. The lower compartment comprises the oil reservoir.

The crankshaft has three bearings, and is offset ½ in. from the center of the cylinder. The gears which drive the camshaft, ignition distributer and tire pump are inclosed in a housing which is a part of the crankcase. Gears are lubricated by a separate oil lead and have helical teeth. The lubrication is a combination of circulating and splash, the circulation being maintained by a plunger pump operated by an eccentric on the camshaft. Oil is pumped from the reservoir in the crankcase to the compartments under each connecting-rod, and also to the timing gears in the front. A small quantity of oil is carried to the clutch bearing as well. A unique idea is carried out in the oil indicator. In place of the usual sight feed on the dash, the Mitchell has a plunger type, operated by the oil pressure. This consists of a small rod which protrudes from the dash, proportionately to the pressure of the oil in circulation. In addition to this, an oil level indicator is provided on the crankcase. Push rods and valve stems are supplied with an oil vapor through breather openings into the crankcase.

Fan and Water Pump Combined

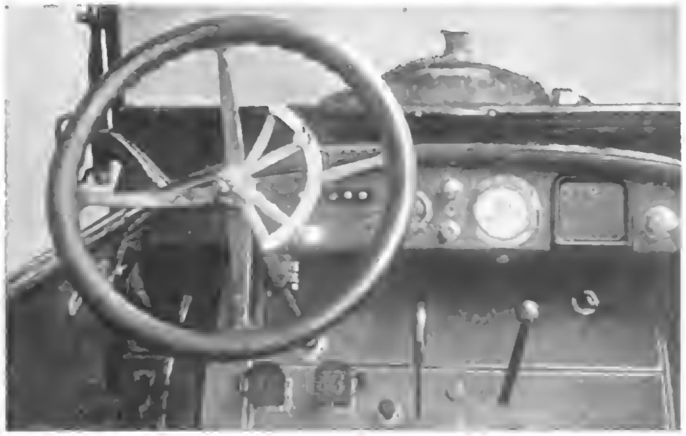
Another unusual bit of design is in the combination of fan and water pump, at the front end of the motor. Instead of mounting it on a lay shaft, the pump, which is a centrifugal type, is mounted on the fan shaft and thus is driven by the fan belt, which is made of endless fabric. Adjustment is provided by a wing nut. This swings the entire fan and pump assembly upwards and thus tightens the belt. The integral fan and pump bracket also forms the outlet for the water pump, thus simplifying the construction to a point where only one hose connection to the pump is necessary. As stated, the waterjackets have been carried down, so that they have extra capacity around the exhaust valve seats.

Ignition is taken care of by a storage battery and an automatic circuit breaker and distributer of the single-unit type, which is driven through a worm gear from the timing gears of the motor. The high-tension wires to the plugs are carried over the engine with special supporting bracket, which prevents chafing and leaking.

Integral Intake Manifold

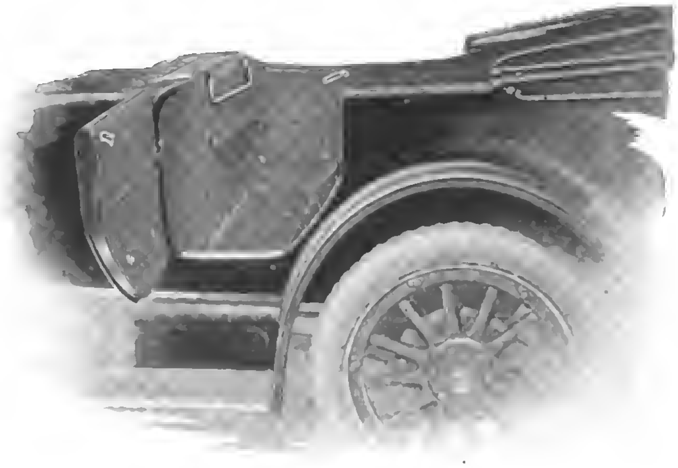
The carbureter is a Rayfield mounted on the right side of the motor. The intake manifold is cast inside of the cylinders, and passes between the middle cylinders from the carbureter on one side to the valves on the other. Fuel is supplied from a tank at the rear by the Stewart vacuum system. Within the flywheel is a cone clutch, which is made up of a stamped-steel spider faced with chrome leather, and having auxiliary springs. Adjustment is provided by three nuts.

Mechanically the alterations have been more in the way of slight changes in the motor which work for increased accessibility. This feature of accessibility is one characterized in the Six of '16 and Mitchell engineers have progressed still further in the new model. To this end the single-unit starting system which was a part of the design in the earlier six has given way to the Westinghouse two-unit system in which the generator and distributer are driven off the same shaft on one side of the engine while the starting motor operates through a Bendix drive to teeth cut on the flywheel. This eliminates the silent chain, which was a part of the starter-generator drive in the previous motor.



A feature of the Mitchell instrument board is the glove compartment

The front view of the new Mitchell six gives an excellent idea of the improved appearance in the body design. Note the high, narrow radiator and sloping lines of the hood



The tonneau door is wide and there is a light in the tonneau cowl

The 2 in. increase in the wheelbase brings this figure up to 127 in. This has been made possible by lengthening the cantilever springs 2 in. Last year these cantilevers were underslung and have been one of the factors in making the Six of '16 an unusually easy riding vehicle. Along with the increase in the length of the springs, the number of leaves have been correspondingly increased.

The engine-driven tire pump has been elevated to a point where it can be gotten at easily and is now mounted immediately behind the fan and driven by a gear on the fan shaft.

Demountable rims, with 34 by 4 tires, anti-skid, on the rear, power tire pump, one-man top and dimming headlights, are among the features of equipment.

Tracing the Why of Carbureter Parts

Cleveland S. A. E. Hear Paper Explaining Functions of Compensating Jets and Air Valves—Diagrams Show Exact Effects of Alterations in Design

By F. H. and F. O. Ball*

THE laboratory used in the investigations here reported contained a gasoline motor and an electrical equipment for loading the motor, also a metering outfit for measuring the gasoline and air used by the carbureter under all conditions. A steam ejector was arranged to be used as another means for drawing air and gasoline through the carbureter. A water column provided the means for observing the suction or head which impelled the flow, thus furnishing the data necessary for plotting curves showing the quantities of gasoline and air discharged at each head.

The Law Governing Flow

Contrary to a somewhat prevalent opinion, the same law governs the flow of air and of gasoline through a fixed orifice and the quantities discharged in both cases vary as the square root of the suction or head. This law does not hold good at extremely high velocities, but throughout the range covered in carbureter practice it may be accepted as approximately correct. It follows, therefore, that in a fixed orifice carbureter, if the flow of gasoline and air begin at a common zero, the ratio of one to the other, at any point, will be the ratio throughout the whole range of working capacity.

In practice it is not desirable to maintain the gasoline level at the overflowing point in the discharge nozzle, therefore the zero of the gasoline curve of flow does not coincide with the zero of the air curve.

Quantity Curves

The foregoing is illustrated in Fig. 1, in which the suction or head is indicated by the scale at the bottom of the chart. The quantities of gasoline are indicated by the scale at the right and the air scale is at the left.

These curves, as drawn in this case, indicated that the capacity of the respective orifices was such that with a suction equal to 20 in. of water, 10 oz. of gasoline were discharged per minute and 100 cu. ft. of air. This ratio has been found to be a strong, clean burning mixture. It corresponds approximately to 12 lb. of air to 1 lb. of gasoline.

Referring again to Fig. 1, it will be noted that the air curve and gasoline curve do not have a common zero and therefore the ratio of gasoline to air, at different points on the curves, is not constant.

Quality Curves

The actual ratio of gasoline to air, under the conditions shown by the quantity curves of Fig. 1, is clearly shown in Fig. 2. Here the horizontal scale is in cubic feet of air per minute and the vertical scale in ounces of gasoline per 100 cu. ft. of air. The right-hand end of the quality curve indicates 10 oz. of gasoline per 100 cu. ft. of air and corresponds with the right-hand end of the quantity curves of Fig. 1 where they coincide. Progressing backward toward zero, the quality curve of Fig. 2 shows the effect of the difference in the zeros of the two quantity curves of Fig. 1.

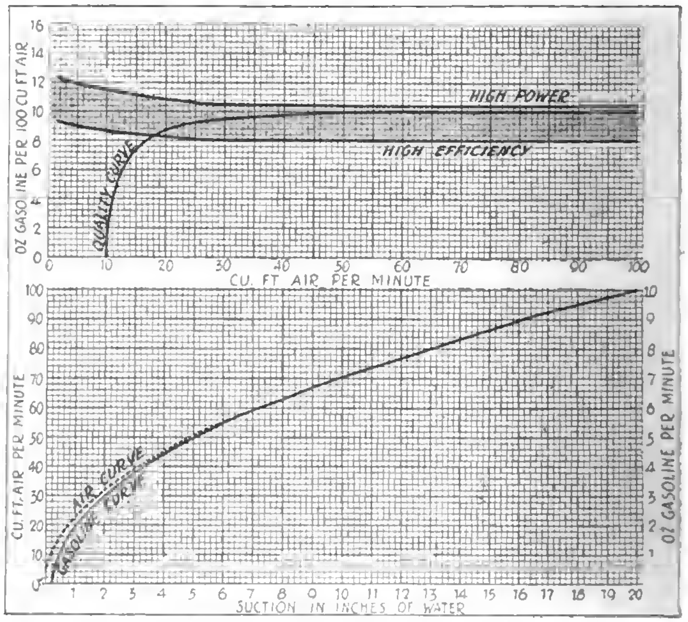
The shaded zone in Fig. 2 covers the range of quality within which it has been found desirable that the quality should be maintained by the carbureter.

The boundaries of this zone may not be universally accepted as the best, but that is a matter of no importance because they are at least approximately the best and the zone is entirely satisfactory as a field in which to plot the characteristic quality diagrams of various types of carbureters for comparison.

Referring to Fig. 2, it will be seen that when less than 18 cu. ft. of air per minute is being drawn through the carbureter, the quality passes outside the desirable zone.

This makes it impossible to enrich small quantities of air. Therefore, the elemental fixed orifice carbureter cannot be used with success, and it becomes necessary to embody in the carbureter some means for augmenting the gasoline supply where it is deficient. Various devices are used for this purpose. Some affect the necessary compensation by acting on the gasoline supply, others act on the air and still others on both.

It is proposed to illustrate and analyze the effect of the most important of these devices, selecting those which have been the most extensively used in high grade instruments. This analysis is made solely for the purpose of showing the effect of the various devices in maintaining a normal quality to a lower minimum quantity than is possible with the elemental fixed orifice carbureter as shown on Fig. 2. In this analysis no attention is paid to the relative maximum capacities nor to any other question relating to the several types of carbureters. These other questions will be considered separately in connection with quality diagrams made by actual carbureters of the several types that are being theoretically analyzed.



Below—Fig. 1, Above—Fig. 2—Curves for elemental carbureter with fixed air and fuel orifices

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*Penberthy Injector Co.

Figs. 9, 11, 12, 15 and 17 of original paper are omitted as their character is well described in the text.

This carbureter differs from the elemental fixed orifice carbureter in that it is provided with supplemental or compensating devices which increase the supply of gasoline, particularly at that part of the quality diagram where it is most deficient.

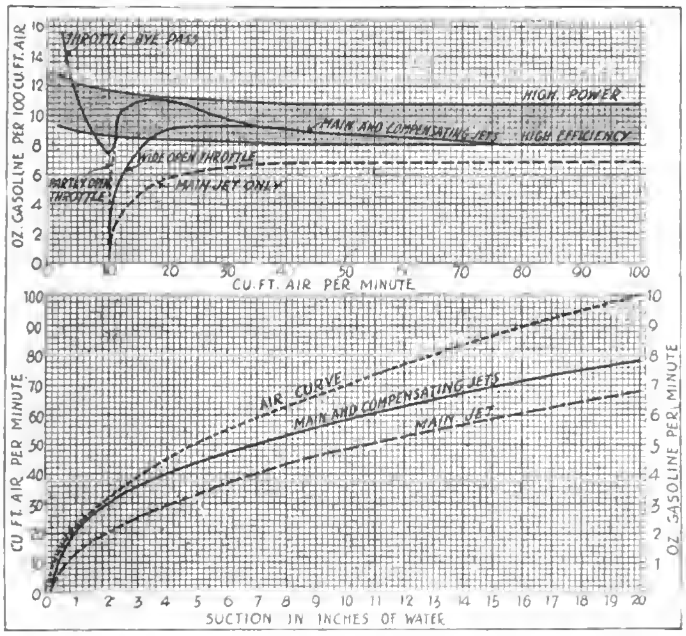
Figs. 3 and 4 illustrate and analyze the effect of these compensating devices. In Fig. 4 the quantities discharged by the main jet under various amounts of suction will be found along the main jet quantity curve.

The quality produced by these quantities is shown on Fig. 3 along the curve marked main jet only. Referring again to Fig. 4, a second supply is drawn from a well open to the atmosphere and supplied with a constant quantity of gasoline from the float chamber by gravity. The total quantities of gasoline from this double supply are indicated by the curve marked Main and Compensating Jets in Fig. 4, and the effect on the quality is indicated in Fig. 3 by the curve marked Main and Compensating Jets. It will be noticed that the quality curve branches and that the two branches marked Partly Open Throttle and Wide Open Throttle come together at a common zero. This will be explained further on.

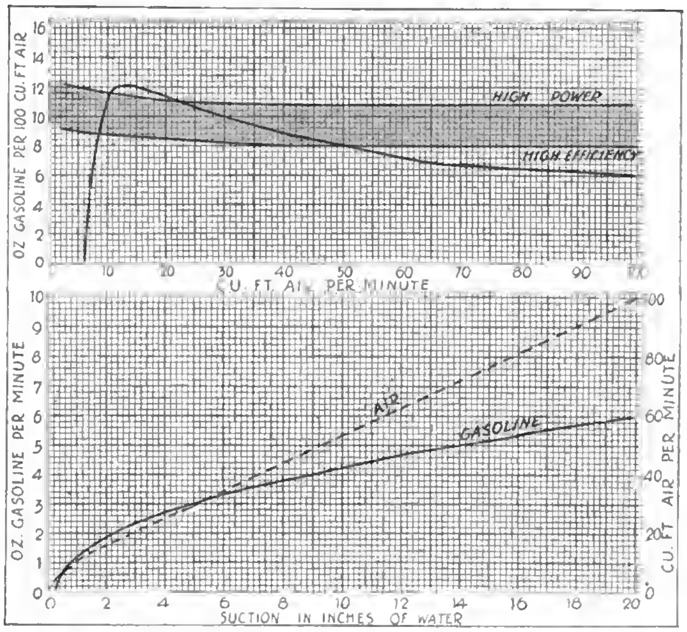
A third supply of gasoline is drawn from the atmospheric gravity well already referred to and discharged at a point on the motor side of the throttle. This is also essentially a constant quantity and its effect on the quality is indicated by the quality curve marked Throttle By-Pass in Fig. 3.

When the throttle is nearly closed the by-pass comes into action and draws gasoline from the gravity well, but when the throttle is wide open and the motor is slowed down by additional load the decreasing suction of the motor permits the atmospheric well to gradually fill with gasoline, thus decreasing the gravity head in the float chamber and causing the quantity discharged into the well to decrease. The effect of this smaller quantity of gasoline drawn from the atmospheric well is shown in Fig. 3 on that part of the quality curve marked Wide Open Throttle. The other branch marked Partly Open Throttle in Fig. 3 indicates the quality when, by progressively closing the throttle, the by-pass comes into action and prevents the level in the atmospheric well from rising. The quantities which produce the branches of the quality curve Main and Compensating Jets, are shown in Fig. 4 by the branches of the quantity curve.

With this arrangement then the carbureter has two distinct quality curves as shown by full lines.



Above—Fig. 3, Below—Fig. 4—Curves for carbureter with fixed orifices and compensating device



Above—Fig. 5, Below—Fig. 6—Analysis of mixture produced by elemental type air valve carbureter

This completes the analysis of this class of carbureters. It is a small class and no further types will be considered.

Air Valve Carbureters

This class of carbureters is much larger than all other classes combined, and the class is represented by a large number of types. Only a few of the most important types will here be considered.

The air valve carbureter will be best understood by first making an analysis of the simplest form, in which all the gasoline is admitted through a fixed orifice and all the air through an air valve closed by a spring.

This is an imaginary type which could not be used with success in practice.

Referring to Fig. 5, it will be seen that the quality does not follow the desirable zone, but crosses it at an angle, thus making a very limited range of capacity through which the mixture would fire.

The analysis of this quality diagram will be found in Fig. 6.

Comparing the quality diagram of Fig. 5 with the diagram of Fig. 2, it is evident that a combination of the two systems of control would make a better quality diagram than either.

This suggests the type of air valve carbureter that will be next considered.

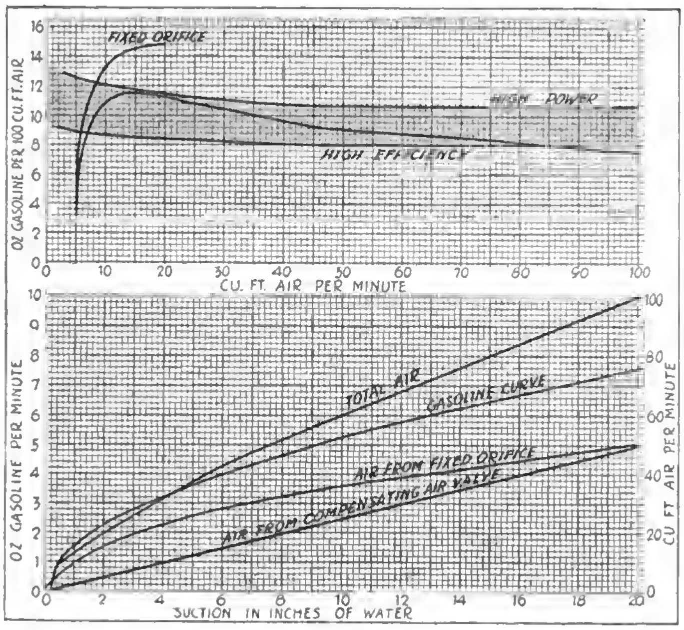
A Simple Carbureter

A carbureter with compensating air valve and fixed orifice is well known in a great variety of forms. The fixed air orifice is often called the strangle tube, or the venturi choke, and ordinarily the gasoline nozzle terminates in this passage. It will be assumed in this case as in the preceding cases, that the gasoline is regulated by a fixed orifice, or, in other words, that the area of the gasoline orifice remains unchanged in the operation of the carbureter.

A second air passage in this type is closed by a spring opposed air valve, which opens as the suction increases.

Referring to Fig. 7, the three dotted curves represent quantities of air passing through the air passages with different degrees of vacuum in the manifold as indicated by the scale at the bottom of the chart.

The lower dotted curve indicates the quantities admitted by the progressively opening air valve. The next dotted line represents the quantities admitted through the fixed air orifice and the third dotted line is the sum of these quantities



Below—Fig. 7, Above—Fig. 8—Carbureter with compensating air valve device

and is therefore the total air. The full line curve indicates the quantities of gasoline admitted through the fixed gasoline orifice.

Referring to Fig. 8, the dotted curve shows what the quality would have been if the air valve had been prevented from opening, and the full line curve indicates the quality when the air valve is free to open in response to increasing suction.

Supplemental Gasoline Jet

Various means have been used to cause a second gasoline jet to come into action before reaching maximum capacity, thus augmenting the supply where it has become deficient.

If this second jet comes into service abruptly as it does in many cases, it causes the quality diagram to make abrupt changes of quality.

This is clearly shown in Fig. 9, which is a diagram actually made by a well-known carbureter of this type. The dotted curve shows what the quality would have been with the first jet only, and the added richness caused by the second jet is shown by the full line curve.

Metering Pin on Air Valve

Fig. 10, shows how the effect sought to be produced with the double jet as shown by Fig. 9, is more perfectly produced by a tapering metering pin attached to the air valve and arranged so that when the aid orifice is increased by opening the air valve, the gasoline orifice is simultaneously increased by withdrawing the tapering pin.

With this device a fluid dashpot attached to the valve seems to be necessary to prevent objectionable reciprocating motion of the metering pin attached to the air valve. These moving parts attached to the air valve prevent a delicacy of action that is desirable when small quantities are being used and the forces acting on the valve are consequently very weak.

To overcome this difficulty and give stability of action it has been found necessary to make the primary fixed air orifice larger than with the simple carbureter, thus making it possible to keep the air valve in contact with the seat until the actuating forces have become of some magnitude. The effect of this is to make it impossible to enrich a small quantity of air. This will be seen by referring to Fig. 10. Under these conditions the closing of the throttle for slow speed reduces the motor speed partly by reducing the quantity of mixture entering the cylinder and partly by the decreasing richness of the mixture. This results in an extremely lean mixture for idling, and slow running, which fires with uncertainty and is very susceptible to the cold.

Throttle Cam Needle Valve

Fig 11 shows a quality diagram made by the best known carbureter of this type and it illustrates the effect produced by this method of control.

It will be seen that each of the several quality curves have the same general characteristic as the curve in Fig. 12.

These several curves in Fig. 11 show that in each case the needle valve remained in one position throughout the curve, which would necessarily mean that the throttle valve also remained in one position and the speed was changed by changing the load.

If the load at each speed is such that the necessary position of the throttle causes the needle valve to supply the amount of fuel required by the air that is being used, then a normal quality of mixture is supplied, but under all other conditions the mixture is either too lean or too rich. To understand this clearly, refer to Fig. 11, and note that when 100 ft. of air was being used by the motor, the quality of the mixture was 10.

Assuming now that the throttle remains wide open, and the speed is reduced by increasing the load (as it would be in climbing a hill) the quality grows steadily richer following the upper curve and the motor presently ceases to fire because of excessive richness. This is a condition that is always found the gasoline orifice is varied by opening and closing the throttle.

Liquid Friction as a Factor

In the analysis of all the types of carbureters that have been considered, the quantities of gasoline flowing through a fixed orifice have been assumed to vary as the square root of the suction or head. The curve representing these quantities is also the curve representing the velocity of a mass in equal increments of time when acted on by a constant

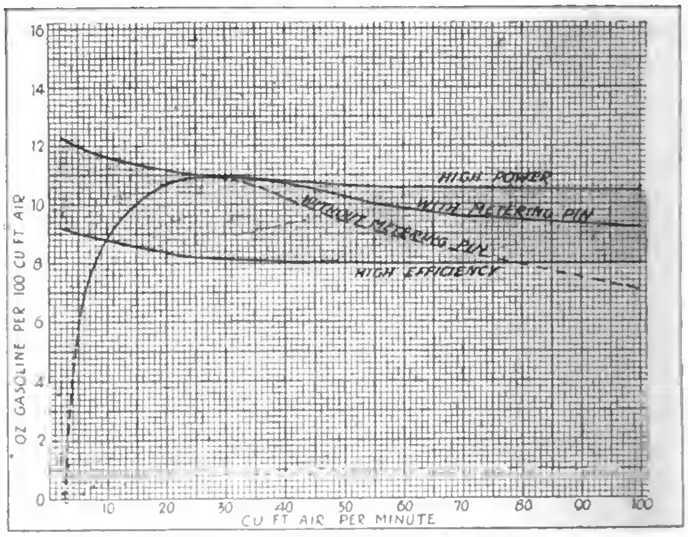


Fig. 10—Carbureter with metering pin attached to air valve

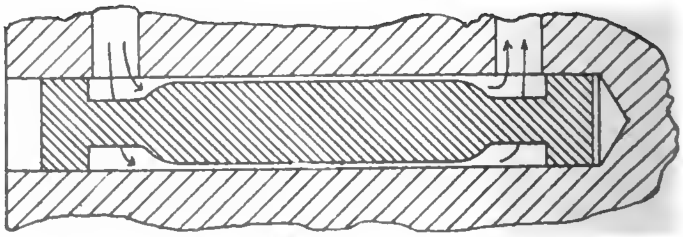


Fig. 13—Device for creating liquid friction and restricting gasoline flow

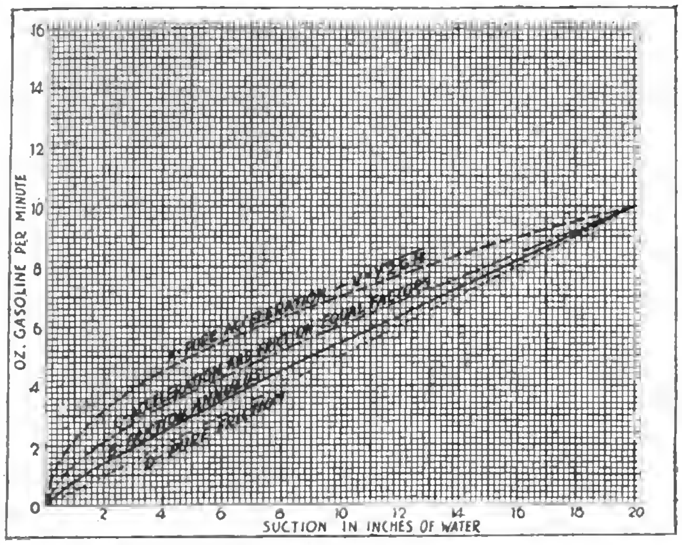


Fig. 14—Curves showing effect of liquid friction attachment

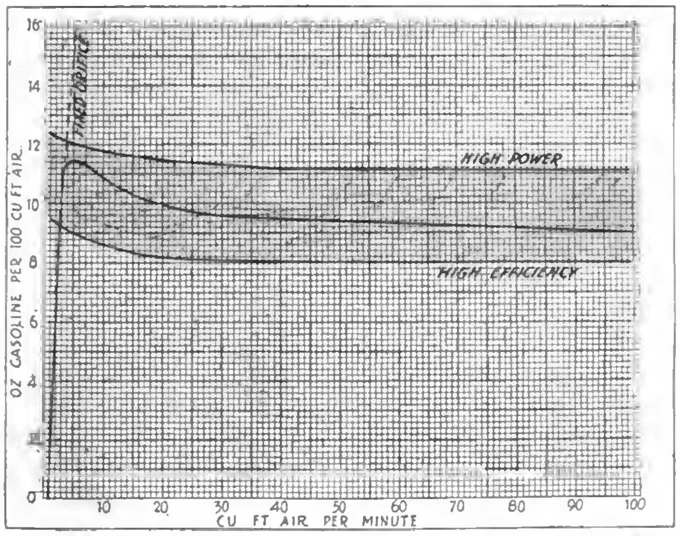


Fig. 16—Curve from air valve carbureter with frictional gasoline damper

force as the force of gravitation, and the law is called the law of acceleration. Because of the foregoing, it is evident that the friction of liquid flowing through an orifice is a negligible quantity, and that the inertia of the liquid which opposes acceleration through the orifice is practically the only factor, and the flow may be called an acceleration flow.

Liquid friction, however, may be so magnified relatively to the inertia of the liquid as to become the dominating factor, in which case the shape of the curve is greatly changed because the resistance of friction is directly as the velocity and not as the square of the velocity.

Fig. 13, represents a device for magnifying liquid friction relatively to the resistance of its inertia. It will be seen that the liquid passes through a very thin annulus of relatively large diameter. This thin liquid tube encounters liquid friction on a large surface, both inside and outside. Because of the high degree of friction thus developed, the cross section area of the annulus must be much larger for a given quantity than would be required with an orifice flow, and this decreases the velocity and consequently the effect of inertia.

The rounded corners of the entrance to the annulus eliminates a resistance called entrance head. Fig. 14, is a graphical illustration of the foregoing. The curve *A* will be recognized as the curve representing the relative quantities discharged by an orifice. The diagonal line connecting the ends of curve *A* represents the quantities that would be discharged if the only resistance to the flow were friction, because in that case the quantities would increase directly as the head. This, of course, is an impossible condition in practice. Curve *B* represents the quantities actually discharged when the flow was resisted by a device such as is shown in Fig. 13.

The dotted curve *C* passes midway between the curve *A* and the diagonal line. All curves between *A* and *C* may be called curves of acceleration flow, because in every case acceleration is the dominating factor, and curves between *C* and the straight line may be called curves of friction flow, because in every case friction is the dominating factor.

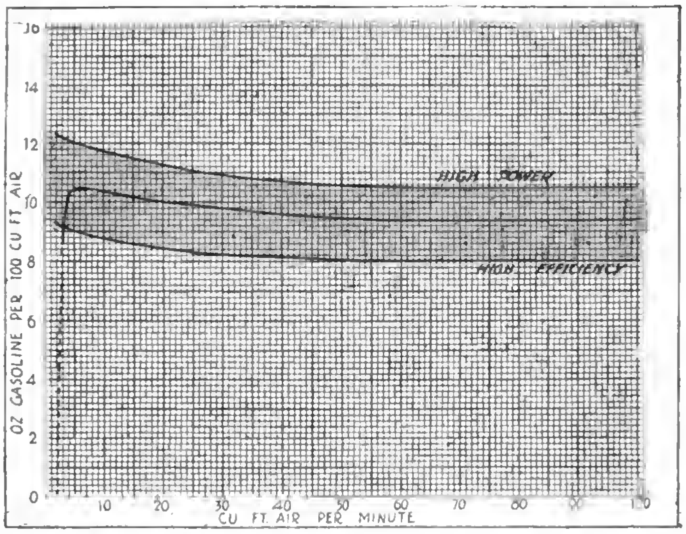
Friction Control of Gasoline

Referring to Figs. 5 and 6, it will be noticed that the reason a constant ratio between the gasoline and air cannot be maintained is that the quantities of gasoline discharged by a fixed orifice are found along a curve and the quantities of air discharged by a spring opposed air valve are found along a straight line, or practically so, and a straight line cannot be made to coincide with a curve except at a single point.

Referring now to Fig. 15, it is evident that a gasoline flow represented by curve *B* is much more desirable to use with an air curve represented by a straight line than the gasoline curve *A*.

In Fig. 15, will be found the analysis of a carbureter using friction control of gasoline. This analysis follows the same general plan that was followed on the preceding pages, and the resulting quality diagram will be found in Fig. 16.

(To be continued)



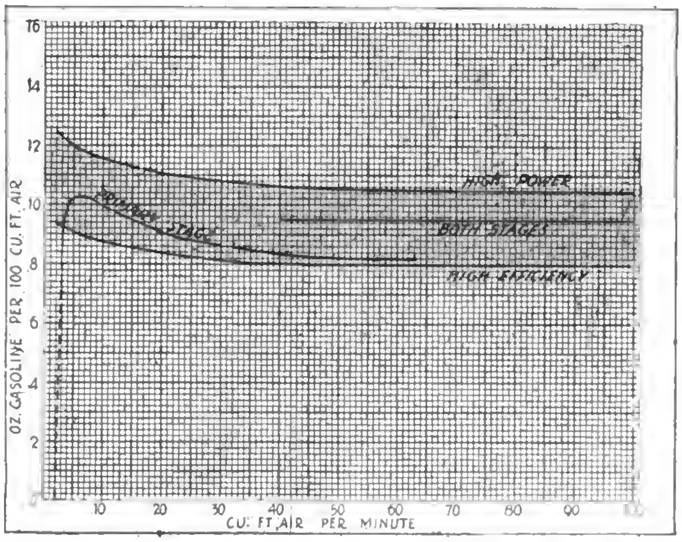


Fig. 18—Air valve carbureter with friction device taken from actual carbureter

Fig. 19—Curves of actual two-stage carbureter

Springs without Shackles Possible

Some Experiments Being Made With Different Designs—A New System for Spring Leaf Lubrication

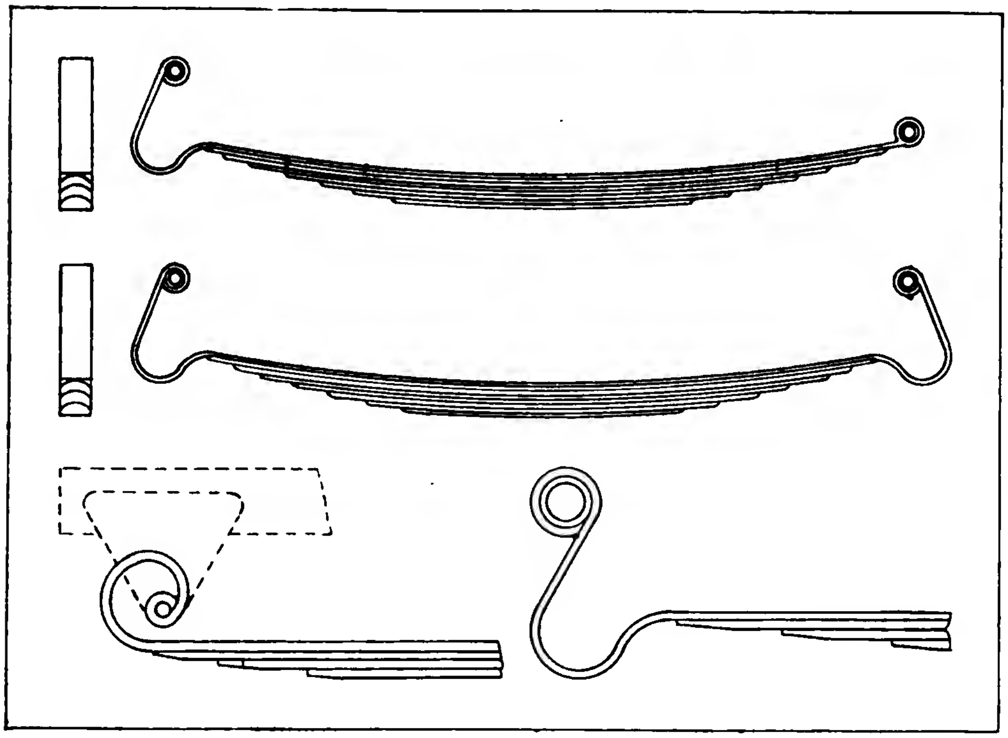
RECOGNIZING that the part of the spring suspension which is the quickest to show wear is the spring shackle, the Sheldon Axle & Spring Co. have been making experiments with several designs of spring in which the shackle is eliminated altogether. The amount of movement on a shackle pin is extremely small, which is the reason why these pins are so difficult to lubricate properly. Since the purpose of the shackle is to allow for the very slight variations in length of a flat spring as it is flexed, the substitution of a secondary spring action to replace the shackle is a natural step, and the Sheldon design consists of a slight alteration to the form of the main spring so that it can compensate for changes in length within itself.

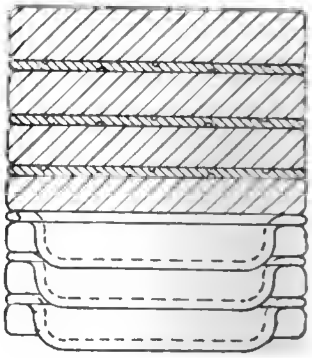
The sketches show several different ways of working out the idea, and the experiments so far are promising in their results. It must be explained, however, that these springs are not yet being used commercially since it is desired to try out the different shapes thoroughly.

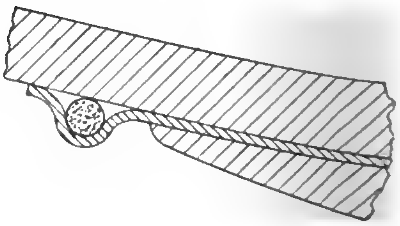
The upper spring in the left group is designed for the rear position where Hotchkiss drive is used; the one immediately beneath is for use with a torque tube design where the spring needs to be free both ends, and the two scrolls at the bottom are alternative designs which are being tried out for durability, side by side.

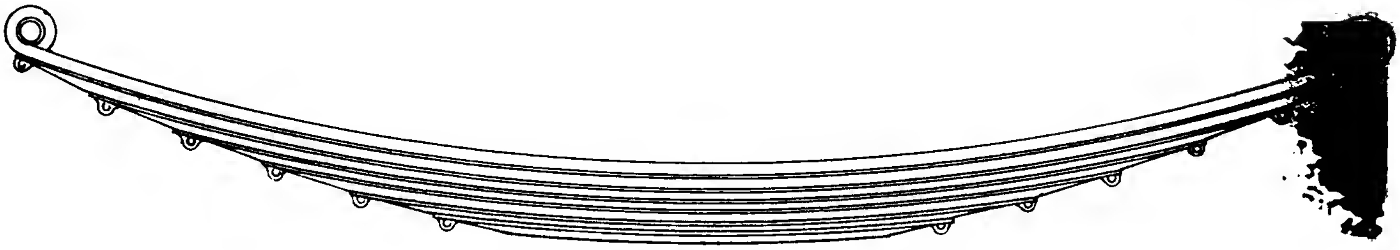
A Lubricating Idea

The large spring at the bottom of the cut, and the two sections on the right side show an idea of A. M. Laycock's for lubricating spring leaves. Between each leaf pair is a piece of thin steel with grooves cut or pressed in it. These spacing strips are extended beyond the ends of the leaves and then rolled into little channels with the ends turned up, and the cup so formed is filled with an absorbent pad. The channel has a hole pierced in one end, the spring being so mounted that this end comes on the outside of the chassis, and it is only a short task to inject a squirt of oil into each cup.







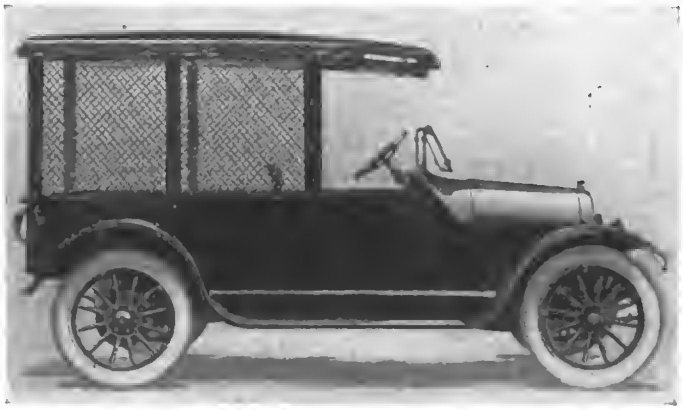


Top Left—Group of scroll end springs designed for use without shackles. Below and Right—Idea for lubricating spring leaves with an oil can.

Overland Adds Light Delivery Model

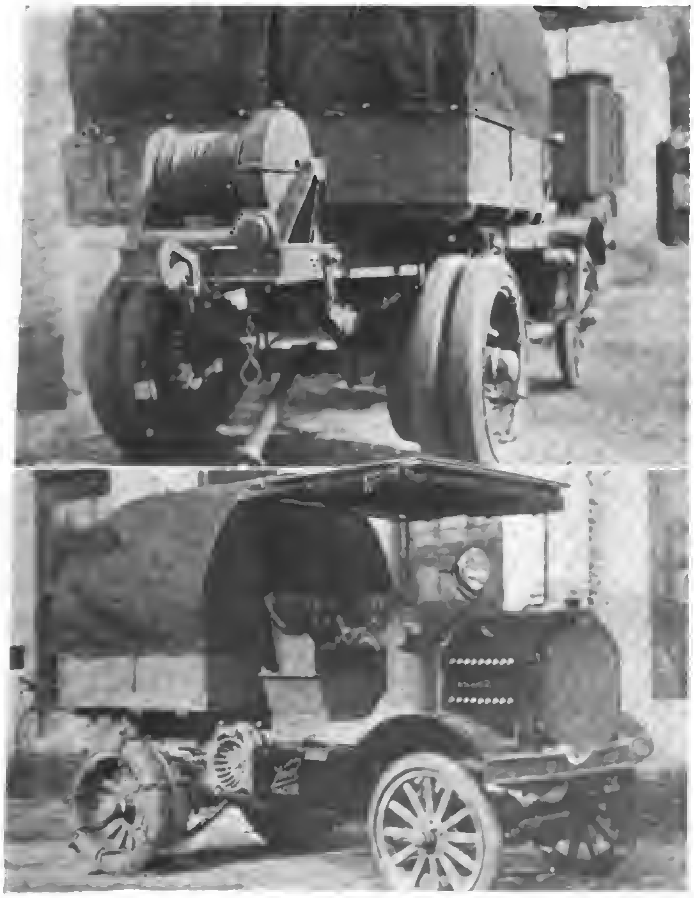
A NEW delivery car known as model 75 has been brought out by the Willys-Overland Co., Toledo, Ohio. The new car is smaller than the previous Overland delivery vehicle, which had 800 lb. capacity and sold for $695. The new car sells for $595 and has a capacity of 750 lb. It is furnished complete with a screen-sided body and is intended particularly for light fast delivery work. It is mounted on pneumatic tires and is provided with side doors on the cab and complete electrical equipment.

The new motor differs from that employed previously on the Overland commercial wagon. The cylinders are cast in block and the valves are to the right instead of to the left. The previous engine had individual cylinders. Cooling is by thermo-syphon and ignition by the single Splitdorf instrument with hand advance.


The new Overland light delivery car selling at $595

It has a cone clutch, connected with the gearset by a torsion tube inclosing the driveshaft, the gearbox being mounted on the rear axle as in previous Overland models. Torque and propulsive stresses are both taken through the torsion tube. Rear springs are of the cantilever type, three-quarters-elliptic springs being used on the larger model. The steering wheel is to the left and the levers are in the center. The tires are mounted on demountable rims. The standard body is of the piano box type, extending back on a line with the top edge of the cab door and surmounted by a stage top on six uprights. Roller curtains are provided in addition to the screen sides and a tailboard is fitted at the rear with leather retaining straps. The driver's seat extends part way into the body and, unlike the helper's seat, has a folding back to afford access to the load from the front. The helper's seat folds out of the way when not in use.

A New Knox Towing Winch Tractor


Two views of the new Knox towing winch tractor, showing its compact construction. The mounting of the towing winch horizontally across the rear is illustrated above

A NEW towing winch tractor has been placed on the market by the Knox Motor Associates, Springfield, Mass., under the name of model 36. The new machine is a self-contained vehicle practically identical with the model 35 semi-tractor, except that the frame is carried well back of the rear axle and it is mounted on a single set of semi-elliptics instead of the two sets of springs, semi-elliptic and cantilever, used on the older model. The body, which is about 4-ft. long and of about the same width, is placed immediately behind the cab, the winch being placed horizontally across the frame behind it. It is equipped with towing hooks fore and aft, the rear being centrally located and the front consisting of two mounted on each forward corner.

Triangular brackets of substantial section are used for the winch mounting and the drive is by worm from a transverse shaft driven off the gearset. The winch is controlled by a separate clutch. It carries 150 ft. of wire cable, and at 1000 r.p.m. the motor hauls in the cable at 150 ft. per minute. There is a large sprag to anchor the tractor when the winch is in operation. This can be lifted readily when not in use and is pivoted directly to the rear axle to allow the cushioning effect of the springs to come into effect when it is in use.

A heavy coil buffer spring is used in connection with the rear towing hook to cushion the draft. The capacity of the chassis is 4 tons, the body permitting a traction-giving load to be carried and also providing carrying space for road tools, etc., if desired.

Among the uses of the winch may be mentioned wrecking purposes, heavy hoisting, emergency hauling and all-around utility work in pulling through bad stretches of road, etc. The pulling-power of the winch is 20,000 lb. For traction on roads not adapted to rubber tires steel wheels are provided at slightly extra cost. These are interchangeable with the rubber-shod wooden wheels. The hydraulic brake used on the older model tractor is also employed on this. The price of the vehicle is $5,000.

The FORVM

WHEEL WOBBLE CAUSED BY STEERING LINK LAYOUT—THROTTLING BY CHANGING LIFT OF INTAKE VALVE—KEROSENE TROUBLES IN USING GASOLINE—BRAKE-ACTUATING SYSTEM AND REBOUND CHECKS

Steering Link Design Causes Wheel Wobble

By Leon A. Chaminade

THE articles on steering gear layout published in THE AUTOMOBILE for March 23 and April 6, by H. H. Dyke and Theo. D. Stanley respectively, have brought to my attention a correction for the faults of the present steering system, which has not been, to my knowledge, brought forth in the trade papers. Having had many years' experience as a driver of automobiles and being at present a student of machine design, I heartily agree with Mr. Dyke about the advantages of the present arrangements of the front spring, steering link and knuckle steering arm, which cause a bad wobbling of the front wheels while traveling over rough roads.

Mr. Dyke is in error in saying that with any alternative construction, from the present standard arrangement of steering connection from frame to axle, the steering link must run crosswise or partly crosswise of the car. Fig. 1 shows a front spring pivoted at its rear end and shackled at its front end. The steering gear housing is attached to the top of the frame and the steering gear arm projects downward outside the frame, having its lower point on the center line of the front spring pivot pin when the wheels are parallel to the axis of the frame, that is, when the car is traveling in a straight line. Since the axle in its up and down motion travels along the arc *A*, which has its center at *A*, the steering knuckle arm will move along this same arc. In the present standard arrangement this true motion of the steering knuckle arm is interfered with as explained by Mr. Dyke, but with the construction shown in Fig. 1 there is no interference and therefore no wobbling of the front wheels because the front end of the steering link moves along the same arc, *A*, for the steering link and spring are pivoted on the same center line.

The advantages of this construction are that the spring will act as a cushioning buffer between the front axle and frame as in the standard arrangement; that the spring will prevent side sway or lateral movement of the front wheels relative to the frame; and will permit the cushioning movement between the front axle and frame to take place without interference with the proper action of the steering connection. The steering gear arm, and therefore the steering gear housing, will be placed further forward than in the standard arrangement, necessitating more rake to the steering column, which means a more comfortable position of the steering wheel for the driver. There will be much less wear on all steering gear parts. This construction does not bring the steering link crosswise of the car but parallel to it. The disadvantage is that the front axle is pushed by the spring and not pulled by it; but this disadvantage is far more theoretical than practical as shown by the best racing machines and a large percentage of the stock cars built today, on which not only the rear axle but the whole car is pushed by the rear spring. If the rear spring is capable of pushing the whole car satisfactorily why cannot the front spring push the front axle and wheels in a perfectly satisfactory manner?

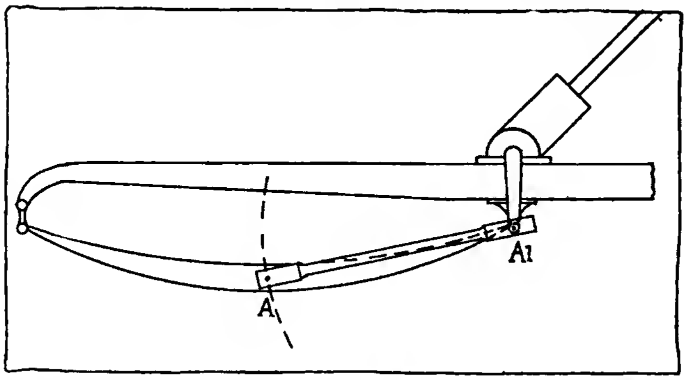


Fig. 1—Action of steering link when front spring is pivoted at its rear end and shackled at the front. This construction is designed to prevent the wheels from wobbling

Throttling by Changing Intake Valve Lift

By C. J. Morrison,

Chief Engineer, Meyer, Morrison & Co., Inc.

THE suggestion in a recent issue of THE AUTOMOBILE that throttling be accomplished by changing the lift of the intake valve is very interesting. It appears, for many reasons, to be a better way of throttling than present methods, but, unfortunately is hard to accomplish on motors having more than two cylinders.

The old one-cylinder Cadillacs used this method of throttling with great success. This motor, in common with other early types, was modeled after the steam engine, and the intake valve was actuated by means of an eccentric on a half time shaft just back of the crankshaft and a connecting-rod similar to the device used on steam engines. The back end of the rod ran on a roller which could be raised and lowered by means of a fulcrum connected to a rod which led to a handle on the steering column. When the fulcrum was in its lowest position, the connecting-rod simply ran back and forth on the roller without lifting the valve. As the fulcrum was raised, the rod opened the valve more and more until the full opening was reached. Of course the rod had considerable travel in order that the valve could seat after being lifted to its greatest opening.

The carbureter on this car was also interesting as its design was entirely different from present practice. Gasoline passed through a needle valve and dropped down onto a fine mesh wire screen which completely filled the air inlet. This screen was funnel shaped and had its point toward the incoming air. As the air passed through the screen it picked up the gasoline vapor and formed a perfect mixture. The stem of the needle valve was attached to a flat circular disk which raised in response to the suction from the engine and permitted gasoline to fall down onto the screen.

This carbureter was not waterjacketed but was practically part of the cylinder head and therefore kept warm. The addition of a stove over the exhaust pipe would undoubtedly enable it to handle present day fuel very efficiently.

Excellent Vaporization

The method of vaporizing the gasoline and mixing with the air was better than in some of the latest designs. When a drop of gasoline fell on the screen it spread out in a thin film which insured that it would vaporize and mix thoroughly with the incoming air.

A few years ago a man who was still driving one of the old Cadillacs was asked what kind of a carbureter it had. He studied for a moment, then said, "Carbureter? What is that? I don't believe my car has one." Although he had driven the car for many years and had taken all the care of it himself, he had never had any reason for discovering the carbureter. There is a lesson in this for some of the designers of the modern car.

Kerosene Troubles Exist in Gasoline Carburetion

By W. P. Deppé

I WISH to call attention to a phase of carbureting so-called cracked gasolines which is beginning to become more apparent every day as the increase of kerosene cuts, perhaps, are being forced into gasolines, to answer the public's cry for more fuel all the time.

In the article on "The Problems of Kerosene," in THE AUTOMOBILE for March 30, quite ably written by A. L. Clayden, chairman of the standardization committee of the S. A. E., he calls attention to some well-known features of difficulty surrounding the use of kerosene in high speed variable speed engines, as compared to the use of gasolines in the same engines.

But he did not mention the fact that kerosene troubles are actually existing to-day in the average gasoline carburetion on practically all automobiles now outstanding with the ordinary designs of carbureters, as they are now generally known. It is the cause of loss of power, difficult starting at times in cold engines, less miles per gallon, even in the smaller engines, and lighter cars, in some sections, with resultant fewer ton miles per gallon of fuel consumed than ever before. This is apparent when one takes the time and trouble to go into details of any average statistics bearing on this subject.

Properties Remain the Same

I refer to the fact that if you crack crudes or kerosenes, by any known method of distillation, into so-called gasolines, which may perhaps show higher Baumé scale readings, and lower boiling point temperatures when in liquid state as such cracked gasolines, in comparison to the same readings in the crudes or the heavier hydrocarbons from which they were cracked, that you do not as yet seem to alter the action of the vapors or gases, in carbureting for internal combustion engines with these so-called cracked gasolines. That is, the vapors and gases seem to require just as high temperatures and heat volumes to hold them in such states as the original oils required for their vapors and gases, when in motors, mixing chambers, manifolds, valve chambers, and within the cylinders during intake stroke, etc.

The vapors of so-called cracked gasolines, and their gases act just like those of kerosene mentioned by Mr. Clayden in the article mentioned, in transit in manifolds, seem just as susceptible to temperature variations due to throttling, expansion, precipitation from gas to vapor and then to liquids, and are just as slow to ignite and with flame propagation seemingly just as slow as the vapors and gases of the heavier hydrocarbons from which these so-called gasolines were cracked by any method I have seen demonstrated either in the laboratory or in the commercial sales of gasolines.

I am glad to say, however, that it is possible now for any automobile engineer to have carburetion methods installed in any good four-cylinder model, with proper designs used for gas producers, distributing manifolds, valve chambers, with correct relation between bore and stroke, and where the highest engine speeds do not require much over 2000 r.p.m. using either gasoline or kerosene.

Either Fuel Can Be Used

In such a unit, it is now possible to operate either on all gasoline, mixtures of gasoline with kerosenes, either mechanically after put into the markets, or through the cracking methods of making gasolines from heavier hydrocarbons, or on all kerosenes, when gas producers and other details are adjusted with heat sufficient to handle all kerosene. There is no perceptible difference in road work, with but very slight variations on brake load in the testing rooms, as between all gasolines, or all kerosenes, with heat sufficient to handle all kerosenes; all on the same fixed meter adjustments. There is a slight loss of power above 2000 r.p.m. and even some brake load losses in power over 1000 r.p.m., but these are not apparent on the road tests, because these gas producers on the road tests work as designed. That is, they average up the variables met with on the road, but some of which are fixed in dynamometer tests, and too much heat develops on the brake tests, in some respects, but which are leveled out in road work, as cars are used in ordinary daily routine.

There is no apparent difference in the throttling flexibility as between so-called gasolines of to-day and all kerosene, as such things are now furnished to the average user, because for the reason given above, there is really no difference in the action of vapors and gases of so-called cracked gasolines and all kerosenes, after being carbureted. The only thing one must guard against is to avoid fractional distillation or gas dissociation in carbureting with such high temperatures as are required in handling all kerosenes.

Thinks Four Is Ultimate Engine

In my opinion, from a purely gas production standpoint, I should say that the four-cylinder engine, L-head type, is the ultimate engine, because of the time elements, the actions of vapors and gases of present day oil fuels however distilled from crudes, or however vaporized or gasified, when carbureted. Because of the fact that as I understand it no two intake valves are open at once in a four, and there are two in a six, and more in engines with more than six cylinders, which bring about temperature drops, as outlined by Mr. Clayden in his article on kerosene carburetion. You cannot permit the splitting of the mixture charge to two cylinders at once, without setting up some of the disadvantages mentioned by Mr. Clayden in this article.

With gas producers furnishing a more or less dry gas rather than vapor mixtures at all times, even under the action of throttling, from the lightning-like governor throttle in four-cylinder, vertical tractor engines, to the more leisurely throttling complications from working through several miles of Fifth Avenue traffic at the time of greatest congestion, a four with the same crankshaft finish and balance, as has been developed in most good sixes, etc., will be just as velvety, with not as much vibration as with six or more cylinders, will have swifter getaway, better traction in snow, mud, sand, and on long hills, in the gasolines now coming into play, which the gentlemen of the S. A. E. must plan to treat as kerosene vapors and gases must be handled, if there is to be that greater development of the internal combustion engine which the past development of that form of prime motive power would indicate is possible.

L-Head Feature Important

As one who knows little else but gas production from oils, I should say that it is not a question of mechanical merit, or refinement, as between engines with four cylinders, or more cylinders, but it is in fact a question of the engine which can be carbureted with the oils now here, and worse coming, and which must run in fact on kerosene vapors and gases, whether you feed them cracked gasolines, or all kerosene. Any man who has spent enough time on carbureting kerosenes and their gases and vapors to find out just how little he really knows about the oil fuels will certainly suggest that the fours from now on be given very careful consideration, and particularly the L-head type, because of the fact that the exhaust gases pass out next to the intake ports in that form of engine.

Brake-Actuating Mechanism and Rebound Checks

By Marius C. Krarup

IN the article by A. L. Clayden last week on brake action with the so-called Hotchkiss drive, through the rear springs as driving-struts, two things strike me as remarkable: It is perfectly clear and it offers a remedy. Furthermore, this remedy is applicable also in those cases where the fault is already remedied in part through the use of nearly straight springs and other provisions tending to equalize the distance from brake pedal to brake cam for all positions of the axle.

To illustrate how your article strikes through, I may mention a few of the ideas to which it seems to loan new strength. One lies close to the surface, relating to rebound checks. As you point out, if there is a dangerous discrepancy between the curve of the axle movement under shock action and the curve described by the end of the brake pull rod, this discrepancy will be most pronounced at the extremes of the movements, at the highest and at the lowest possible positions of the axle. The shorter the arcs can be made without interfering with the springing, the more accurately can they be made to correspond If the lower or rebound end of the arcs is cut out, a little can be added at the upper end, in favor of greater flexibility in the semi-elliptic leaf springs, and it seems to be generally admitted that greater flexibility is desirable in truck springs, if it can be managed. As brakes are particularly liable to be applied sharply immediately after a severe shock—even though a second earlier would have been better—and about simultaneously with the rebound, your article, it seems, demonstrates an advantage in properly designed rebound checks, in the matter of safeguarding the brake action, to which attention has not been called before.

Whether the equalizer shaft can always be located so as to have the action correct without introducing a new and additional element in the linkage, with corresponding accentuation of wear and frequent need of re-adjustment, or other complications, is perhaps another question, to be decided only by a careful examination of the layout in each case. At all events, an important point to which only the foremost designers have paid much attention in the past, has been brought clearly into the foreground for the information of all. All must now look to have the last section in the brake rod linkage act from the most suitable center, even if the drive is not taken through the springs.

From such material most practical progress has been forged. It comes not only through the direct adoption of the suggested remedy but also by shaping and strengthening the conception of other methods by which the shortcoming may be obviated. Thus the superficial idea, if it is correct and practical, really strikes toward the root of things with admirable efficiency—if you will permit me this bit of philosophic observation—reaching all who are interested in things as they are, and not only those pioneers whose mental chronometers show the time of day to a second while their ambitions are two to ten years ahead of the calendar.

Avoidance of Wear

A much more radical thought is suggested, however; radical in the sense of going to the root of things. It is understood that the greatest danger of failing brake action comes through the need of adjustment of the linkage. We should have an actuating mechanism that does not wear or is not affected by wear, so far as the brake action resulting from a given pedal movement is concerned.

Tracing the wear back to its source, we find that most of it is due to the resistance. During the act of turning the cam the progressive resistance of the cam is transmitted to every working joint. We should therefore have an operating mechanism that does not share in the work done by the brakes while they are being turned on. The cam is retroactive. But even if it were worked through an irreversible worm, the linkage would still support the work of tightening the brakes and the conception of a mechanism which works without any notable resistance is more attractive. The electric brake is in this class. The hydraulic brake can be designed on this plan. The compressed-air brake likewise. And it is not out of all question to have a mechanical friction brake so actuated, even if it is not of the centrifugal type which probably never can be resurrected. We can, for example, easily imagine a pin being pushed into a hydraulic device within the brake drum, to set certain valves and causing the device to be actuated with greater or lesser resistance according to the depth to which the pin is inserted, or causing the hydraulic device to operate, by means of the rotation of the wheel, ordinary brake shoes in the drum. I have no doubt that, in cars with electric equipment, electric brakes will be in use long after the pedal-shaft-crank-rod-crank-rod-equalizer-crank-rod-crank-shaft-cam-retractor-spring mechanism has gone to the discard. And with regard to the other types of brake which may be operated without notable resistance or wear in the actuating mechanism, the designing and perfecting of them probably only awaits the demand.

Your article will do a great deal, I should judge, to bring such a demand to a focus both among the public and the manufacturers, having laid before us so clearly the most radical shortcoming in the existing system.

I should like to dwell on the clear and unmistakable language in which your subject is set forth, as to my mind there is the most intimate relation between lucid diction and engineering progress, but, as your space is limited and the subject a separate one, even if it is suggested in this connection, I shall bring this up some other time.

One more word about rebound checks, however, as they were referred to above only as an aid in obtaining reliable brake action. Their chief mission is of course to secure comfort with flexible vehicle springs and protect the latter, but it may not be amiss to mention another purpose, which they always serve in some degree and could be made to serve more fully. I refer to their value for obviating the vibration of axles which are heavy at the middle and for which now an adjustable brace rod is commonly provided. This brace rod with its dangers of maladjustment and fractures could well be spared if suitable rebound checks were applied. Frequently two straps are used, each about midway between the differential housing and the wheel, but they are necessarily adjusted to light load (so as not to make the springing hard for that condition) and protect neither the axle nor the springs sufficiently when severe shocks are received under full load. If, on the other hand, a more efficient rebound check were applied at the middle of the axle, such practice would be economical, and the axle vibration would be fully obviated. And, in the case of one-wheel shocks, probably as much checking effect for the rebound of the springs as is necessary can be obtained on this plan, provided the checking device is robust enough and of the required design. The requirements in this respect, at least for all trucks and omnibuses, are simply, it seems, that the rebound check shall have an action accommodating itself perfectly to load variations, so that the checking may always be entirely completed when the spring has returned, after a shock, to its original position of equilibrium under whatever static load it happens to carry at any given time—and not always to the same position. If there is not room for a practical development in this direction it would be interesting to know why not, and I take it that your Forum is the place for just such questions and their answers.

Differential Increases Difficulties for Dump Trucks

By L. G. Bartlett,

Chief Engineer, Old Reliable Motor Truck Co.

THE writer was very much interested in the article by A. Ludlow Clayden in last week's issue of THE AUTOMOBILE respecting the experiments which are being carried on by various engineers respecting the possibility of eliminating the differential from commercial vehicles, and gladly gives you his experience with heavy dump trucks, which had approximately 8½ tons paying load.

The chassis and body, with hoist complete, weighed 12,500 lb., and the wheelbase was 150 in., with dual 40 by 7-in. tires in rear and 36 by 6-in. singles in front, with chassis and body distribution of 55 per cent in rear, and 45 per cent in front, while the paying load distribution is approximately 85 per cent in rear, and 15 per cent in front. This load distribution may seem excessively heavy in rear, but the writer has checked a number of jobs where the distribution has shown an excess of 100 per cent, the overhang having been tolerated in order to provide the required dumping angle, and also eliminate body and hoist strains.

With the abovementioned loading conditions, and with the very short wheelbase which the American type of truck allows, we found that it was entirely impossible, with the differential locked, to make anything like the short turns which we had been able to accomplish, and moreover, were quite surprised to find that when the streets were sufficiently wet and slippery, to allow a differentiating action to take place, the result was that the much greater traction of the rear wheels would force the front wheels to proceed in direct line with them, regardless of the manipulation of the steering gear. This would invariably occur in alleys, or in places where there was considerable soft earth, or loose material, and was of decided disadvantage to the particular truck in question, because the short wheelbase made abrupt turning easily accomplished, and reduced running time very materially on short hauls, and in tight places. On slower turns, there was a decided increase in the power required, but steering was not seriously affected.

The writer is pleased at this time to extend to you his hearty congratulations on the original work, and open forum which your articles are making possible in THE AUTOMOBILE, and no doubt expresses the feelings of many, that you are keeping us in closer touch with one another's difficulties and achievements, and materially assisting in the production of more economical and serviceable transportation.

Troublesome Differential's Days Are Numbered

By E. C. Shumard,

Engineer, United States Motor Truck Co.

IN reference to A. L. Clayden's article on locked differential, the writer has given this proposition considerable thought for a number of years, and will soon be testing out a Sheldon worm axle without differential.

There have been devised numerous contrivances for the purpose of locking together an ordinary differential to be used when one drive wheel encounters a slippery place. As a rule, they have not been altogether successful, because of complication and the human equation. The writer has observed many times that such locks have been connected and after the truck had been freed from the slippery position, the lock had been completely forgotten, and truck had proceeded on its way. It was evident that if this could be done frequently without damage or without even knowing of the condition, the differential was not a necessity.

Without data from actual tests, the writer is of the opinion that greater damage is done to the tires by their contact with the road under accelerated speed after bouncing over an obstruction and causing the wheel to leave the ground than could occur from the necessary slipping in making turns with both drive wheels keyed to a single bar.

Further, the fact that one wheel must spin when it leaves the ground or comes in contact with a slippery spot, and nearly always is stopped, suddenly, throws severe strains on differential and other parts, as well as the tires.

It has been generally believed that more power will be required in making turns without the differential. However, this argument is questionable because the increase in gear ratio through the differential is considerable, and also calls for more power when making short turns.

The writer believes that the troublesome differential's days are numbered.

Trucks Do Not Need Differentials

By J. G. Paine,

Detroit Commercial Car Co.

WE note with interest the article relative to the elimination of the differential from trucks. We have not carried out any experiments along this line, but it has long been our opinion that this move is not only desirable but is practical as well. In theory it may not line up just as we would so desire, but in our judgment for truck use, especially the slower-moving trucks, the absence of the differential would never be noticed, even in turning the shortest radius, but there would be a very distinct advantage where a truck had one driving wheel in a hole with no bottom on one side and the solid pavement on the other.

The writer has seen this condition many times this spring.

We hope to see discussions on this subject from manufacturers who have actually made experiments.

Differential Will Be Simplified

By A. C. Wollensak,

Chief Engineer Sterling Motor Truck Co.

WE have read with interest the article by A. L. Clayden relating to elimination of the differential, and also the article by Mr. Laycock and the editorial.

We are sure that great strides will be made in this direction in the near future. We do not know whether the differential will be entirely eliminated, but we do believe that it will be considerably simplified.

The History of the American Automobile Industry—27

Further Petroleum Developments—Its Use for Medicinal Purposes—Drake's First Well in 1859—Petroleum Ignored and Wasted—Later It Begins to Influence Inventors

By David Beecroft

IN spite of repeated forcing of her bountiful petroleum upon a blind and unwilling generation, Mother Nature was unable to make a people who thought they were progressive accept the wealth she was so anxious to give. Occasionally, some man with more ambition than his neighbors would bottle a little of it and sell it for medicinal purposes at 50 cents per half pint or would send a few bottles to the coast cities, recommending it for everything from cattle cures to cancers, in the hope of introducing it and getting a market started. The total used in this way was but trifling, however. The oils needed by civilization were secured largely from the sperm whale and from the products of the farms. Yet, with this natural supply neglected, we find a considerable industry growing up in artificial oil extracted at considerable expense from certain coals and shales.

In 1846, an illuminating oil made from a coal secured in Albert County, New Brunswick, Canada, was put on the United States market. Camphene distilled from turpentine was used for lighting, although considered quite dangerous because of its easy inflammability.

In 1850, the making of paraffin oil from coal, peat and shales had grown to such an extent as to be considered a financial success and the next ten years showed a very considerable development of these artificial products. Even the paraffin candle was produced, although it could not have competed with the tallow candle had it not been a by-product. Some idea of the progress since that date is expressed by the fact that the Standard Oil Co.'s candle output a couple of years ago in this age of acetylene, electricity and gas was 300,000,000.

1859—Drake's First Well

The Moses who had vision enough to lead out of this period was E. L. Drake, who, in 1859, went from the East to Oil Creek and drilled the first well near Titusville, his object being to secure oil. This started the movement toward the now great petroleum industry and the manufacture of artificial oil from coal ceased in 1860. The names of the earlier products, however, remained with us and were largely applied to the later natural ones. The next ten years were largely development ones. Wells producing oil rapidly increased and many attempts to use the newly recognized product were made in many different lines. Lighting by kerosene lamps became quickly the common and accepted form and absorbed the major portion of the oil output. The gasolines were thrown away as being both useless and dangerous, while the heavier portions were used principally as lubricating oils and found a considerable market in spite of prejudice against the new thing and in favor of animal lubrication.

The Waste of Gasoline

A peculiar manifestation of this period was numerous attempts to make gas for illumination from the kerosene by the application of heat and by the use of complicated mechanical constructions, while the gasolines, ready and willing to convert themselves into gas by the mere mixing with air, were ignored and thrown away. The only explanation possible seems to be that the experimenters were working with the material at hand and did not know of the waste by-product. This condition of affairs is found so often and in so many lines that it would seem a wise government should establish a public information bureau to which an experimenter might apply for the facts of benefit to himself and humanity in general without any additional expense.

Gasoline Influences Inventors

With this development of the oil industry in 1860, we can now understand why the internal combustion engine began to attract attention and crowd its predecessors to the rear just as the air engine or combined air and steam engine or steam and smoke engine had been promising to crowd the original steam engine. Kerosene, being available in practically every market, was naturally the fuel used. The internal combustion engine had been pretty well made known to the American public by Dr. Alfred Drake of Philadelphia, who, beginning his experiments in 1837, had exhibited his engine with hot-tube ignition at the Crystal Palace, New York, in 1855, which engine is said to have been "precisely like Lenoir's, which was brought out in Paris in 1860-2 and often claimed to be the first of this type. Ericsson's hot-air experiments on a large scale propelling an ocean-going steamer and his exploitation of same had done much to direct public attention toward air and gas engines. Five air engine patents were granted to him between 1851 and 1860 and about forty hot-air engine patents were issued in the next twelve years, a very large number when the total patent issue is considered. George B. Brayton was building air and gas engines in 1864 and it is believed had taken up the work as early as 1857, although his first patent seems not to have been issued until 1872.

A Bubbling Type Carbureter

The patents of that period show a bubbling type carbureter by Ashcroft in which a float rested on the surface of the liquid while air admitted below the float followed a scroll or a spiral passage in the bottom of the float for a considerable length and so had much time to be saturated with the vapor of the liquid. This device was used by De Dion and other foreign makers thirty-five years later. A patent to Richardson & Pond in 1867 shows air sprayed in fine streams into and rising through the liquid for the same purpose.

That the gas engines of those days were troubled with carbon, was undoubtedly truer than to-day when carbureters are better, and Wiegand in 1864 mentions in his patent a liquid put into the cylinder, "to carry off the carbon" and improve the ignition. American publications described in 1865 the engine of Hugon as an improvement on the Lenoir and a method of obtaining an inflammable vapor by passing air through naphtha, petroleum or other volatile liquids invented by Wenham, both the above being foreigners. Lenoir cards were published in the *Scientific American* in 1866 and in the same year benzine vapor was suggested for the "newly introduced gas engines."

The next year, 1867, there appeared several articles on the use for petroleum for fuel and the activity in this line is indicated by the term mania.

In 1869 Maxim and Radley patented a carbureter in which the air was passed through heating and vaporizing chambers, this being the H. S. Maxim, who afterward built the light and powerful aeronautic engines which were so interesting to the earlier automobile workers.

In 1870 we find liquid fuel advocated for steam engines and petroleum gas from their own well, probably natural gas, in use at the Erie Water Works.

In 1873 Sloper patented a portable gas machine which was fitted with concentric partitions packed with picked cotton and excelsior through which the air could be drawn and absorb the vapor from these wick-like substances which rested in the petroleum liquid.

With these mentions, it seems unnecessary to consider further development of the use of petroleum in its relation to the automobile. The Brayton engines which rapidly assumed a commanding position, beginning with the early seventies, introduced the liquid fuel by pumps. The Otto engines, which in the middle eighties began crowding the Brayton from its position, mostly used city gas but where a carbureter was needed, it was of the surface or Sloper type, and this was the kind seen in use by Charles E. Duryea in 1886 when he selected the gasoline engine with its portable gas producer and electric ignition as containing the elements of the successful motor vehicle motor.

Elwood Haynes used, at first, a pump to introduce the liquid fuel and later, a mixing valve which admitted both air and liquid in approximately proper proportions. Duryea, however, never used the gas tank lest fire result and because a fear and criticism of this result would certainly exist, but in his very first machine, begun in 1891, developed a spray device. This was not wholly new with him, however, having been shown in a British patent of 1874 and being simply a modification of the well-known atomizer used for perfumes.

Gasoline at 5 Cents Per Gal.

The production and development of the petroleum industry, although in starting proceeded rather faster than the demands for the product so that the last years of the century found Duryea buying 5 gal. of high-grade gasoline at the corner grocery store in Peoria, Ill., hundreds of miles from an oil well, for an insignificant 25 cents. Kerosene at 3 to 4 cents per gallon in barrel lots delivered was so cheap that he refused to shovel coal and ashes but patented and used a kerosene burning furnace for heating his house. In more recent years the condition has reversed. Gasoline, once thrown away, is now the leader, the demand for kerosene has greatly diminished proportionately, while lubricating oil, particularly of high fire test for superheated steam and for gas engines, has become so necessary that these improved devices could hardly operate without it. So rapidly did these changes take place in the first dozen years of the present century that an old and experienced oil man refused to invest any money whatever in a truck propelled by gasoline because he was certain that gasoline prices would be prohibitive before he could get the truck on the market in paying quantity. The development of new fields greatly relieved the gasoline demand, but the condition would have been critical before this had not a process or processes been discovered for re-assembling the hydrogen and carbon constituents of petroleum so that the heavier grades may now be separated into lighter with a residue of still heavier ones.

Bulletin on Nickel Steels

WASHINGTON, D. C., April 22—The Bureau of Standards Department of Commerce, proposes to issue a series of circulars of information on the proporties of the more interesting or technically important metals and alloys. The first of the series, describing the properties of the non-expansible alloy Invar and other nickel steels, has just been published. The magnetic, electrical, thermal and mechanical properties are given with numerous illustrations, together with statements concerning microstructure, constitution, applications, and sources of supply.

The publication is circular No. 58, entitled Invar and Related Nickel Steels, and copies will be sent free to interested persons upon application.

The Rostrum

Pinion Is Meshed Too Tightly

EDITOR THE AUTOMOBILE:—From the rear axle of my Saxon B roadster, 1915, there comes at low speeds a singing, humming noise which seems more pronounced at lower speeds, but at about 25 m.p.h. it is more or less lost in the other noises. I have packed the universal, the transmission and the rear axle pinion gears, but this has not seemed to have made any difference. The car has but lately come into my possession, so I do not know how long this condition was in developing. Could the small pinion be meshed deeper into the ring gear to overcome this, and if so, what will be the steps necessary? In this model how is this done? Could the gears already be too closely meshed? How can I tell when the adjustment is about correct? The rear wheel has vertical play of about 3/32 in. The right wheel is without play. In this excessive? Could this cause the noise?

Oil leaks out of the valve so that this side of the engine is covered with oil which drips on the mud pan, which in this car supports the engine. Would packing the valve cover plate with felt stop this or do I require new valve guides?

Summit, N. J. H. B. R.

—The pinions can be adjusted by removing the large pipe plug on the top of the transmission case and loosening the set screw on the side of the case. The adjusting nut is then turned in or out. In this case it is believed that the pinion is meshed too tightly with the ring gear, and it should be backed out six or eight notches.

The vertical play in the rear wheel is no doubt caused by worn bearing or axle shaft and to eliminate it it will be necessary to install new parts in place of the worn ones. The vertical play in the wheels would not cause the noise in the axle.

To stop the leak around the valve tappet cover it is only necessary to install new felt washers around the cover.

Correct Temperature for Vulcanization

Editor THE AUTOMOBILE:—What is the right heat a tire should have in order to vulcanize and how long should it be kept to said heat?

Fall River, Mass. J. H.

—This depends whether it is the inner tube or outer tube you are vulcanizing as far as time is concerned. Generally about 15 min. suffices to make an inner tube vulcanization at a temperature of about 145 deg. C. The tire shoe takes a longer time depending on the depth of vulcanization. It would be best to simply follow the directions with your vulcanizing outfit for practical results as this has been worked out to give proper temperatures for the conditions for which it is designed.

Wants More Quality in Cars

Editor THE AUTOMOBILE:—It is about two years now since a craze started for the production of "quantity" cars, in the sense that every American manufacturer seems to be striving to give a big car for little money.

There must be a large number of agents and dealers to whom this trend is unsatisfactory. An overwhelming number of our prospects are men not in a position to afford the enormously increased maintenance ratio consequent upon the use of a car with a long wheelbase having, necessarily, larger tires and increased weight. We point out that a 30 by 3½ tire sells, out here, for $25, a 34 by 4 for $35. Gasoline retails at never less than 60 cents per gallon and oil $1.40. Therefore the one desideratum is economical running cost.

Only the short-wheelbase, light car can give us this and instead of a 112-in. wheelbase, 2500 lb. car retailing, in America, at $750, we need a car of but 102 to 104 in. wheelbase weighing not more than 1750 lb. The selling price of $750 is about right, and as against the greater quantity we could be given more quality.

Trusting that it will not take up too much of your space, below we give a few abridged specifications which we think needful:

Wheelbase	102 in.
Track	56 in.
Tires	30 x 3½
Weight	1750 lb. or less
Cooling	thermo-syphon, large water capacity.
Motor	long-stroke, high-speed type 25 hp.
Carbureter	Zenith or similar type.
Gasoline tank	in dash.
Body	all metal; enamelled; very low streamline.
Speeds	three forward, one reverse
Seats	tilting downwards to rear.

Such a car, if put on the market by one of the big manufacturers, would command an instant clientèle.

For two years we have carefully scanned all your announcements giving details of any new models likely to suit us, until we came to the item wheelbase, our interest then ceasing, for it is invariably given as 110 in. or more.

The Studebaker Corp. put the just right car on the market during 1913, and withdrew it the following year. Why?

We have seen nothing in use of late that will compare with that little car for quality of material and equipment.

A similar size car is needed, but with altered body lines, etc., conforming to more modern ideas.

Beaufort, West, So. Af. J. W. COURTIS, Motor Supply Co.

Storage Battery for Dual Ignition

Editor THE AUTOMOBILE:—Why do we use battery with dual system magneto?

2—Why is spark advanced when cranking on the magneto?

3—Why should a magneto armature run at engine speed on four-cycle, four-cylinder engines?

4—Where is set ignition placed and on what system is it used?

Columbus, Ohio. L. L. S.

—The accompanying diagram, Fig. 2, illustrates the necessity for a storage battery to carry out the scheme of dual ignition. If there were no storage battery you would not have dual ignition, but single instead. Dual ignition employs two sources of current with one set of spark plugs. Hence the battery and the magneto.

2—Spark is advanced to take care of mechanical and electrical lag and to make the explosion occur as nearly as possible to upper dead center. In cranking, if the spark occurs at the point of highest compression ignition is much more certain.

3—The magneto produces two sparks to the revolution and since a four-cylinder, four-cycle engine has two explosions to a revolution it is necessary, in order to have the two sparks, to have the magneto operating at engine speed.

4—Set ignition can be used on any system desired. It simply means that the spark cannot be manually advanced. Generally the spark is set in relation to the speed of the motor so that the explosion will occur as near upper dead center as possible. See Fig. 1.

Noise Probably in Timing Gears

Editor The Automobile:—Since equipping my Stoddard-Dayton 48 with patent piston rings, the motor makes a loud humming and grating noise. The oiling system seems to be working all right. What is the cause of this and what should be done in this case?

Madisonville, Ky. F. D. C.

—It does not seem possible that piston rings can give a humming or grating noise. The indication of a ring which is too tight in the groove is a clicking sound, and it is suggested that you look after your timing gears, etc.

Connecting Accessories on McLaughlin-Buick

Editor The Automobile:—How would I correctly add an automatic cigar lighter made by the Electric Automatic Cigar Lighter Co., New York, and a self-winding clock made by the Hartford Clock Co., to a model D45 McLaughlin-Buick six-cylinder car; also an attachment for a trouble lamp?

Brandon, Man. W. M. C.

—The trouble lamp connection which fits in the instrument lamp socket is already furnished with these cars as a part of their regular equipment. Other devices such as the cigar lighter and the electric clock should be connected to No. 1, 2 or 3 switch terminal, but No. 3 terminal would probably be found to be most convenient. It will also be necessary to provide a ground connection for this lamp.

Information on Model 10 Buick

Editor The Automobile:—What is the fastest time a Buick 10 ever made?

2—What ratio did it have between motor and wheels?

3—What kind of magneto and carbureter?

4—What speed has a stock Buick 10 in good condition?

5—Will I have to get a complete new axle or new pinion and ring gear in order to gear a Buick 10 up?

6—About what will be the cost of same?

7—What is the ordinary ratio for this car?

8—What is the speed of the 1909 or 1910 Simplex, chain-driven, 50 hp.; National 40; Stutz bearcat; Mercer raceabout?

9—How, and to what limit can I speed up a Buick 10?

Norfolk, Va. R. M. P.

—The fastest time ever made by a Buick 10 car is unknown, as there are no official records on this model.

2—The model tens were geared 3 and 3½ to 1 with 32-in. wheels.

3—They were equipped with Remy magnetos and Schebler carbureters.

4—Between 50 and 60 m.p.h.

5—The gear ratio can be changed by inserting new pinion and ring gear only. Any Buick dealer or branch will be able to quote you prices for this material.

6—Given in question 5.

7—This is given in answer No. 2, which is printed above.

8—All the cars you mention when tuned up are good for about 75 m.p.h.

9—About 60 m.p.h.

Friction of Tire on Road

Editor The Automobile:—I am desirous of obtaining certain information relating to the tractive effort or rolling friction co-efficient of solid rubber tires on various road surfaces. That is, what relations exist between tractive effort in pounds at the rim of the driving wheel of a motor truck or other motor vehicle, total load on the wheels, speed of the truck and power of the engine or motor when operating over the various good and bad conditions of streets and roads.

This information is to be used for the theoretical calculation of the power required to drive certain capacity trucks over or through various road conditions at given speeds, employing solid rubber tires.

Columbus, Ohio. L. R. Yeager.

—The following are the accepted figures for co-efficients of road friction for solid rubber tires of the usual compound:

Hard, level asphalt	0.0100
Wood pavement	0.0115
Level macadam	0.0115 to 0.0300
Plank road	0.0090
Cobble stones	0.0175
Good dirt road	0.0110 to 0.0200
Ordinary dirt country road	0.0200
Sand	0.2000

The tractive resistance of average roads against solid rubber tires is generally assumed to be 60 lb. per ton of weight on the wheel. Speed and motor power do not materially affect these figures excepting that there is a certain percentage of slip at high speeds and that too sudden application of power will of course prevent the tires taking hold.

Tire Sizes and Speedometer Gears

Editor The Automobile:—I am using a 37 by 5 tire on a 36 by 4½ rim but did not change the speedometer gears which are for the 36 by 4½ tire. What amount in speed and mileage is my speedometer registering wrong if anything at all? I think my speedometer is registering too slow but would like to know how much.

Allentown, Pa. H. J. G.

—The mileage will err to the amount of 3.1416 in. every revolution of the car wheel. The reading on the speedometer will indicate too little by that amount. At 10 m.p.h. a 37-in.

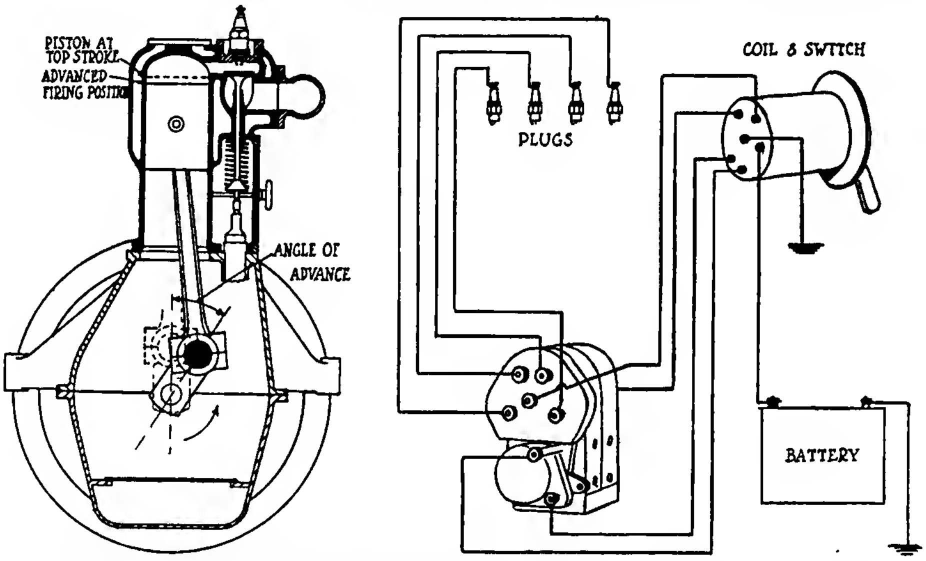


Fig. 1—Left—Top center and advanced firing positions. Fig 2—Right—Wiring diagram of a dual ignition system

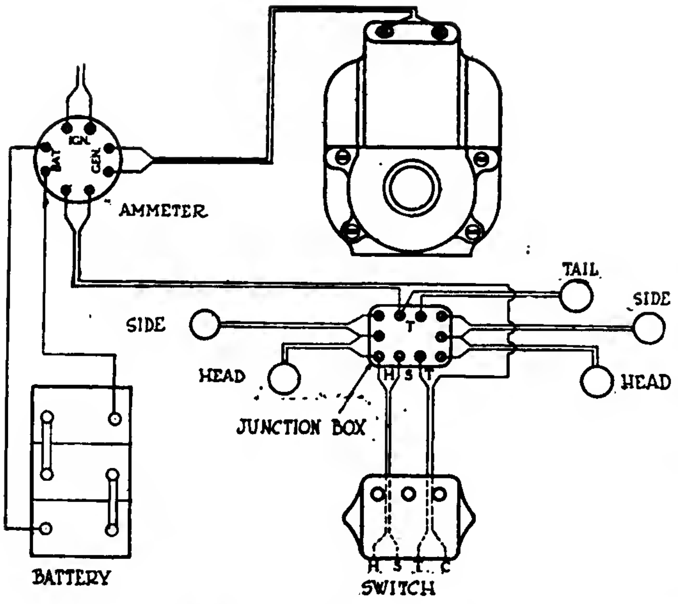


Fig. 3—Wiring diagram of the Remy electric system on the Stutz

wheel is rotating 90.9 times in 1 min. while a 36-in. wheel is rotating 93.4 times. Or to put it another way, if the 37-in. wheel is rotating 100 times in a minute the car will be traveling 11 m.p.h. The 36-in. wheel will have to rotate 102.7 times a minute for the speedometer to indicate 11 m.p.h.

With the conditions above outlined holding true the speed readings on your speedometer and the distance readings will be about 97 per cent of what they should be.

Correct Setting of Fixed Spark

Editor THE AUTOMOBILE:—I saw an article in a recent issue about set spark. It stated the piston should be within ⅛ in. of top on compression stroke when the spark should occur. Is this right? If so, I have been setting mine wrong. My engine has a set spark and the only gas control is a foot accelerator. Now when the throttle is closed for idle running I have my spark occur when the piston is at top dead center on compression stroke. If I change it to occur ⅛ in. before top center will it be all right? What is the best position for the most power obtainable? The markings on the engine are entirely gone so I am depending on your best judgment.

New Durham, N. J. S. A.

—Carry the spark as far ahead as you can without having the engine knock and without having it kick back in starting. The distance in advance of dead center depends on the speed of the motor and on the type of ignition apparatus. This is true because the higher the motor speed the further in advance should be the spark, and the greater the mechanical and electrical lag in the ignition apparatus the further ahead the spark should be set.

Diagram of Remy Electric System

Editor THE AUTOMOBILE:—Please publish a wiring diagram of the Remy starting and lighting system as used on Stutz roadster, starting motor model five, lighting generator model 0.

2—Is this system typical of all Stutz cars?

3—Describe the Bosch waterproof magneto as used on this car.

4—Where can the S. A. E. handbook be obtained, and what is the price of it?

Montreal, Canada. J. W.

—The wiring diagram you request is illustrated in Fig. 3. No diagram of the starter wiring is available as it is simply a two-wire system direct from the battery to the starter with the switch cut in.

2—Yes. This is typical of all Stutz cars.

3—This is a regular stock model Bosch magneto. The magneto model is the Z-R four or six in accordance with whether the car has four or six cylinders. It is very similar to the familiar Bosch DU type magnetos except that it is provided with a waterproof cover.

4—The handbook can be secured from the Society of Automobile Engineers, 29 West Thirty-ninth Street, New York City. The price for the two volumes is $7.

Wants Definition of Torque

Editor THE AUTOMOBILE:—Kindly define and explain the word torque as applied to automobiles.

Rochester, N. Y. J. D. M.

—The word torque is a definite one and means the same whether referred to automobiles or any other piece of mechanism. It is the force which tends to produce rotation or torsion and is measured tangentially by multiplying the force by the radius about the axis of rotation. That is, the torque in a given shaft would be equal to the power applied to the shaft times the distance of the tangential point of application from the axis of the shaft.

A Plea for Amateur Racing

Editor THE AUTOMOBILE:—In these days, when automobile racing, after some bad years, is so rapidly regaining its interest and popularity with the public, it seems strange that some serious effort is not being made to build up the amateur side of the sport. The publicity for the manufacturers, to be gained from stock, or even special, cars raced by nonprofessionals is tremendous, and furthermore it would be cheap, which can hardly be said for factory teams. From the standpoint of the promoter, a larger and more interested crowd than at any, except the very greatest, professional races would be assured from the friends of, and club and city "rooters" for, the various amateurs. Also, the prizes, as an inducement for entering, would not have to be so large. The potential purchasing power of the amateur and his friends is, also, by no means to be neglected.

There seem to be two particular reasons why promoters are averse to running an event of this class, the first being that they believe there are no eligibles, under the definition of the A. A. A., who would dare to race, and the second that, even if there were, their lack of skill would render them a menace to each other and the spectators, as well.

In regard to the first reason, the cause is to be found in the fact that no attempt is ever made to canvass the owners of fast cars who have the time and money for sport. Secondly, if some publicity was given the idea in the press, a surprising number of additional prospects would come forward, once the actual conditions of the contest were explained to them, and they were assured of meeting a class of cars and drivers of the same general ability as their own.

In regard to the second reason, the simple fact that a man is willing to receive money for racing is no reason that it should at once endow him with a superior competency to that of the man who is not. If experience was a requirement for drivers' certificates, the situation might be different, but this is not the case. There are any number of young men in this country who can, and do, drive fast, and are perfectly competent to handle cars at speed. If given a chance, they should show surprising ability. At any rate, the amateur's car would not be as speedy a proposition as the professionals', and the danger would be proportionally lessened.

It might be a good idea to hold some of the first races on "dangerous" courses, that is to say, those on which sharp turns and rough surfaces would keep down the speed to a point where a wreck would, probably, not be serious, and where the ability of the men could be better observed than on a perfectly banked speedway, where the average would be high, and good luck in not blowing a tire at a bad place would count more than good driving.

The writer, recently, tried to interest the management of the Panama-California Exposition in holding, in connection with the race of March 25, an amateur event. The course exactly met the above requirements, Burman's winning speed, in a Peugeot, being only a little better than 50 miles. Spectators were amply protected by bales of hay. The Exposition management declined to follow the suggestion, for the reason herewith quoted from their letter.

"The idea . . . would be a valuable special event, but for the fact that the course here is so difficult as to entirely prevent any amateur driving. . . . The condition is not due to the fact that they cannot drive well enough, but rather to the fact that they may become over-enthusiastic and an accident would result."

That over-enthusiasm is a failing by no means confined to the amateur was shown rather clearly, a few days later, in the March 26 *Los Angeles Times'* story of the race.

"On the opening lap, Burman, Tetzlaff and Durant overran the hair-pin turn in front of the Cristobal Cafe, and plowed through an opening in the banked baled hay, running into a jam in the safety zone. . . . In the mix-up the Durant Special lost three spokes out of the left rear wheel and bent the frame in several places. The Milac inherited a battle scar on the rear end of its gas tank." Comment is unnecessary!

Del Mar, Cal. JOHN F. GRAY.

What Makes Electric Current Flow

Editor THE AUTOMOBILE:—What makes current flow? I have read the article entitled, Automobile Electricity in THE AUTOMOBILE for April 6, and I would like to know what it is that makes the current flow through the electric circle.

New York City. D. M. L.

—Electricity travels from the point of higher pressure to that of lower pressure. It travels in measurable quantities and since these quantities have direction of flow and pressure they are capable of performing work. Electrical pressure can be measured by standard units. Water or air pressure is denoted by pounds to the square inch. Electrical pressure is measured by volts. The amount of water flowing through a pipe is calculated in gallons per minute. The quantity of electrical current flowing through a wire is calculated in amperes. Resistance to flow of water through pipes is given by the coefficient of friction and by measuring the obstructions in the pipe. Resistance to electrical flow is measured in ohms.

The amount of current flowing is equivalent to the pressure divided by the resistance or, using the units of measurement just defined, amperes equals volts divided by ohms.

This equation is the basis of practically all electrical calculations. A practical example is in a lamp. If we take a headlamp of 12 cp. and say that it has a resistance of 3 ohms. and that it is intended for a 6-volt circuit it is possible to determine at once how many amperes are necessary to light the lamp. Applying the equation the amount of current is equal to 6 volts divided by 3 ohms or 2 amp.

Taking the simple elementary case mentioned before of a battery, a switch and a lamp, the resistance to the flow in the circuit is encountered in the wire, in the switch and in the lamp. The wire acts for the current the same as the pipe does for water. The smaller the pipe the greater the amount of resistance to flow. The smaller the wire the greater the resistance to the electric current. Poor connections between the wire and the switch would introduce resistance into the line as the current would be compelled to flow through the poorly-made contact at the points of connection. This would utilize some of the pressure that could otherwise be employed in lighting the lamp and the result is that the lamp would be dim. If it takes 6 volts pressure to bring the lamp to the proper degree of brightness and other resistances in the line due to poor connections, etc., weaken the pressure at the lamp until it is down to 4 volts, the lamp instead of lighting brightly will light dimly. If the resistance in the line becomes so great that current cannot flow at all the lamp will go out. When the circuit is broken due to the fracture of a wire, for instance, or the disconnection of a lead the current is interrupted and flow ceases.

If an extremely high-tension circuit were used, or in other words, a circuit in which the pressure or voltage ran up to thousands of volts, a small break in the wire would not be a means of altogether interrupting the current as the pressure would be sufficient for the electrical current to be forced acoss the gap in spite of the resistance of the air. Such an occurrence takes place in the high-tension ignition system where the current circle is completed by the high tension spark caused by the current jumping across the gaps between the electrodes in the spark plug.

Using Camphor Gum in Fuel

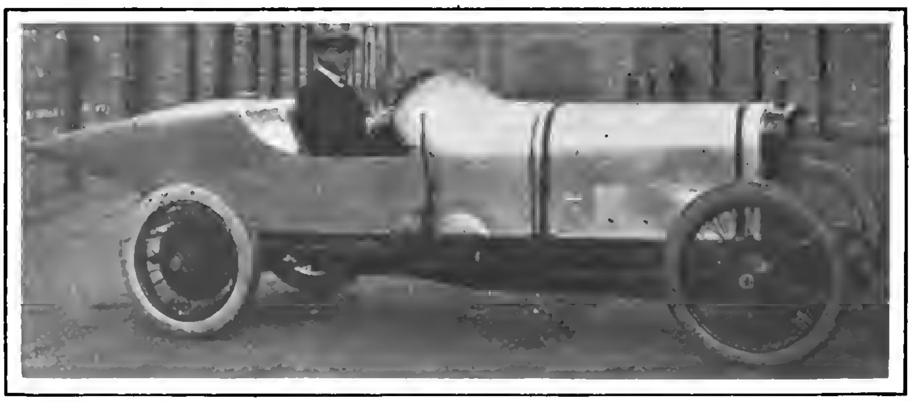
Editor THE AUTOMOBILE:—What advantage is gained in adding camphor gum to gasoline for fuel? I am told to mix 2 oz. camphor gum to 10 gal. gasoline to improve mileage from 10 to 15 per cent. Does it improve the mileage and does it affect the cylinders to add ether to the gasoline?

Cleveland, Ohio. A. D. S.

—THE AUTOMOBILE does not recommend the use of camphor gum in fuel.

New Sunbeam for Sheepshead Bay Races

AS announced in THE AUTOMOBILE for April 20, Louis Coatalen, of the Sunbeam factory, has cabled to the management of the Sheepshead Bay Motor Speedway Corp. the entry in a new Sunbeam racer of Joseph Christiaens at the Sheepshead Bay opening scheduled for May 13. The car is a 1916 model, it is stated, which has never raced before, but, according to reports from Brooklands, it has developed a speed of 116 m.p.h. Christiaens and the car have already reached this country. The illustration shows Louis Coatalen at the wheel of the new racer.



Trailers in Many Sizes

Miami Line of Vehicles Specially Designed for Automobile Work Range from 800-lb. to Four-Wheel 1250-lb.

IT very frequently becomes necessary in depot, bus and taxi work to carry large pieces of luggage along with the passengers. Where a small trunk is all that is necessary it can be readily put up on the driver's seat and will not interfere greatly with his movements. On the other hand, there are a large number of instances where the passenger would like to have several large pieces of baggage delivered at the same time that he is. To handle work of this kind the Miami Trailer Co., of Troy, Miami County, Ohio, has brought out a line of trailers designed and built especially for automobile speeds.

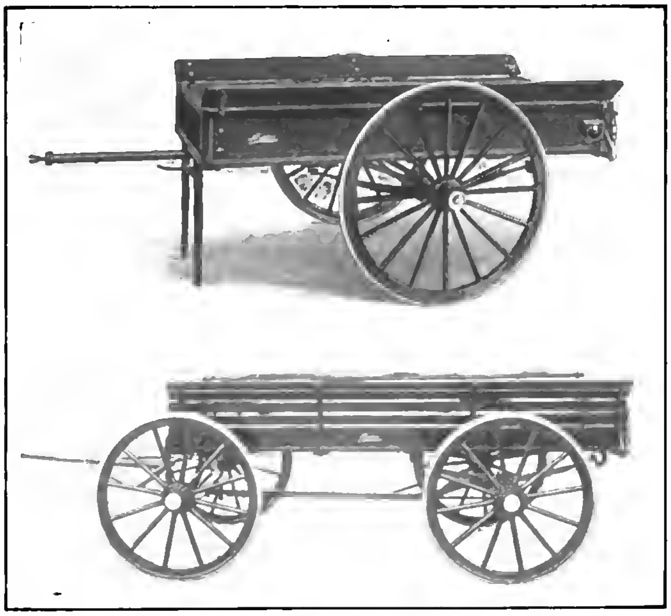
The present line comprises five models of different capacities and sizes, all of which are capable of being fastened behind passenger cars by means of a special shock-absorbing drawbar arrangement. The fundamental features of these trailers are centered about the fact that they can readily be attached to a passenger car and are capable of traveling at the speeds ordinarily used with vehicles of this type.

Attached to Chassis

Attachment of the trailer is made to the chassis or sprung part of the car and not to the unsprung axle. Thus there is no tendency on the part of the trailer to increase the proportionate unsprung weight. The axles and bearings used in the construction of the trailers are of the same grade as those used in automobiles and in the case of the four-wheel trailers they are designed to follow or trail perfectly with the automobile.

Wide Range of Sizes

In size the trailers range from a two-wheel 800-lb. vehicle to a four-wheel type with a carrying capacity of 1250 lb. The weights of the trailers in themselves range from 290 lb. up to 500 lb. The models are known as 1, 1A, 2, 3 and 4.



Above—Model 3 Miami trailer with 9-in. panel body
Below—Model 2, which has an 8-in. flareboard and is of solid oak lined with steel

Standard automobile axles and bearings are used in the construction of Miami trailers

Models 1 and 2 each have a carrying capacity of over 1200 lb., the rating of No. 1 being 1250 and No. 2, 1230. No. 1A is a modification of No. 1 with pneumatic tires 30 by 3 in. in size in place of the solid tires used on No. 1. The technical specifications of these little trailers of over 1200 lb. capacity show them to have 1¼-in. Timken axles equipped with Timken roller bearings. They have regulation artillery wheels, 32-in. in diameter both front and rear, except on the vehicles which take the 30 by 3-in. tires. Specially designed, short-turn gears to assist in proper tracking are employed and the spring mounting is semi-elliptic with 1½ by 38-in. front and rear springs, the front having six leaves and the rear five.

Standard Tread Dimension

The tread of these trailers is 56-in. standard and the height from the ground to the bed is 26-in. The shock-absorbing drawbar previously mentioned is employed and the wheelbase is 70 in. For body equipment the No. 1 design has a 10-in. panel type, 96 by 38 in. in interior dimensions with a 6-in. flare board. There is a drop end gate with chain.

Body No. 2 has the same internal dimensions with an 8-in. flareboard and is of solid oak, steel lined. The finish is black, striped and varnished and an electric tail light is provided to conform with traffic ordinances.

Model No. 3 is a two-wheel vehicle having 1¼-in. axles and solid rubber tires. The body in this case is a 9-in. panel type with interior dimensions 78 by 38 and a 5-in. flareboard. Its carrying capacity is 1000 lb.

Model No. 4, the smallest type, has a 1⅛-in. coach axle with plain taper bearings. The wheels are 32-in. artillery type with 1¼-in. solid tires. Semi-elliptic springs of 1½-in. width and five leaves are used. The tread is standard 56-in. and the body 78 by 38 in. with 8-in. panel and 5-in. flareboard. The weight of this little vehicle is 290 lb.

Bodies for Special Purposes

For special purposes the Miami company will make bodies to order, but for all ordinary work the line described should apply. These small trailers should be particularly useful in carying baggage from the small hotel to the railroad depot. An ordinary size car is generally sufficient to meet the requirements of passenger traffic, but for baggage work the local express company or some other vehicle must often be relied upon. The upkeep of a small trailer of this kind is very low and the parts of which it is composed are as substantial as those on the small automobile. In fact, they are exactly similar to automobile parts.

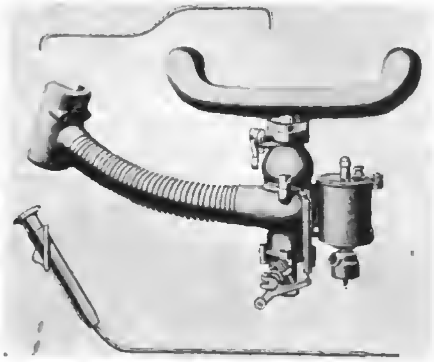
ACCESSORIES

Stewart Carbureter for Fords

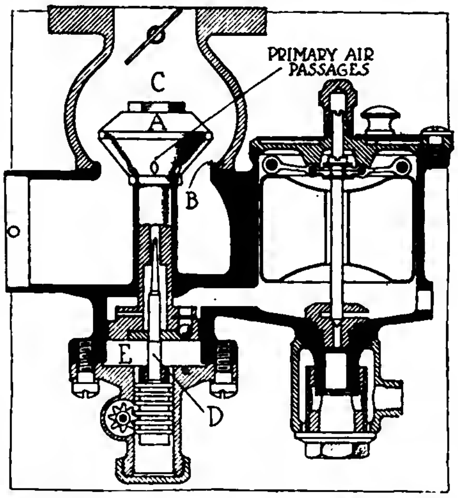
A SPECIAL carbureter for Ford cars has been added to the Stewart line. This instrument works on the same metering-pin principle as the other Stewart instruments, but is designed for the needs of the Ford engine. Besides the carbureter itself, a manifold, hot air connections, dash adjustment and all fittings are included in the outfit as retailed at $15.

The principle of the Stewart carbureter may best be understood from the sectional view. The metering valve *A* rests upon the seat *B* when the engine is not running, but as the engine begins to rotate, the suction raises the valve from the seat, drawing in air around it from the air intake. This suction also draws gasoline up within the valve stem, this mixing with the incoming air in the chamber *C*. The Stewart has but one adjustment, that being for the amount of gasoline. The air is a fixed amount, it being simply necessary to regulate the amount of gasoline admitted. This is controlled by the tapered metering pin *D*, and the adjustment is made when the engine is running at idling speed. By turning the adjusting screw either to the right or left, the position of the metering pin is raised or lowered, thereby allowing a greater or less supply of fuel to be drawn up into the mixing chamber. When the right proportion has been determined at low speed, it is evident that as the speed of the engine increases, the metering valve *A* raises higher from its seat and away from the metering pin *D*. This allows a greater supply of both gasoline and air to be admitted in the right proportions as predetermined when designing the instrument.

In the Ford type of Stewart carbureter the float bowl is furnished in either one of two positions. Some Fords are specially equipped with a high-tension magneto, in which case it will be necessary to have the bowl at right angles to the air port or between the carbureter body and the hood base of the car. Where there is no high-tension magneto installation, the float bowl is placed at 180 deg. to the air port, or forward of the carbureter body.—Detroit Lubricator Co., Detroit, Mich.



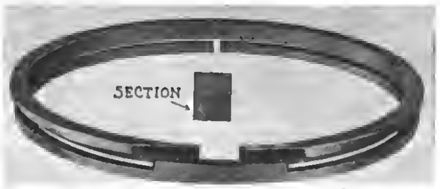
Stewart carbureter for Fords, with manifold mounting indicated



Section through new Stewart carbureter

Du Bois Piston Ring

The Du Bois is a two-piece concentric ring. One section is the full width of the piston groove and is of L-shaped cross section, while the other is smaller and fits into the angle of the larger part. The splits come at diametrically opposite points; the width of the large ring is such that it seals the split in the small one, while the latter has a projecting part to seal the split in the wide ring. The makers claim particularly that the ring produces a good vacuum in the cylinder, so that the full charge is drawn in at each intake stroke.—Du Bois Machine Shop, Inc., Albany, N. Y.



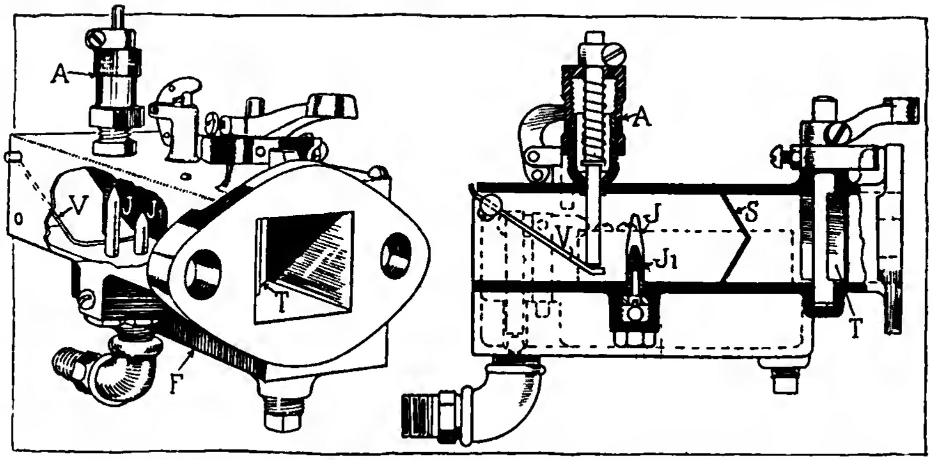
Du Bois two-piece piston ring

Sunderman Mouse Trap Carbureter

Simple in construction and in adjustment, this carbureter is claimed to feed pure combustible gas from cold kerosene or gasoline to the motor without changing the adjustment, no hot air or water jacket being needed. As shown in the illustration, the rectangular float chamber *F*, fitted with a primer, is adjacent to the mixing chamber, which is simply a square passage. The fuel is admitted to this passage through the jet *J*1 for low speeds and when idling and when the speed is increased the taller jet *J* automatically comes into play so that both jets are operating at once.

Air is drawn through the valve *V*, which is regulated by the tension on the spring controlled by the adjusting collar *A*. In the illustration the air intake door is shown in the position it assumes when the motor is idling and fuel is being fed through the short jet *J*1 only. As the air rushes into the vacuum behind the intake door it sweeps the globules of fuel from the jets and the resulting vapor is further disintegrated into a homogeneous mixture by passing through the screen *S*, after which it passes the throttle *T* on its way through the manifold to the combustion chamber.

Besides an unusually high degree of fuel economy, the makers claim the carbureter gives great flexibility with consequent minimized gear shifting. The screen *S* prevents backfiring with its attendant dangers, and the elimination of a gasoline adjustment by the use of the regulating jets renders adjustment extremely simple. In fact, the makers state that when the carbureter is once set correctly, fur-



Sunderman Mouse Trap carbureter, showing the two jets, the safety screen preventing backfiring and the simple adjustment of the air inlet valve ther changes will be entirely unnecessary.

The carbureter is made in brass, iron or aluminum alloy, in ¾ in., 1 in., 1⅛ in. and 1¼ in. sizes, under the names of models *A*, *B*, *F* and *C*, respectively, and as the model Twin *F* for eight or twelve-cylinder cars. Model *F* weighs 1¾ lb. in brass or iron and 10 oz. in aluminum alloy, and is 4½ by 2½ by 1⅞ in.—Sunderman Corp., Newburgh, N. Y., maker. J. F. Renfro Co., Inc., New York City, sole factory distributor.

Eclipse Piston Ring

The Eclipse ring is composed of two rings, one of which is an eccentric L ring and the other flat and concentric. The eccentric ring, which is designed to secure an even pressure at all points around the cylinder, is held tight at the joint by the concentric ring so that it conforms exactly to the cylinder diameter. A straight cut in the eccentric ring prevents compression turning the outside ring around on the eccentric ring so that pins are unnecessary and weak spots are eliminated. The entire ring can float around inside the piston, without impairing compression. Eclipse rings are made of gray iron and are guaranteed to fit in any diameter and width. A feature of this ring's construction is that it prevents leaks of gas and oil and lengthens the life of unground cylinders.—Hope Machine Co., manufacturer; Edwin T. Craven Co., Philadelphia, Pa., sole distributor.

Bell Air Valves

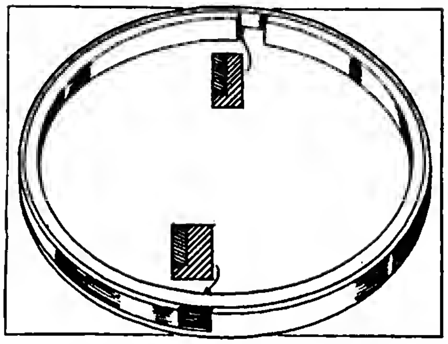
The Evertite valve is made in ¼, ⅜ and ½-in. sizes; the enlarged stem end and the peculiar corrugations make it practically impossible for the hose to be blown off. The Premier combination consists of an Evertite valve combined with a tire gage. The Automatic Electric not only registers air pressure, but also automatically controls the current for the electric pump motor; with this valve the makers state that a storage tank can be dispensed with and there is no pressure on the hose except when a tire is being inflated. Prices, Premier, $3; Automatic Electric, $8.50; Evertite, $1.—Bell Brass Mfg. Co., 205 White Building, Seattle, Wash.

Spee-Dee Hand Cleaner

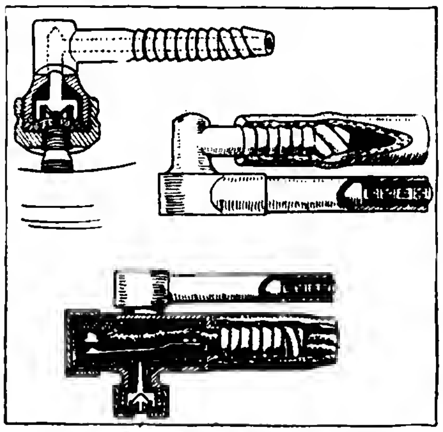
The Spee-Dee cleaner is a solvent for grease and when applied to the hands it takes up all dirt, leaving the hands clean when wiped off. It is used without water. The maker states that it does not injure the skin in the least. The emulsion can be mixed with water and used to clean oily motor parts. Spee-Dee sells for 15 cents per can.—States Chemical Co., Chicago, Ill.

Economy Manifold

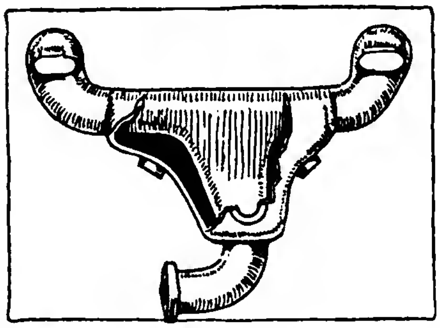
The Economy special intake manifold has a jacket through which part of the exhaust gas is passed, heating the intake and the vapor which passes through it and bringing the mixture to a more completely combustible state. The maker states that carbon deposits are reduced and gasoline consumption lessened by the use of this appliance. There are no adjustments and no loose parts. Manifolds will fit any Ford from 1909 to date. Price, $6 attached.—Economy Manifold Co., Syracuse, N. Y.



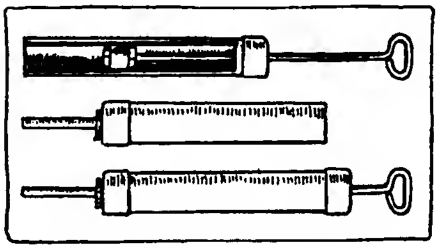
Eclipse piston ring, showing section



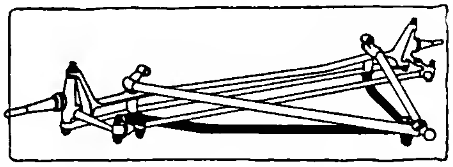
Three types of Bell air valves



Economy exhaust-jacketed manifold



Puritan easy-loading grease gun



Standard radius rod support for Fords

Puritan Grease Gun

The Puritan grease gun is ingeniously filled. There is an inner tube which can be withdrawn when the plunger is drawn up as far as it will go; the tube is filled with grease and inserted in the gun and expelled in the usual way. The tube can be inserted in one position only, so that it cannot be put in wrong. The gun sells for $1.50.—Puritan Mfg. Co., Bridgeport, Conn.

Standard Radius Rod Support

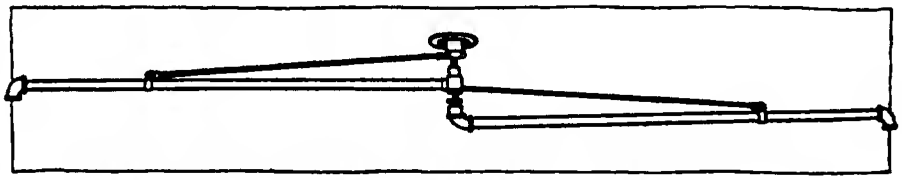
In this device steel tubing radius rods are installed on the Ford car in the same position as the regular radius rods, except that they attach below the front axle instead of above it. They are held by the spring hanger bolts on the axle and in the rear at the ball-and-socket joint just in front of the magneto casing. The object is to stiffen up the front axle system and incidentally to steady the steering of the car. Price $1.50.—Standard Auto Accessory Co., Leipsic, Ohio.

Raban Revolving Washer

Washers are made in several different styles but the general features claimed for all of them are simplicity and a method of support which removes all strain from the working parts. The Leader, which lists at $17, is provided with an inside valve which is said to prevent leakage even when the pressure is abnormal. Price $15 to $35.—W. A. Raban, Port Chester, New York.

Sexton's Castor Motor Oil

Castor oil and vegetable and mineral oils are compounded in such proportions as to form a lubricant said to possess the desirable qualities of pure castor oil without its drawbacks. The lubricant is made suitable for any service by varying the proportions of castor and other oils, and various grades are made that are suitable for various motors, their individual characteristics being taken into consideration. The price is about the same as that of the highest grade mineral lubricating oils.—Sexton Oil Co., Chicago, Ill.



Raban double-ended overhead washer to permit two men to work at once

The Automobile

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British Taxation

THE recently issued British order in Council which prohibits the importation of passenger cars, parts and accessories is bound to have a serious effect upon the dealers of the United Kingdom as the latter have lately been depending almost entirely upon American supplies to maintain their business. The prohibition of importation of parts appears likely to work some hardship upon British owners of American cars, though it is to be presumed that the big distributors like the Ford and Overland branches in England carry sufficient spare parts to care for their customers' wants for a fair period.

Following the importation prohibition, however, comes the new taxation imposed by the budget for 1916. This increases the annual license fees which are paid to the national exchequer by 100 per cent on small cars and 200 per cent on larger machines. To give an example, the old taxes which have been in force for some time made the annual tax on a Ford car $30.24 and this is now raised to $90.72. The tax is based upon a horsepower formula exactly similar to the A. L. A. M. and the $90 tax is payable on all four-cylinder cars having a bore over 3 5/32 in. on sixes with a bore exceeding 2 9/16 in. and on eights with a bore over 2 3/16 in.

Nor is the $90 tax the worst, for there are three other stages. Cars rating over 26 hp. are charged $126 per annum, over 33 hp. $156, over 40 hp. $315 and cars over 60 hp. rating $630, the conversions to dollars being in round figures.

It is highly improbable that these motor car taxes will be reduced directly upon the declaration of peace and the removal of the importation prohibition, which latter will almost certainly be discontinued as soon as the Atlantic freight situation eases. This means that for some years to come there will probably be a premium upon cars with a bore of 80 mm. (3 5/32 in.) or under, as this is the limit of bore for fours to come under the $90 tax. The rating of this size of engine is 15.8 hp. and practically every American car exceeds this amount considerably. It means that the quite small, high-speed four is going to be the favorite car for export to Great Britain.

What of the Four?

A YEAR ago when the six versus eight argument was at its height, when the twelve was about to make its bow to the public and cylinders were the main topic of engineering conversation, there were many who expressed the view that all the discussion would serve to draw attention to the advantages of the four. The highly successful meeting of the Metropolitan section of the S. A. E. last week, at which the future of the four was the topic of the evening, proves that interest in the four is reawakening.

It means something more than the swing of the pendulum. Probably it marks the first step in the commencement of the endeavor to reduce the cost of operating an automobile, which appears to be one of the most important problems now facing engineers.

It is agreed that the demand for large, heavy cars will be limited in the future, and that the highly efficient, light machine is the coming type. Such a car may prove to be most easily made with any number of cylinders, but undoubtedly the four shows to better advantage as the total size of the engine is reduced.

There is a very general feeling that a small four with the highest possible class of internal and external finish would command a good price and sell in considerable quantities. It may be either right or wrong, but while it lasts interest in the four will continue.

Comprehending Carburetion

THE paper read in Cleveland by F. H. Ball and F. O. Ball is noteworthy because it shows in a very graphic manner just what are the main problems of successful carburetion. The diagrams showing the action of the various types of instruments enable the essential functions of the different parts that go to carbureter makeup to be clearly grasped, and the effect of altering one part or another to be appreciated.

From the diagrams we see how comparatively difficult it is to hold the mixture curve of a carbureter within the effective zone, giving a mixture neither too rich nor too strong.

Cleveland Meeting Shows Progress In Standardization by S. A. E.

Few New Standards Actually Recommended But Progress Reports of Divisions Indicate Full Program for Summer Meeting—Some Big Things in Hand

CLEVELAND, OHIO, April 21—Laying down the details of the proposed form for fuel economy testing of automobiles provided the highest spot in the meeting of the S. A. E. Standards Committee held at the Statler Hotel to-day. There was a large attendance, some seventy members participating in the discussions, and reports were received from all divisions of the committee. It was made clear that all divisions with but two exceptions, have programs before them which will provide work for the rest of the year; there has never been a time when more important matters were before the Society.

A very noticeable feature of the meeting was the tendency to ask for data of a fundamental nature. In discussing the reports of the divisions there were several demands for purely scientific treatment of the problems; demands that the theory of the subject be considered more fully than current practice in establishing new recommendations.

Tire Standards Division

An important vote was one recommending the Council to appoint a new division of the committee to be called the Tire Standards Division. Hitherto matters relating to solid tires have been handled by the truck division and there has been one division with a special interest in pneumatic tires. It is felt that there is need for a careful analysis of such things as the proper loads and air pressures for tires of different sizes, the comparative durabilty of solid tires of different sections and so forth. The new division would be entrusted with research work along such lines and would endeavor to develop S. A. E. recommendations to which all tire makers could subscribe. It is also thought probable that a standardization of passenger car felloe bands is now possible which would make rims of different type interchangeable, and the examination of this subject would be one of the new division's first tasks.

Seek Ability Formula

The most vigorous discussion of the day took place at the afternoon session, on the presentation of the report of the research division which is given complete on page 790. The report is an amendment of one presented to the January meeting and turned back as insufficiently rigid. The report as now presented was accepted, but only as a progress report, the committee thinking that the recommended test ought to cover acceleration and other things. The research division is thus entrusted with the expansion of the scheme for fuel economy testing into a comprehensive test which will show everything about a car that can be tested.

The discussion was very general, among the speakers being C. T. Myers, Timken-David Brown Co.; Professor Fishleigh, Michigan University; K. W. Zimmerschied, past chairman Standards Committee, and E. E. Sweet, Cadillac Motor Car Co. The possibility of an "ability formula," which has long been an ideal, was the main subject. Engineers in various parts of the world have for years past been trying to find some method of testing which would enable a figure of merit of some kind to be given a car that would include everything, economy, speed, acceleration, weight, etc. Mr. Myers held that it was possible to develop a test which would give satisfactory results and J. Younger, Pierce-Arrow Motor Car Co., drew attention to the close similarity of the theoretical work done by independent investigators. It was finally voted to accept the report as far as it went, but not to recommend its adoption by the Society till the research division had completely examined the ability formula idea and reported to the Standards Committee.

Speedometer Drive Details

The Miscellaneous Division is one that always has a full slate, and the report read by J. G. Utz, chairman of the division, showed that there was much in hand. This also was a progress report, nothing being quite ready for adoption, though several things are near that stage. Mr. Utz explained the proposed speedometer drive connection, which is now being examined by manufacturers. This consists of a socket with a shaft and a flange for attaching to any convenient part of the gearbox. It is proposed that the gearbox maker should provide the original driving gear within the gearset so that the speedometer manufacturer would furnish a standard end to the flexible drive which would fit the standard socket. The nest of gears giving opportunity for variation to suit tire size and gear ratio could be either within the gearbox or outside. It seems certain that this standard will go through without much difficulty, though the design may be altered a good deal. The present idea provides quite a small flange on the gearbox and E. G. Gunn, Premier Motor Corp., suggested that it might be well to make the hole larger, so that the nest of gears could be inserted from outside the gearset and thus accommodate the different ratios required without pulling apart the transmission.

In discussing this drive the error caused by using rear wheel drive for the speedometer was mentioned. Berne Nadall, Stewart-Warner Corp, stated that this did not exceed 1.5 per cent under ordinary circumstances and was no greater than the error caused by variations in tire diameter away from nominal size. E. E. Sweet added that this tire variation was surprisingly great, saying that he had found tires of the same nominal size which varied in circumference as much as 5 in.

Next in the list of this division are recommendations for the depth of piston ring grooves, this following previous work in connection with their width. A formula for determining the width in terms of the piston diameter is

$$G = \sqrt{\frac{.01\,D^2}{8} + .005}$$

and this appears to give very good results, providing a groove which will accommodate nearly all types of ring. This will be ready for acceptance by the Society in June.

A very small detail of substantial importance which the Miscellaneous division is about to standardize is the thread on the top extremity of spark plugs, so that any spark plug nut will fit. Seeing the ease with which these terminal nuts can be lost, this should be a standard much appreciated by the general public.

It was voted that the recommended practice for gearshift gates or lever positions should be given in the data book as follows—left side, reverse forward, low gear back; right side, intermediate forward, high back. This setting is stated to be now used by 82 per cent of makers. Recommendations for four speed positions are to be removed.

C. W. McKinley, Willys-Overland Co., asked that the Miscellaneous division give attention to the length of thread on S. A. E. bolts saying that this was now so short that the usefulness of the standard bolt was greatly curtailed.

Lamp Investigations

The Electrical Equipment division has held two formal and one informal meetings during the past few weeks, the chief work done being the appointment of a sub-committee under the chairmanship of W. E. McKetchnie, Cadillac Motor Car Co., to confer upon lamp standardization; of another committee under chairmanship of F. Conrad, Westinghouse Elect. & Mfg. Co., on generator, starting

(*Continued on page* 789)

Plan $5,000,000 Ford Plant

80 Acres Bought in Newark, N. J.—To Expand Chicago Plant

DETROIT, MICH., April 24—The Ford Motor Co. has acquired 80 acres of land just outside of Newark, N. J., on which it is planned to erect a service station and assembly plant, at a cost of about $5,000,000.

Frank L. Klingensmith, vice-president and treasurer of the Ford company, states that no definite ideas have been formulated beyond the fact that an assembly plant and service station similar to the one at Long Island City is to be erected. The tract is large enough to erect any sort of plants the Ford company may need in the future and the move is more in the nature of a step to meet any later needs of the company in the way of expansion in the Eastern territory. It is pointed out that inasmuch as the tract could be bought at a reasonable figure, it was acquired without any definite idea as to exactly how it would all be utilized. There is a hint that possibly an Eastern unit of the Ford tractor business will find its location on this tract and also that an export factory will be erected.

Coincident with the news that the Ford company had acquired property near New York City, it has also been learned that a plot, 100 by 161 ft. on Michigan Avenue, Chicago, has been acquired. This adjoins the new assembly plant recently completed in that city and will be utilized for enlarging this building when occasion demands. Another lot 75 by 121 ft. has also been acquired in Chicago at the corner of West Madison and Kildare avenues, where a service station may be located.

Murray New Eight

PITTSBURGH, PA., April 25—The Murray Motor Car Co. has been organized here to manufacture the Murray touring car, an eight-cylinder design with seven-passenger accommodation with 127-in. wheelbase for car and roadster types. W. B. Murray, who has been connected with Packard distribution in this city, is president and associated with him are J. W. Pontefract and W. W. Bensel. Fred Berger is chief engineer and Joseph Gardham production manager. A factory has been secured at 3700 Grand Boulevard, and materials have been contracted for.

The car will largely be an assembled one, using a unit power plant composed of an eight-cylinder Herschell-Spillman motor 3¼ by 5, and a Covert gearset. Other parts to be used are Timken axles, Perfection springs, Parish & Bingham frame, Gemmer steering gear and Blood universals. At this time it is not definite what electrical equipment will be used, but it is expected that Westinghouse starting and lighting equipment will be standard. Bosch ignition will be fitted. The price has not been decided upon, but it will be in the zone of $2,000.

Two New Jeffery Trucks

KENOSHA, WIS., April 22—The Thos. B. Jeffery Co. of this city has added two new trucks to its line. One is a 1500-lb. capacity car at $900, which follows along the lines of the four-cylinder passenger car design and the other is a 3000-lb. truck, selling at $1,400 and of heavier construction throughout as compared with the lighter one, but nevertheless of somewhat similar design.

Briscoe Advances Prices

JACKSON, MICH., April 24—The Briscoe Motor Corp., this city, has raised its prices $40 on the 4-24 to $625; $35 to $785 on the 4-38, and $35 to $985 on the eight-cylinder model. The prices went into effect April 15.

Argo Raises Prices $20

JACKSON, MICH., April 24—The Argo Motor Co., Inc., announces that due to the higher cost of materials and improvements in construction of the Argo cars, the price of the touring car has been raised from $435 to $455, and the roadster from $385 to $405, an increase of $20 on each model.

Sears-Cross Lowers Prices

BROOKLYN, N. Y., April 21.—The Sears-Cross Co., this city, on March 25 reduced the prices of its speedometers. Model F-15, for Fords, has been reduced from $12 to $8; model FF-16, also for Fords, has been reduced from $15 to $10, and the F.C.M.B. model has been reduced from $25 to $12.

New Company to Take Over Standard Roller Bearing

PHILADELPHIA, PA., April 21—The reorganization committee of the Standard Roller Bearing Co. has agreed on the tentative plan for refinancing the company which was outlined in THE AUTOMOBILE for Jan. 6, 1916. Under this plan the holders of debenture gold 5's maturing April 2, 1916, convertible gold 6's due March 2, 1918, bills payable and accounts payable are to receive in cash 20 per cent of the principal of their claims, and the balance of the principal of their claims, 80 per cent in second preferred stock, in a new company to be organized to purchase the old company.

Overland Wages Up 4 to 10

17,000 Employees Affected by New Pay Schedule in Effect June 1

TOLEDO, OHIO, April 21—Effective June 1, about 17,000 factory employees of the Willys-Overland Co. will receive an increase in wages ranging from 4 to 10 per cent and a reduced schedule of hours.

The shops of the company will be operated on an 8-hr. basis, the present working time being 50 hr. a week. The company will give 50-hr. pay for 48-hr. work. All the advances are voluntary on the part of the company.

This means that the company's payroll for factory employees, now about $250,000 a week, will be increased to $275,000 a week. It also means an annual distribution of wages amounting in round numbers to $14,300,000.

According to the special factory notice, beginning June 1, all factory employees receiving 25 cents or less per hour will then receive an increase of 10 per cent. Those now receiving over 25 cents and up to and including 30 cents per hour, will receive an increase of 7 per cent. Those now receiving over 30 cents per hour will receive an increase of 4 per cent.

As in the past the company will pay time and one-half for overtime, and double time for Sundays and holidays.

Winton Raises Wages 10 per Cent

CLEVELAND, OHIO, April 22—The announcement is made by the Winton Co. that all of the employees will be given an advance of 10 per cent in wages, effective May 1. In all 1300 men are affected by the increase.

Jordan Plant to Be Completed June 1

CLEVELAND, OHIO, April 21—The first unit of the new Jordan Motor Car Co. plant on East 152d Street, this city, will be completed by June 1 and production of the Jordan car will begin soon after that date.

The first building of the plant group will include 30,000 sq. ft. of floor space and will cost about $50,000.

It is understood that the six-cylinder chassis will contain the one best unit produced by each one of the leading makers among parts producing companies in America.

To Sell Lauth-Juergens Assets

FREMONT, OHIO, April 22—The stockholders of the Lauth-Juergens Motor Truck Co. will meet April 25 to vote on the adoption of an agreement for the sale of the entire property and assets of the company to the H. G. Burford Co.

Packard Makes 116 M. P. H.

Special Car with 300-In. Aeroplane Engine Tried Out on Speedway

NEW YORK CITY, April 26—The 300-cu. in Packard aviation engine is being tried out this week on Sheepshead Bay Speedway, it having been fitted to a specially built chassis of great engineering interest. The 2-mile wood track is not yet dry from the recent rains, so that it has not been possible to make any laps at full speed, as it has been thought unsafe to go to the top of the banking. On complete laps the car has been doing well over 100 m.p.h. and on the straightaways 116 m.p.h. is readily attainable. This is not official timing but is conservative checking with the stopwatch.

The engine has twelve cylinders 2 21/32 by 4½ in., giving just a trifle under 300 cu. in. piston displacement, and the gearing gives a crankshaft speed round about 3000 r.p.m. at 100 m.p.h. There are four valves per cylinder line. For these shafts, there is a gear drive Peugeot fashion, only this is arranged at the flywheel end instead of in front. An especially striking feature is the use of Delco ignition with a storage battery and a small Bijur generator; there is no magneto.

J. G. Vincent, vice-president, and Ralph de Palma have been driving the car in these preliminary trials. It is understood that the car is shortly to return to Detroit for examination and may be back on the speedway in a few weeks.

Steenstrup Sails April 29

DETROIT, MICH., April 24—Peter S. Steenstrup, foreign representative of the Hupp Motor Corp., this city, will leave April 29 for Russia, Italy and other foreign countries in the interest of the Hupp organization. He will establish headquarters in London.

Electric-Vehicle Program Out

NEW YORK CITY, April 26—The first session of The National Electric Light Assn. convention in Chicago devoted to electric vehicle interests will take place May 24, and will include the following program:

Chairman's address by Walter H. Johnson, secretary's report by A. Jackson Marshall, treasurer's report by H. M. Edwards, reports of section activities, and the committee reports as follows:

Membership committee, Joseph D. Israel, chairman; Standardization committee, E. R. Whitney, chairman; Motion Picture Film committee, Carl H. Reed, chairman; Traffic and Good Roads committee, A. H. Manwaring, chairman; Insurance committee, Day Baker, chairman. Appointment of Nominating committee.

The Thursday morning session will be devoted to the following committee reports and papers:

Garage and Rates committee, George B. Foster, chairman; Legislation committee, P. D. Wagoner, chairman; Federal and Municipal Transportation committee, J. H. McGraw, chairman; Industrial Truck Applications, by C. W. Squires, Jr.; Electric Truck Troubles and How to Eliminate Them, by F. E. Whitney; The Relation of Tires to Electric Vehicle Efficiency, by S. V. Norton; Greater Garage Service, by Harry Salvat.

Reports and papers for the last session, Thursday afternoon, are:

Operating Records committee, W. P. Kennedy, chairman; Central Station Cooperation committee, E. S. Mansfield, chairman; Exchange Battery Systems, by P. D. Wagoner; Passenger Vehicle Problems and Activities, by E. P. Chalfant; Central Station Promotion of Electric Vehicle Use, by W. P. Kennedy. Report of Nominating committee.

Goodyear Issues $10,000,000 Preferred—To Increase Output

AKRON, OHIO, April 22—To take care of increased production and factory enlargements, the Goodyear Tire & Rubber Co., this city, has announced the sale of $10,000,000 of new preferred stock. The new facilities will make way for a much greater cord tire production than heretofore. The company has been working day and night for the past year and has been making factory enlargements for some time past to take care of increased business. But these additions have not kept up with the business growth and as a result the company expects to practically double its production facilities within the next ten months. The company has been turning out practically 17,000 tires a day. Within the year its capacity will be 25,000 tires a day.

The new cumulative preferred stock yields 7 per cent. A syndicate of bankers, composed of Kissel, Kinnicutt & Co., of New York City; Borton & Borton of Cleveland, and others, have taken over the stock for sale. The company agrees to set aside each year a sinking fund sufficient in amount to retire the issue at 112 within about twenty-three years and, in addition, to at all times maintain its net quick and total assets at not less than 115 per cent and 200 per cent, respectively, of the preferred stock outstanding. The financial strength of the company is indicated by the fact that the net quick assets, after this sale, amount to 154 per cent on the preferred.

The stockholders of the company will meet May 20 to adjust and increase its capital. The present outstanding issue of preferred amounting to $6,200,000 is to be called for redemption at $120 a share and will be replaced by a new issue of $17,700,000. Common shareholders are to receive a stock dividend of 100 per cent, bringing the outstanding common issue up to $17,500,000. Preferred stockholders will have the alternative of accepting $120 a share cash or the new preferred stock at $105 a share.

Niles Co. To Build Trucks

Railroad Car Maker's Line Will Comprise ¾ to 1-Ton and 2 to 2½-Ton

NILES, OHIO, April 21.—The Niles Car & Mfg. Co., this city, will shortly enter the commercial vehicle field with two models, one designed to carry from ¾ to 1 ton and the other from 2 to 2½ tons.

The two models will be along the same general lines, having the motor under the bonnet, with approximately an 85-per cent live load on the rear axle. The light truck will be equipped with pneumatic tires on demountable rims while the heavy truck will have solid tires.

Both models will be worm driven, the Timken David-Brown worm being employed. The front axle is Timken. On both models standard units will be three-point suspended Continental motor; Borg & Beck dry plate disk clutch; Stromberg carbureter; Fedder's honeycomb radiator; Blood Bros. universal joints with tubular driveshaft; and heavy artillery type wood wheels. Frames are pressed steel with heavy angle and reinforced with cross members and gusset plates. All bodies will be built by the company.

The Niles company, which has been manufacturing interurban electric and other types of passenger railway cars for over 15 years, will operate a large plant in Niles for the manufacture of the trucks. Special machinery is being installed at present.

Service stations will be opened and maintained in all the more important cities where the company's sales will be concentrated. The sales policy will be the direct-to-user plan, no agents or dealers being appointed.

Warner and Patterson Buy Double Lens Company

CHICAGO, ILL., April 26—A. P. Warner, formerly with the Stewart-Warner Speedometer Corp. and E. C. Patterson of *Collier's* have purchased the double Lens Co., making double lens non-glaring headlight glass. The new concern will be called the Warner Lens Co. and the product will be known as Warner Glass lens. In the new concern will be J. H. Cattell, formerly with the *Scientific American*. Warner and Cattell will be the active figures in the concern.

Bruske with Mop Co.

DETROIT, MICH., April 21—Paul Hale Bruske, formerly director of publicity, Maxwell Motor Co., has become advertising manager of the O-SO-EZY Mop. Co., Detroit.

American Plant for Plainfield

Corp. Recently Formed Plans 3000 Five-Passenger Sixes in Year

NEW YORK CITY, April 22—The American Motors Corp., recently formed by Louis Chevrolet and a group of Eastern business men, has practically completed negotiations for the establishment of a plant in Plainfield, N. J. Production is expected to start by the middle of July and the corporation will turn out about 3000 cars the first year.

A five-passenger six-cylinder car selling under $1,000 has been planned as the first model. A Continental 3¼ by 4½-in. motor will be used. Other features include spiral-bevel drive, 122-in. wheelbase, 32 by 4-in. tires, self-starter and electric lighting.

A considerable part of the capital has been paid in. The company is capitalized at $1,250,000 and at the present time has $500,000 preferred and $500,000 common outstanding.

Louis Chevrolet will be chief engineer of the corporation. W. H. Hoople, president of the Interstate Electric Corp.; J. C. Spiers, formerly general manager of the Autocar Co. and factory manager of the Locomobile, Mercer, S.G.V. and Standard Roller Bearing companies, and G. F. Baright, formerly advertising manager of the Prudential Life Insurance Co., Newark, N. J., are backing the company.

Develop Bournonville Rotary Valve Motors for Aeroplanes

NEW YORK CITY, April 26—Bournonville rotary valve motors are now being developed for aeroplane work by the Bournonville Motors Corp., this city. The work has proceeded far enough so that it is expected to have one of the motors on test at the A. C. A. about June 1.

In addition to the New York company, another has been formed in Canada, being incorporated in Toronto for $500,000. The incorporators are William Gilchrist, James Stewart and H. J. Stuart and others, all of Toronto. It is understood that the leading spirit in the Canadian enterprize is Col. J. B. Miller, head of the Polson Iron Works, Toronto. This concern builds the M.F.P. aeroplane.

For the time being, the automobile end of the business is understood to have been shelved and the company is pushing forward as fast as possible its work on the aeroplane motors, owing to the great demand for motors of this type. The motor which has been developed is expected to show from 160 to 180 hp. on the block test as 1600 to 1800 r.p.m.

The Bournonville motor was described in THE AUTOMOBILE for Dec. 24, 1914, on page 1156. It is a balanced rotary valve arrangement in which a single rotary valve is placed over the cylinders. The valve is made in separate pieces to avoid the complications due to longitudinal expansion. The arrangement of gas passage so that the gases act as a carbon sweeper is one of the features of the motor.

Chevrolet Starts Building on $1,000,000 Additions

FLINT, MICH., April 22—The Chevrolet Motor Co. has begun several large additions to its plants here, these to cost between $750,000 and $1,000,000, and when completed it is stated the local Chevrolet organization will have a capacity of 350 cars per day, besides making it possible to turn out 1000 motors and 1000 axles each day, for distribution to the concern's several assembly plants in other sections of the country.

One of the new buildings will be an axle plant measuring 120 by 900 ft., all single story except 284 ft. at the front end, which will be two stories, to provide lunch rooms and other accommodations for the workmen. Another is a warehouse, 150 by 500 ft. and four stories high and additional assembly space is also to be provided in the form of a U-shaped structure with two 750-ft. wings three stories high. These buildings will all be of reinforced concrete factory construction.

As was recently announced, the Chevrolet organization has acquired manufacturing plants at Bay City, Mich., from the National Cycle & Mfg. Co. and the National Motor Truck Co. and this added capacity will be devoted to the making of some 200 motors a day.

Hawkeye Is 1¼-Tonner

SIOUX CITY, IOWA, April 24—The Hawkeye Mfg. & Repair Co., this city, has brought out a 1¼-ton truck designated as model H. the chassis price of which is $1,250. A 36-hp., four-cylinder block-case valve in the head motor is used. This engine is made by the Hawkeye company. Other features are Stewart Warner vacuum feed, Eisemann magneto, three-speed gearset mounted in unit with the motor, multiple disk dry-plate clutch, semi-elliptic springs, etc.

Puritan Buys Keeton Stock

DETROIT, MICH., April 25—The Puritan Machine Co., Detroit, Mich., recently purchased from the defunct Keeton Motors, Ltd., whose factory was located at Brantford, Ont., the stock of parts, blueprints, drawings, jigs, dies and tools, etc., and will continue service to Keeton car owners from the Puritan plant here.

Monroe in Welch Plant

Turns Over Flint Plant to General Motors—Durant Out of Monroe

DETROIT, MICH., April 24—The General Motors Co. has made a deal with the Monroe Motor Co., Flint, Mich., whereby the Monroe company turns over its factory at Flint to the larger organization and takes possession of the plants formerly occupied by the Welch Motor Car Co., Pontiac, Mich., now out of business. The plant at Flint adjoins the Buick factories and prior to its being occupied by the Monroe Motor Co. was used by the Chevrolet Motor Co.

The move seems to have been an advantageous one all around, because it allows the further expansion of the General Motors industrial organization at Flint, besides permitting the Monroe Motor Co. to concentrate its activities in Pontiac, where the Monroe Body Co., from which the Monroe car concern secures its bodies, is also located in Pontiac. It is expected that Monroe will make the move about May 15.

W. C. Durant, prominent figure in General Motors and Chevrolet activities, has severed his connection with the Monroe concern, of which he was formerly vice-president.

United Motor Fuel Corp. Predicts Abundant Gasoline

NEW YORK CITY, April 26—The work of the United Motor Fuel Corp., in the interests of the automobile manufacturers during the last month, point to four conclusions, first, and most important, that the future has in store an abundant supply of motor fuel at prices lower than those prevailing; second, that no process now in common use does all that can be done in the production of gasoline; third, that no process except the Burton is as yet a demonstrated economical commercial success; fourth, that at least two processes now in their infancy will eventually develop into important factors in price reduction.

These deductions, according to the National Automobile Chamber of Commerce, are based on examination of all the well known processes and a number not so well known; of the probable supply of crude oil; of the possibility of using crudes now almost neglected as sources of gasoline supply, and on careful examination of all patents since the issue to C. H. Hall in 1869.

The United Motor Fuel Corp. has been flooded with all sorts of proposals, but is interested in nothing except processes demonstrated and in actual operation.

Iowa Buys 15,000 Cars in 1916

136,500 Registrations — Claim State in Third Place on March 31

DES MOINES, IOWA, April 25—Of the 136,500 cars already registered in Iowa for 1916, 15,000 are new machines, the records show. The oldest car thus far registered for this year is a 1903 Reo, and the next oldest is a 1905 Ford.

Iowa ranked third in the United States on March 31 in the number of automobiles registered for 1916, according to figures compiled by Roy Allen, head of the Iowa Automobile Registration Department. New York was first and California second.

Seven States registered over 100,000 cars in 1915. The number of cars registered in each up to April 1 of this year is shown in the following table:

State	Total, 1915	To April 1, 1916
New York	231,831	154,405
California	163,795	158,423
Iowa	145,109	136,500
Ohio	181,332	129,442
Illinois	180,832	120,447
Pennsylvania	159,984	115,408
Massachusetts	102,663	64,835

Stanley Bros. Apply Steam Automobile Engine to Rail Use

NEWTON, MASS., April 22—F. E. & F. O. Stanley, the manufacturers of Stanley steam cars, are the principal figures in the Unit Railway Car Co. of Massachusetts just formed to make their steam motor applicable to railway cars. Those who have seen the new car that the Stanley brothers are building, and know what is planned, say that the passing of the electric trolley with its wires, expensive power stations and the huge steam locomotives with their coal and soot is not an impossibility in the near future. Kerosene will be used as fuel, giving five miles to the gallon.

For a long time the Stanley brothers have been working upon a plan of adapting to railroad and railway purposes the steam automobile engine which they have developed through a long series of years. They have now reached a point where the first car to be built will be ready for a trial trip in a little more than a month. When finished the new car will be given a trial on one of the railroads in New England.

The car will weigh much less than the ordinary railroad or trolley car of similar capacity, and it will cost much less to build.

The car now in process of construction will carry forty-four passengers and it has a baggage compartment and another one for the engineer. It will weigh about 35,000 lb. and will cost about $10,000. The car is adapted to interurban service or use on standard steam roads. It is to have a steel body, air brakes, electric lighting system and the standard railroad equipment required by the Inter State Commerce Commission. In addition to this car designs have been drawn up for a smaller car to carry twenty-six passengers.

Material Prices Steady

NEW YORK CITY, April 25—Market prices last week were steady. With the exception of another 13-cent drop in lead and one of $2.50 in tin, prices were normal. Rubber prices are still being maintained at the low level established two weeks ago. The gasoline situation remains unchanged, no advances and no decreases having occurred. Since Louis Enricht of Farmingdale, L. I., made public the announcement of his new fuel, he has been swamped with reporters and cranks, but nothing further regarding the nature of the product has been divulged, nor have any more tests been permitted by the inventor.

Aluminum, copper, and open-hearth and Bessemer steels were steady and unchanged. Copper reached 29½ cents a pound last week with good sales. The aluminum market is easier with sellers lowering prices.

Oils and lubricants remained steady. Lard oil rose to 98 cents while cottonseed oil saw a 30-cent gain.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.58	.58	.58	.58	.58	.58	...
Antimony	.41½	.40	.40	.40	.40	.40	— .01½
Beams & Channels, 100 lb	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb	.29½	.29½	.29½	.29½	.29½	.29½	...
Copper, Lake, lb	.29½	.29½	.29½	.29½	.29½	.29½	...
Cottonseed Oil, bbl	10.50	10.60	10.65	10.65	10.65	10.80	+ .30
Fish Oil, Menhaden, Brown	.54	.54	.54	.54	.54	.54	...
Gasoline, Auto, bbl	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.96	.96	.98	.98	.98	.98	+ .02
Lead, 100 lb	7.63	7.63	7.50	7.50	7.50	7.50	— .13
Linseed Oil	76	.76	.76	.76	.76	.76	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	....
Petroleum, bbl., Pa., crude	2.60	2.60	2.30	2.30	2.30	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.73	73	.73	.73	.73	.73	...
Rubber, Ceylon, First Latex	.83	.83	.82	.82	.82	.82	— .01
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb	52.00	51.00	50.50	50.50	50.50	49.50	—2.50
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06	...

Cleveland S. A. E. Ranks Third

207 Attend Dinner and 250 Hear Carbureter Paper Following

CLEVELAND, OHIO, April 22—The Cleveland Section of the S. A. E. arranged a dinner at the Statler Hotel to mark the conclusion of the Standards Committee meeting held here yesterday, the dinner being followed by the paper on carburetion by F. H. and F. O. Ball, which is reprinted on page 762. A number of members of the Council were present. Mr. Ball read the paper from a small platform at the end of the large hall, the audience sitting at their tables. Before the paper was read a few short speeches were delivered from the chairman's table. Coker F. Clarkson, general manager of the S. A. E., spoke concerning the use of trucks by the United States Government, stating that the army found mechanical transport 30 per cent cheaper than animal. It is his conviction that the S. A. E. will take an important part in helping the military authorities to work out their plans for properly organized systems. Committees from the S. A. E. will be appointed to work with the army and give all the help possible.

J. H. Herron, chairman of the Cleveland section, said that the section had made rapid strides in membership, without much effort beyond that obtainable from an energetic membership committee. C. S. Pelton, secretary of the section, stated that the membership is now 171, being a gain of forty-five in one month. This puts the section third in membership and places it very close to that of the Metropolitan section. On June 24 there will be a field day, for which preparations are well advanced, and details of the entertainment program will be ready shortly.

The next meeting of the section will be on May 19, the paper for that occasion being entitled Efficiency in Automobile Practice, by A. Ludlow Clayden, chairman of the Standards Committee.

353 Reservations for S. A. E. Cruise

DETROIT, April 24.—Reservations have been made to date for 353 S.A.E. members and friends for the summer cruise June 12—16. Treasurer W. H. Conant of the 1916 Meetings Committee reports daily receipts increasing, and it is now certain that the total accommodation of 550 on S.S. Noronic will be taken by June 1, if not earlier. At the present rate the ship will be sold out before that time.

Chairman Geo. H. Dunham had a full

meeting of his 1916 Meetings Committee in this city Saturday, and completed many plans for the cruise. For the benefit of those who want a day's fishing in Georgian Bay a complete outfit of fishing tackle will be carried on the Noronic and sold to members. The boat will stop at Sarnia, Ontario, on the return trip, Friday, June 16, for the convenience of those wanting to catch eastern trains at that point. This also applies to Grand Trunk trains west.

Attendance this year promises to eclipse all former years from the viewpoint of wide representation. Already nearly all of the past presidents have made reservations. The broad gage and high caliber papers that have already been arranged for have had much to do with many of the early decisions to go on the cruise.

In addition to the papers already announced the following have been definitely decided upon: W. H. Allen, Single vs. Dual Tires for Truck Wheels; A. P. Brush, High Speed Motors; Benjamin Liebowitz, Dynamics of Vehicle Suspension; H. L. Horning, Motors for Trucks and Tractors; A. J. Slade, Motor Truck Transport Preparations, and B. D. Bachman, truck subjects.

Dividends Declared

Stewart-Warner Speedometer Co.: quarterly 1¾ per cent on preferred and 1½ per cent on common, both payable May 1 to stock of record April 22.

Splitdorf Electrical Co. will send out checks for an additional 7 per cent on account of dividends in arrears, leaving 12 per cent still unpaid.

Break in Security Prices

Liquidation on Heavy Scale—Recovery on Favorable Report from Germany

NEW YORK CITY, April 25—The effect of unfavorable news or some national crisis on security prices was illustrated last Saturday when a violent break in stocks occurred, accompanied by liquidation on a heavy scale. The unfavorable tenor of Berlin advices at that time and the Mexican crisis overshadowed all other market considerations. One of the largest drops in automobile securities was that of General Motors, which declined 20 points. This stock and others, however, picked up substantially yesterday on intimation that Germany will endeavor to preserve peace with the United States.

Goodyear common was the only issue last week which showed strength. This stock rose to 405, or a gain of 35 points. The previous week it went up 34 points. This stock has been in great demand as a result of the coming stockholders' meeting, where it is said action will be taken on a 100 per cent stock dividend.

Chevrolet, Maxwell, Studebaker and Willys-Overland again dropped. Chevrolet, which declined 6 points the previous week, dropped 7 points on Saturday; Maxwell common, first preferred and second preferred showed net losses of 2⅝, 7⅝ and 4⅜ points; Studebaker common went down 18 points while its preferred dropped 4 points; and Willys-Overland common dropped 18 points after a 2-point drop the preceding week.

Tire issues which featured the market last week with substantial gains were a little lower. Goodrich common went down 3¼ points; Kelly-Springfield common dropped 4½ points; and U. S. Rubber common and preferred declined 2½ and 2 points, respectively.

Detroit quotations were in sympathy with those on the local exchange. Chalmers dropped 9 points; Continental Motor common declined 3 points; General Motors common 10 points and its preferred 3 points. Maxwell common and first preferred were 2 points lower while the second preferred dropped 1½ points. Studebaker common closed at 120, a decline of 14 points.

Hurlburt Increases Capital $300,000 To Add Equipment

NEW YORK CITY, April 21—The need of more factory equipment to take care of its production facilities has caused the Hurlburt Motor Truck Co., this city, to increase its capital $300,000 from $150,000 to $450,000, of which $350,000 will be preferred stock paying dividends semi-annually beginning Oct. 1, 1916 at the rate of 7 per cent per annum. The balance, $100,000, will continue as common stock.

With the new equipment, the company expects to increase its present production materially. Production now ranges from 600 to 1000 cars a year.

Stewart-Warner Retires Preferred

CHICAGO, ILL., April 21—The Stewart-Warner Speedometer Corp., this city, will retire at 110 and accrued dividends the $241,480 preferred stock, which is one-third of the amount outstanding.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	66	68	—1½
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	80	87	86	90	—1
Chalmers Motor Co. com	93	98	150	155	..
Chalmers Motor Co. pfd	92	94	97	99	..
Chevrolet Motor Co	..	..	178	182	—7
Electric Storage Battery Co	..	..	62	64	+2
Firestone Tire & Rubber Co. com	450	458	800	..	..
Firestone Tire & Rubber Co. pfd	110	112½	114	117	..
General Motors Co. com	144	146	400	420	—30
General Motors Co. pfd	99	101	111½	112½	—3½
B. F. Goodrich Co. com	47	48	73½	74	—3¼
B. F. Goodrich Co. pfd	101	102½	114	115	—1
Goodyear Tire & Rubber Co. com	237	240	405	440	+35
Goodyear Tire & Rubber Co. pfd	104	105	116	119	+2
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	17½	19½	10	15	—3
International Motor Co. pfd	32	35	20	25	—5
Kelly-Springfield Tire Co. com	132	134	68	69	—4½
Kelly-Springfield Tire Co. 1st pfd	84	85	95	97	—1
Kelly-Springfield Tire Co. 2d pfd	130	140	..	..	..
Maxwell Motor Co. com	47	49	69½	70½	—2⅝
Maxwell Motor Co. 1st pfd	81½	83½	77	79	—7⅝
Maxwell Motor Co. 2d pfd	37	39	50	52	—4⅜
Miller Rubber Co. com	185	190	265	..	..
Miller Rubber Co. pfd	101	103	113½	114½	..
New Departure Mfg. Co. com	137	138	190	195	+9
New Departure Mfg. Co. pfd	106	110	112	..	+1
Packard Motor Car Co. com	86	..	165	175	..
Packard Motor Car Co. pfd	93	..	100	104	..
Paige-Detroit Motor Car	..	..	750	850	..
Peerless Motor & Truck Corp	..	..	20	24	—5½
Portage Rubber Co. com	34	36	75	77	..
Portage Rubber Co. pfd	85	95	108	109	..
Regal Motor Car Co. pfd	..	..	20	24	+2
*Reo Motor Truck Co	14½	16	28¼	29½	+ ¼
*Reo Motor Car Co	33	34	38	39	—1
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	68	69	84¼	85	—2¼
Stewart-Warner Speed. Corp. pfd	103	105	109	..	..
Studebaker Corp. com	65	67	120	123	—18
Studebaker Corp. pfd	100	102	108	111	—4
Swinehart Tire & Rubber Co	90	95	84	86	..
Texas Co.	137	139	179	181	—10
U. S. Rubber Co. com	68	69	50½	51	—2½
U. S. Rubber Co. pfd	106	108	106	108	—2
Vacuum Oil Co	209	212	230	235	—10
White Motor Co. (new)	..	..	49½	50½	+ ½
Willys-Overland Co. com	125	127	210	215	—18
Willys-Overland Co. pfd	100½	102	102½	103½	—1½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co	..	..	..	..	..
Chalmers Motor Co. com	..	95¼	..	155	—9
Chalmers Motor Co. pfd	93	96	96½	99	..
Continental Motor Co. com	175	190	34	35	—3
Continental Motor Co. pfd	80	85	..	10¼	..
Ford Motor Co. of Canada	600	..	385	405	..
General Motors Co. com	143	145	410	440	—10
General Motors Co. pfd	100	103	110	113	—3
Maxwell Motor Co. com	51	53	69¼	72	—2
Maxwell Motor Co. 1st pfd	82½	84½	80	84	—2
Maxwell Motor Co. 2d pfd	38½	40½	51	54½	—1½
Packard Motor Car Co. com	80	..	..	174	—1
Packard Motor Car Co. pfd	93¾	..	..	104	+ ½
Paige-Detroit Motor Car Co	..	..	..	850	..
*Reo Motor Car Co	32¾	33¾	38	39	— ¾
*Reo Motor Truck Co	14¼	15¼	..	28½	—1
Studebaker Corp. com	65½	67½	120	126	—14
Studebaker Corp. pfd	99	101	109	..	..

INACTIVE STOCKS

*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	195	..	320	365	..
*W. K. Prudden Co	19¼	21	30	32½	— ½
Regal Motor Car Co. pfd	12	20	15	22	..

*Par value $10.

Automobile Industry Represents 28% of Capital in Detroit Manufacturing

U. S. Census Statistics for 1914 Show 120 Concerns Making Cars, Trucks, Bodies and Parts, Etc., Produce 40 Per Cent of Value of All Manufactures in That City

DETROIT, MICH., April 12—Some striking facts to indicate what the automobile industry has done for the city of Detroit are to be found in the statement just issued, which gives detailed statistics of the four leading industries of this city; namely, automobiles, copper, brass and bronze, slaughtering and meat packing, and tobacco. This covers the year 1914 and is supplementary to the preliminary report made some months ago, giving results for Detroit of the census of manufacturers for the calendar year of 1914.

That the automobile industry really constitutes a considerably larger proportion of Detroit's industrial wealth than has been supposed, is indicated by the figures which show that the amount invested in the industry here, including parts makers was 28 per cent of the total amount of money invested in all business enterprises of this city for 1914.

Automobiles and parts to a value of $163,588,000 were produced in the year, equal to 40 per cent of the $402,864,000 value of all manufactures. The industry paid for materials $101,259,000 out of $223,527,000 paid by all manufacturing trades, or 45 per cent, and added $62,329,000 to the value of the materials by manufacture.

The present statement shows that $82,561,000 of the total capital of $295,171,000 invested in manufacturing plants in Detroit, was invested in the automobile industry; $9,405,000 in copper, brass and bronze works; $4,121,000 in slaughter houses and meat packing, and $8,505,000 in tobacco works.

Of the city's total of 2030 manufacturing concerns in 1914, 120 were devoted to the automobile industry; forty-one to brass, bronze and copper works; thirteen to slaughtering and meat packing, and 1007 to the manufacture of tobacco, cigars, etc.

Each of thirty-one establishments produced automobiles, trucks or parts to the value of $1,000,000 and over, 30 to the value of $100,000 to $1,000,000 and 32 to the value of $20,000 to $100,000.

Of the 120,977 persons engaged in manufacturing, the automobile plants employed 37,641; brass, bronze and copper works, 4579; slaughter houses and meat packing, 1299, and tobacco concerns, 7832. Of the total number of persons engaged in manufacturing, 31 per cent are engaged in automobile work.

Of the total industry of the city, the automobile industry constitutes 28 per cent; the number of persons engaged in automobile work constitutes 31 per cent of the total number of persons engaged in manufacturing. Salaries in the automobile business are slightly under the average, as shown by the fact that the motor car industry constitutes 34 per cent of the aggregate salaries and wages and 25 per cent of the total paid in salaries, but the wages paid to the automobile workers constitute 37 per cent of the city's total paid in wages in the manufacturing industries.

Cost of material, value of products and value added by manufacture for the four industries appear in the tabulation.

Industry	Cost of Material	Value of Product	Value Added by Manufacture
Automobile	$101,259,000	$163,588,000	$62,329,000
Brass, copper and bronze	10,442,000	15,159,000	4,717,000
Slaughtering and meat packing	18,489,000	20,321,000	1,832,000
Tobacco	7,309,000	17,044,000	9,735,000

Harkness to Try for World's Record in Blitzen Benz

NEW YORK CITY, April 24—H. S. Harkness has bought the Blitzen Benz in which the late Bob Burman established the world's record in 1911 at Daytona, Fla., when he drove 1 mile in 25.4 sec. The car was formerly owned by S. A. Fletcher, an Indianapolis banker. This car will be driven at the Sheepshead Bay Speedway on May 13 in an attempt to lower the present mark made by Burman at Daytona. Though no driver has as yet been selected for the trial, it is stated that Mr. Harkness will in all probability be its pilot.

Premier Racing Motor Develops 140 Hp. at 2900 R.p.m.

INDIANAPOLIS, IND., April 24—The Premier Motor Corp. is building two or three racing cars which will have four-cylinder 3⅝ by 6⅝-in. motors, developing 140 hp. at 2900 r.p.m. Practically the entire steel work is of chrome vanadium steel.

The motor, an overhead-valve type with two intake and two exhaust valves in each cylinder, has its camshafts driven by a train of gears which extend up the front. Each gear is carried on two annular ball bearings. The crankshaft is made from special steel and is carried on four annular ball bearings.

Castor oil is used exclusively and is carried under air pressure from the tank to sight feeds located on the dash from whence it passes through separate leads to each of the crankshaft bearings and to both camshafts, which are hollow. The oil passes through them the full length of the motor and overflows at the front and on the train of gears. The oil which goes to the crankshaft bearings passes through the ball bearings and after it is thrown off by them it is kept in banjo-shaped rings which are fastened to the side of the crankshaft. After the oil gets into these banjo rings it is thrown by centrifugal force and carried into the crankpins where it lubricates the big end of the connecting-rod and then is carried up on the connecting-rod through a small tube to the piston pin.

The rear springs are semi-elliptic, 50-in. long and absorb both the torque and the drive of the car. The front springs are semi-elliptic and are bound with cord for part of their length. Double shock absorbers are attached to each spring. Several different rear axle lever gear sets were tried and the results noted. The final ratio selected was 3 to 1, using a 35-in. tire.

Empire to Try for West-to-East Record

NEW YORK CITY, April 24—An attempt will be made by the Empire Automobile Co., Indianapolis, to break the West-to-East record of 11 days, 5 hr., 25 min. made by E. G. Baker and W. F. Sturm last May in a Stutz. An Empire car will be shipped to San Francisco today from this city in charge of Robert Hammond, who will drive it from that city. He expects to make the trip in ten days. He will be accompanied by M. Smith, a newspaper man.

Racklyft Joins Sunderman Carburetor

NEW YORK CITY, April 21—J. W. Racklyft, former assistant chief engineer of the Northway Motor & Mfg. Co., Detroit, Mich., has been appointed assistant chief engineer of the Sunderman Corp., this city, and will assist Capt. F. R. Sunderman, chief engineer of the company, in conducting tests for Detroit and Middle Western manufacturers.

Plummer Forms Liberty Agency

NEW YORK CITY, April 20.—J. F. Plummer, for sixteen years local manager of the Locomobile Co. of America branch, has organized the Colonial Motors, Ltd., which will handle the Liberty car.

Splitdorf Gets Hupp Export Contract

NEWARK, N. J., April 20—The Splitdorf Electrical Co., this city, has closed a contract with the Hupp Motor Car Corp., Detroit, Mich., for its magneto requirements for 1917 on all cars for export. The Dixie 40 will be used.

21 Sheepshead Bay Entries

Nine Are of Foreign Make—Full List of 32 Expected

New York City, April 25—Twenty-one entries to date have been made for the Sheepshead Bay Speedway races on May 13. The latest entrant is Joseph Christiaens, the Belgian, who drove the six-cylinder Excelsior into sixth place at Indianapolis two years ago. He has just arrived in this city from London and has brought over a new Sunbeam Six.

To date nine foreign entries have been made for the four events on May 13. These events include the Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles; and a 10-mile handicap, for non-winners, called the William E. Kemble Cup.

France will be represented by four Delages and three Peugeots, while England will be represented by two Sunbeam sixes.

Cars and drivers entered to date are:

Car	Driver
Erwin Forty	Grover C. Bergdoll
Erwin Forty	Eugene Stecher
Peugeot	Ralph Mulford
Crawford	Billy Chandler
Crawford.	Dave Lewis
Crawford	Unnamed
Duesenberg	Eddie O'Connell
Duesenberg	C. J. Devlin
Maxwell	Pete Henderson
Maxwell	E. C. Rickenbacher
Peugeot	Dario Resta
Peugeot	John Aitken
Delage	Carl Limberg
Delage	Jack Lecain
Delage	Unnamed
Delage	Unnamed
Sunbeam Six	Joseph Christiaens
Sunbeam Six	Aldo Franchi
Mulford Special	W. T. Muller
Olsen	C. W. Thompson
J. J. R. Special	Bert Watson

Resta will race against Aviator De Lloyd Thompson in an exhibition event May 6 and 7.

Three Meets for Tacoma

Tacoma, Wash., April 11—The Tacoma Speedway Assn. has definitely decided on three meets for this season, the dates being Decoration Day, July 4 and Aug. 5. The events for the Decoration Day program include three races of 10, 20 and 30 miles. There will also be an outdoor motor car show and a large parade of cars. The prizes for the day total $500 besides accessory prizes.

A New Kerosene Vaporizer

Ohio Gas Generator Co. Will Manufacture Webber Patent Device

Columbus, Ohio, April 22—The Ohio Gas Generator Co. has been formed here to manufacture a kerosene vaporizing device patented by Theodore Webber, formerly of Buffalo, who has been in this city for the past three years perfecting his invention. This consists of a cylindrical container which is placed around the exhaust pipe of the engine; kerosene is passed through this and the heat of the exhaust vaporizes it so that on being mixed with air the gas is highly explosive. Webber also has an attachment which injects a small quantity of water into the cylinder at each revolution of the engine.

Mr. Webber recently gave a demonstration of his vaporizer attached to a 5-hp. stationary gasoline engine which ran 6 hr. on 3 gal. of kerosene.

S. A. E. Standards Considered in Cleveland

(*Continued from page* 782)

motor and ignition standards; and the collection of data on flexible metallic tubing with a view to early standardization.

A. L. Riker, chairman of the division, reported that the sub-committees were at work. The lamp committee intends to make a scientific investigation of the glare question, to standardize some small parts like lamp glasses, and to take up any other work along this line. The other sub-committee is a joint one, having representatives from the Engine and Transmission division, and it seems probable that the lighting generator will be the first point of attack. The variations in practice are so large that it is obviously going to be a serious undertaking to set up standards which will be suitable to all requirements. Probably a good deal of original work will have to be done, but it is felt that the situation is in a plastic state and ought, therefore, to yield to standardization without great difficulty.

The division made some minor recommendations for the revision of the sheets of the data book dealing with grounded return wires. They also recommended that lamps for three-cell batteries should in future be known as 7-volt bulbs and those for six-cell batteries as 14-volt bulbs; the gage of the metal also to be removed from the bulb base specification. These recommendations, together with the rest of the report were accepted unanimously.

Sheet Steel Next Development

The Iron and Steel division had a progress report which K. W. Zimmerschied, chairman, presented. At present sheet steel has no proper classification, its specification for chemical and physical qualities, the nature of the finish and the gage of metal are somewhat obscured by the use of such names as "fender stock," "panel stock," etc. Mr. Zimmerschied said it was anticipated that the work would occupy a year or two.

It was reported that the division found it impossible to recommend any standard system of coloring for steel bar stock to distinguish the brands. The best color system depends upon the grades carried in stock by a manufacturer. A new steel of 40-50 carbon, 3½ per cent nickel will be recommended as an addition to the S. A. E. steels, this being specially suitable for oil tempered gears. Some alterations in test specimen specifications are being considered.

To Standardize Truck Control

W. P. Kennedy, chairman Truck Standards division, reported that the solid tire questions before his division were still active issues, the question of proper loading for the different sections now being under consideration. The chief work before the division is now the standardization of truck controls so that a driver will be able to change from one to another without any feeling of strangeness. Position of gear lever, location of pedals, of brake lever, etc., will be considered, together with such detail as the direction of throttle lever movement, etc. J. Younger, Pierce-Arrow Motor Car Co., made a strong plea for a fundamental consideration of this subject, urging that the division make experiments to discover what is best, and do not pay too much attention to prevailing practice. This view was well supported by the meeting, and the remark was made that there had already been considerable trouble in the Mexican expedition through drivers having to take over trucks which were strange to them. There has been endless trouble in Europe on this account.

Roller Bearings in Metric Size

The Carbureter Fittings division report was presented by V. R. Heftler, Zenith Carbureter Co. It contained recommendations regarding certain sizes of double outlet carbureters and described the work being done with throttle lever throw and gasoline pipes.

The Ball and Roller Bearings division, presented a sheet of proposed dimensions for metric sizes of taper roller bearings which would interchange with standard sizes of ball bearings, and also reported progress with respect to ball thrust bearings. The taper roller bearing recommendations will be circulated and re-submitted at the June meeting.

Professor Fishleigh, in presenting the report of the Engine and Transmission division announced that progress was being made with revision of the S. A. E. engine test forms and determinations of engine characteristic curves. The division has asked for a number of tests to be made on V belts, and the chairman of the Standards Commttiee, A. Ludlow Clayden announced that he had asked Cornell University to undertake the tests. The mechanical engineering department of the University had expressed its willingness to accept the responsibility.

The Spring, Electric Vehicle, Nomenclature and Chain divisions also presented short progress reports describing the work in hand. Mr. Zimmerschied said that the nomenclature compilation was nearing completion, and it was hoped to finish it before the summer meeting took place.

Fuel Economy Test

Hereunder follow the main provisions of the fuel economy test recommended by the Research division which has been accepted as far as it goes, with instructions to the division to proceed with consideration of an ability formula and an acceleration test:

1—The test shall be conducted on an automobile speedway.

2—The fuel consumption shall be measured at a series of speeds varying from 10 miles to the maximum speed of which the car is capable.

At each speed a distance of 10 miles shall be covered and to eliminate the effects of variable wind resistance two runs must be made at each speed in opposite directions around the speedway. The following table shows the order in which the runs must be made and the speeds at which they must be made together, with the approximate time consumed.

	M.P.H.	Dist.	Time	
			hr.	Min.
1st run	10	10	1	
Reversed direction...	10	10	1	
2nd run	15	10		40
Reversed direction...	15	10		40
3rd run	20	10		30
Reversed direction...	20	10		30
4th run	25	10		24
Reversed direction...	25	10		24
5th run	30	10		20
Reversed direction...	30	10		20
6th run	40	10		15
Reversed direction...	40	10		15
7th run	50	10		12
Reversed direction...	50	10		12
Etc. to limit of speed..				
		140	6	42

3—Fuel shall be fed to the carbureter during the test by gravity and shall be supplied from a special tank mounted so that the vertical distance between the top of the float chamber of the carbureter and the bottom of the fuel chamber is not less than 12 in. There shall be two tanks, preferably mounted side by side. These tanks shall be so connected to the main fuel pipe (by means of two cocks or otherwise), that one tank may be cut in and the other cut out in a fraction of a second. Of these two tanks one is a reserve tank used for maneuvering between test runs and this may be a fixture if so desired. The other tank which will be used during the test must be capable of easy detachment so that it can be weighed and replaced without difficulty. The tank used for the tests must contain sufficient fuel to enable the car to complete its run at the maximum speed on one filling.

4—The method of controlling the fuel shall be as follows: The engine must previously be brought to a condition of normal temperature. The special tank shall have been filled with fuel and weighed carefully. It is suggested that this may readily be done on a carefully calibrated spring balance. The tank shall then be connected so that it can be brought into use by the observer sitting beside the driver. The speed at which the test is to be made shall first be obtained from the reserve tank and the special tank shall be switched in by the observer on crossing the starting line marked on the speedway.

5—The speed during each run must be maintained as constant as possible. The time for each lap is to be checked by the observer and in no case must it deviate from the scheduled time by more than five per cent, plus or minus.

6—On the completion of each stage of the test it shall be repeated in the opposite direction every condition being observed as before.

7—At the conclusion of each stage of the test the special fuel tank shall be removed from its attachment and again carefully weighed. The weight of fuel consumed having been entered, the tank may be refilled and weighed again previous to the commencement of the succeeding stage.

8—The whole of the fuel to be employed during the entire test must be retained in a receptacle from which the observer can take a sample for the purpose of checking the specific gravity whence the quantity of fuel employed during the test may be determined from the weights actually measured.

Note: The object of specifying measurement of the fuel by weight instead of by volume is that the accurate measurement of the weight of the tank can easily be made from time to time as required, whereas the accurate measurement of volume calls for more elaborate apparatus and is much more susceptible to error.

9—The entire cooling system of the automobile must be fully operative during the test both as regards air and water circulation.

10—Coasting or declutching is not to be permitted.

11—The entire test is to be made in the highest gear, this including the final acceleration test.

12—The test is to be run with the car in the condition as indicated on the form, that is with all tanks full and full complement of passengers or corresponding ballast.

13—Oils or greases used in the engine, transmission, rear axle or other parts of the car must be of normal quantity and quality.

14—The car must carry its full standard equipment of parts and accessories, which must be the stock accessories as supplied by the manufacturer in accordance with the A. A. A. definition.

15—The test should be certified by a competent and impartial observer having no financial or commercial interest in the results. This observer shall make affidavit before a notary public regarding results of the test and the latter shall affix his seal to the report.

16—Immediately upon conclusion of the fuel economy tests an acceleration test must be made in accordance with the S. A. E. form. This test must be made with the same carbureter adjustment as that used for the fuel consumption tests.

17—From the commencement of the economy test to the conclusion of the acceleration test there must be no manipulation of any carbureter adjustment or control other than the throttle.

Explanatory Notes and Definitions

Weight of car alone—By this is meant the weight of the car with all oil, fuel and water tanks full, including special equipment necessary for the test and full standard equipment of tools, tires, rims, spare wheels, etc., as supplied with the stock model of the car.

Full complement of passengers consists of one passenger or the equivalent for each seat provided, driver included. The average weight for passengers and driver to be 150 lb. each.

For inclosed bodies all windows and doors to be closed. For touring bodies, top to be up, side curtains not used and rear curtain to be fastened down.

Windshield to be fully erected during test.

The pressure in the tires shall be that recommended by the manufacturer of the tires used, corresponding to the load applied both front and rear.

Information must be furnished in the form of a Baumé gravity reading for the fuel and supplemented wherever possible by a curve showing the results of a distillation and heat value tests. The trade name of the fuel used must be given.

Wind velocity—The fact is emphasized that the test should be run at a time when no appreciable wind exists.

The Four-Cylinder Motor of To-Day

(*Continued from page* 759)

pression pressures, while the brake mean effective varies as the mechanical efficiency, which according to good practice ranges between 20 to 30 per cent above compression pressures.

The matter of power impulse per revolutions, or torque quality, is not as new a subject as the road vehicle as we know it to-day. Many years of steam practice combined with that of the internal combustion motor have established the fact, that so far as working ability is concerned, an impulse stroke every 180 deg., or two per revolution, multiplied by the available number per minute, produces an almost perfect power flow.

How the Motor Works Out

Having outlined the factor values as we know them to-day let us consider a motor using the limits specified which are not extreme by any means.

P representing the m.e.p., we can assume as actual at 120 lb., L representing length of stroke in feet has a value of 0.5, A or area of piston equals 7.06 while N or number of power impulses per minute we have as 6000. Expressed by the usual formula we have $\frac{120 \times 0.5 \times 7.06 \times 6000}{33,000} = 77$ hp., a truly remarkable performance when we consider that such a motor complete should weigh about 400 lb.

This motor applied to the road should be geared about four to one with a third speed reduction of 1.33 to 1; second speed 2 to 1, and first 3 to 1, making the motor to wheel gearing 4-5.33-8 and 12 to 1 respectively, using 34-in. wheels, road speeds from 8 to 65 m.p.h. could be had on direct drive, while third speed would afford a possible range from 4 to 70 m.p.h.

The high m.e.p. obtained would not permit a wide open throttle at very low speeds with any spark advance, as very objectionable and detrimental pounding would result. To safeguard against this abuse a purely mechanical carbureter should be employed, with dimensions such as would prohibit a wide open condition at low engine speeds.

If greater car speeds are desired especially for the heavier type of vehicle, more power is easily had by changing the bore to stroke ratio, and still keep within the limits of our m.e.p. and piston speeds. This would, however, result in a slight loss of thermal efficiency.

Constructional features are matters of individual tastes. To obtain, however, the efficiency outlined, neutral space must be kept to a minimum which excludes practically all valve types other than over head or sliding sleeves. Intake gas speeds should be kept below 12,000 ft. per minute, and reciprocating parts must be extremely light.

The practice outlined is beyond the conventional, but has been demonstrated as easily possible many times. Except for the one extremely low factor, that of the thermal efficiency, it represents an ideal easily obtainable.

In comparison to motors with a greater number of cylinders of the same displacement, the answer lies in the question of thermal efficiency. The heat losses represent practically 60 per cent of the total fuel used, and are about equally divided between the flow to the cooling medium and the exhaust losses. The cooling medium losses are in proportion to the surface exposed, times the heat gradient, since the surface exposed increases rapidly in relation to the displacement as volumes are divided. The heat losses are likewise increased; in addition the mechanical losses, while small increase in exact proportion to the number of cylinders added.

Considering that thermal efficiency is the only point that prohibits perfect realization of the Otto cycle theory, anything that tends to decrease the possibilities should be considered a step backward. The demand, however, for power output beyond the possibilities of a four-cylinder motor as outlined must be met by the use of a greater number of cylinders in proportion to the power needed.

Theory Favors Four Cylinders

Discussion of Four-Cylinder Papers Points to Greater Thermal Efficiency of Four—Higher Mean Effective Pressures Urged at Reduced Throttle Openings

OWING to the presence of a number of members of the Society of Mechanical Engineers and the Aeronautical Society, the discussion on these papers very often went over to stationary and aeronautical practice. Some of the comments from the aeronautical point of view were particularly interesting in showing that the cylinder question is not confined to automobile design.

President Barker of the Aeronautical Society called attention to the fact that in Mr. Watts' paper the ultra-multi-cylinder engine is referred to as the de luxe type. "I wish to call the attention of the assembled engineers," said Mr. Barker, "to the fact that the aeroplane motor must be an ultra-multi-cylinder design. Therefore it is the motor de luxe that should require and should have the particular attention of engineers in its development. There seems to be nothing to criticise in Mr. Watts' paper, but it is necessary to look ahead. The development in the automobile engine has reached a very high point. It has become difficult to criticise. Now there are other worlds to conquer. Entering the aerial field you will find ample material for the wonderful ability and skill which has been developed in the past twenty years in the profound study that has been made of the automobile motor. If you automobile engineers will turn your attention to the aeroplane motor you will find there the full opportunity to develop."

Four Cylinders for Aeroplanes

Hugo Gibson, president of the Coalition Co., took exception to Mr. Barker's contention that the ultra-multi-cylinder engine is necessary for aeronautical purposes. He said:

"Since economy is perhaps the prime necessity in aeroplane engines after power, of course, then necessarily the fewer the cylinders the better for the proposition. So with the greater number of cylinders are you not confusing the advantages of smoothness, absence of vibration, etc., with the necessity for economy and large amount of power from a small amount of weight? These are the real necessities in aeronautical matters, and if that is so then we have nearly gone the limit if Mr. Watts' paper is right: that the limit of any cylinder is 4½ in. in diameter. I disagree with Mr. Watts in this point, however."

E. Favary, president of the Favary Tire & Cushion Co., stated that in listening to the papers one is forced to the conclusion that the four-cylinder engines should be in universal use, but while we all agree that the four-cylinder engine is most efficient and that the engines with a higher number of cylinders are not always attuned where they will show up to advantage, still they are here and they are gaining ground.

Mr. Favary went on to say: "Both papers presented this evening show us that the four-cylinder engine has a much higher thermal efficiency and is, therefore, the engine which should be most extensively used in the future. This is no doubt true, but at the same time we all admit that an engine with a greater number of cylinders has a more uniform torque and a more perfect running balance; it allows driving at low speeds without jerks and obviates the necessity for such frequent gear changes. These points, of course, are most important to the automobile user. All vibrations I believe can better be decreased in engines of a larger number of cylinders than in four-cylinder engines. On account of the increased cost of fuel, and the more extensive uses to which the automobile is adapted, economy plays a most important part, and therefore the greatest field for the future, as Mr. Porter pointed out, is to increase the thermal efficiency.

Heat Losses Enormous

"We all know that the heat losses are enormous. For this reason it is of prime importance to find some means for their reduction. The greater the number of cylinders, the greater the jacket area exposed to the hot gases, and the greater are those losses. For instance, a six-cylinder has approximately 20 per cent more area exposed to the cooling water than a four-cylinder engine, and in practice it means somewhere between 10 per cent more fuel. However, even in a four-cylinder, the losses are enormous, and I want to point out some means which might in the future prove a basis for development.

"Since piston speeds are now practical at 3000 ft. per minute, where some years ago 1000 ft. per minute was considered the limit, I think the combustion chamber could be kept at a much higher temperature without danger of pre-ignition. In other words, on account of the high speed of the engine, ignition would not take place before the charge should be fired, knowing that it does take some time after firing before obtaining the full effect of combustion. For this reason, a much higher temperature might be permissible. At the same time we must remember that oil will carbonize at higher temperatures, which would render its lubricating qualities defective and the running of the engine impractical. A possible field of development might be to provide only the part of the cylinder below the combustion chamber with a water jacket, so as to cool the portion requiring lubrication, while at the same time allowing the combustion chamber to have a higher temperature. If desired, the cylinder head may be bolted to the cylinder by the interposition of asbestos packing or some other non-conductor. To get the best results the piston rings should be lower down on the piston so as to increase the cubic content of the cylinder which can be maintained at a higher temperature. The possibility, perhaps Utopian, of still further reducing the temperature of the combustion chamber wall, might be accomplished by lining it with some material substantially impervious to heat. Of course we must bear in mind the occurrence of pre-ignition, but some means might be found for overcoming this.

Outside Compression Possible

"A higher engine speed, as previously mentioned, would greatly assist to overcome pre-ignition. In order to keep the mixture cool, it might be found advantageous to compress it outside the cylinder, and admit it through large valves into the cylinder, after the piston has completed a portion of the suction stroke. The mixture, at a low temperature, entering the cylinder under compression, requires some time before reaching the temperature of spontaneous ignition.

"Furthermore, by forcing the compressed mixture into the cylinder at a certain position of the suction stroke, the gas will expand, thereby tending to lower the temperature of the mixture. On the compression stroke, of course, the temperature will again be raised. This, with the increased engine speed, may render it possible to have the combustion chamber wall at a very much higher temperature, thereby obtaining an increased thermal efficiency."

J. Edward Schipper, technical editor THE AUTOMOBILE, advanced the idea that the matter might be one of piston displacement per cylinder, saying: "In the matter of cylinders it sometimes seems to come down to almost a point of piston displacement per cylinder. The consideration of what are the best working stresses on main bearings and connecting-rod bearings seems to be an important factor that has a good deal of bearing on the number of cylinders. Taking many of the present-day automobile engines that have worked out satisfactorily, it seems as if a piston displacement of about 70 cu. in. per cylinder seems to hit the nail pretty squarely on the head; and Mr. Watts has in his paper classified cars according to the weight. That seems to bear out this way of looking at it also. That is, the four-cylinder engine running less than 300 cu. in. piston displacement seems to correspond to about 70 cu. in. per cylinder, giving an easy working engine as far as bearing surfaces are concerned and also one in which the advantages of good carburetion obtain.

"For cars in what he calls the luxurious class—and he says there that the multi-cylinder engine might be justified—if we take the piston displacement which would be obtained by using say 70 cu. in. to the cylinder that would probably run it rather high. But nevertheless it seems that the piston displacement per cylinder is the limiting factor, which might be one of the methods of determining the correct number of cylinders to use for any given weight of vehicle."

Porter Closes Discussion

In closing the discussion, Mr. Porter said, in part: "Displacement per cylinder, as suggested by Mr. Schipper, I think, is on the right road, but I think it is a little bit under what is the limit, but it is well within what is necessary. I do not believe that there is any automobile built or any condition of automobiling in the world outside of racing that can need more than 300 cu. in. Because out of such a motor you can get 100 hp. without half trying, and it would work well, and you would never have occasion to use that horsepower. The average automobile does not need it: At something like 40 m.p.h. I think the five-passenger, 2000 to 3000-lb. car, takes about 20 hp. at 50 m.p.h.

"Now when it comes to acceleration, your road wheels govern that. It is the amount of traction you give. You can spin your wheels just as fast as you want to. Not more than 300 cu. in. or about 70 cu. in. per cylinder is absolutely all you want unless you have some other condition. The car I spoke of has more than that; it has 450; and I would not trade it for anything. If I get rid of that I guess I will quit. But it is simply because there seems to be no limit to what it can do. It can go to 100 m.p.h. or go up any hill in the world, accelerate as fast as 2500 r.p.m., but it has a great deal more power than is needed."

Factory Miscellany

Erlin Co. to Build—The Safety Auto Light and Mfg. Co., Erlin, Ohio, will build a plant.

Plant for Piedmont—The Piedmont Motor Co., Lynchburg, Va., contemplates building a plant.

Imperial Motor to Build—The Imperial Motor Co., Ottawa, Ont., will build an addition to its factory. L. H. Roy is manager.

Ford Building for Salt Lake City—The Ford Motor Co., Detroit, is planning the construction of an assemblying plant at Salt Lake City, Utah. The estimated cost is $400,000.

White Springs Tire Plant in Edmond—A tire plant will be equipped by the White Springs Tire Co., Edmond, Okla., recently formed with a capital of $50,000. J. W. White and M. J. O'Connor are interested.

Simplex Starter Adds—The Simplex Starter Co., Anderson, Ind., will make another addition. The new unit will enable the company to turn out 100 additional starters a day, which is double the present capacity.

Canadian Plant for Perfection Tire—The Perfection Tire & Motor Co., Fort Madison, Iowa, has had plans prepared for a Canadian branch plant to be erected at Niagara Falls, Ont., estimated to cost about $300,000.

Mid-Continent Tire Plant in Wichita—The Mid-Continent Tire Mfg. Co. has purchased a site at Thirteenth and Washington Streets, Wichita, Kan., upon which to erect its factory building. The building and equipment will cost $150,000.

To Make Accessories—The C. D. Mfg. Co., Marietta, Ohio, will be incorporated with $100,000 capital by F. A. Caskey and others to manufacture automobile accessories. Temporary factory operations will be carried on in the plant of the Galvin Mfg. Co.

Juno Truck Plant Sold—The former plant of the Juno Motor Truck Co., Juneau, Wis., which has been idle for more than a year, has been turned into a milk condensery. The company was organized about four years ago to take over the business of the Brodesser Motor Truck Co., Milwaukee, but after an existence of about two and a half years retired from business.

Ohio Plant News—The plant of the Elmore Automobile Co., Clyde, has been sold to the Universal Paper Products Co., of Chicago. The deal means the passing of the plant, which was one of the most important in Northern Ohio several years ago.

The plant of the Toledo-Findlay Tire Co., Findlay, which went into the hands of receivers several weeks ago and which has been idle since that time, has been placed in operation by Sheriff Kennedy, who has been placed in charge. A movement is on foot for a reorganization of the concern by the stockholders.

The McIntyre Mfg. Co., Columbus, has started ship motor plows from its plant. The first shipment was made to a point in Nebraska. The output of the company is being gradually increased.

The Automobile Calendar

April 24-29	Bangor, Me., Show.
April 26-May 6	Oakland, Cal., First Annual Pacific Coast Motor Power and Automobile Show, Automobile Industries Assn.
April 29	Fresno, Cal., Road Race, Raisin Classic Trophy Assn.
May 3	N.A.C.C. Monthly Meeting.
May 6	Sioux City, Iowa, Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 13-14	Columbus, Ohio, Track Race, Columbus Driving Park. Cee - Cee - Dee League.
May 14-20	Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.
May 18	S.A.E. New York Section, May Meeting.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 25	Pennsylvania's Second Good Roads Day.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 28-30	Cleveland, Ohio, Track Race, Cee - Cee - Dee League.
May 30	Des Moines, Iowa, Iowa Derby, 20 Miles; Des Moines Special, 10 miles.
May 30	Tacoma, Wash., 10, 20 and 30-Mile Races, Tacoma Speedway Assn.
May 30	Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn.
May 30	Indianapolis Speedway 300-Mile Race.
May 30	Minneapolis, Minn., Speedway Race.
June 4	Sheepshead Bay Speedway, 30-Mile Race, American Liberty Day Committee.
June 8	New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphan's Automobile Day Outing Assn.
June 10	Chicago Speedway Race. International 300 - Mile Race, Speedway Park, Speedway Park Assn.
June 12-16	S. A. E. Summer Trip on Great Lakes.
June 16-17	Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.
June 20	Galesburg, Ill., Track Race, 100 miles.
June 28	Des Moines, Iowa, Speedway Free-for-all, 300-mile race.
July	LaGrande, Ore., Track Race, LaGrande Motor Club.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-Mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Riegel-Hiller Co.
July 17-21	Dallas, Tex., Tractor Demonstration.
July 24-28	Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4	St. Louis, Mo., Tractor Demonstration.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 7-11	Fremont, Neb., Tractor Demonstration.
Aug. 11-12	Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Riegel-Hiller Co.
Aug. 14-18	Cedar Rapids, Ia., Tractor Demonstration.
Aug. 18-19	Elgin Road Race, Chicago Auto Club.
Aug. 21-25	Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1	Indiana Tractor Demonstration.
Sept. 2-9	Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 4	Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 4-8	Madison, Wis., Tractor Demonstration.
Sept. 6-7	St. Paul, Minn., Good Roads Congress, Auditorium.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City, Sheepshead Bay Speedway Race.
Oct. 7	Philadelphia Speedway Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Nov	Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in the Industry

Ohio Trade Happenings—The Vim Motor Sales Co., which has been formed in Columbus to distribute Vim trucks, has established its showrooms and service station in the New Columbus Auto Repair Co. Building at 103 South Front Street.

The Times Square Automobile Co. of New York and Chicago, which has purchased the bankrupt stock of automobile accessories of the Columbus Automobile Supply Co., at Gay and Fourth Streets, Columbus, will open a permanent branch store of this company, under the management of S. E. Brown and W. H. Montague, at 137 South High Street.

Twin City News—The Auto Engine Co., University Avenue and Griggs Street, St. Paul, will take over the space in its plant occupied by the Dussenberg Motor Co. The latter has moved to the Lowe-Victor Building, Chicago. The extra space was needed for increased business.

The Morton Brake Co., 45 Tenth Street S., Minneapolis, has begun the manufacture of the Morton Four-Wheel brake, whose power is applied by foot pedal pressure. The mechanism is simple and saves wear on tires by its use by elimination of tire chains.

Wis. Trade Items—The National Weighing Apparatus Co., 917 Third Street, Milwaukee, has taken new and larger quarters, consisting of the former plant of the Milwaukee Separator Co., at 267-273 Sixth Street. The capacity is thereby doubled. The officers of the company are: President, John Malenscheck; vice-president, John Dobnik; secretary and treasurer, J. L. Malenscheck.

The I. B. Rowell Mfg. Co., Waukesha, which has devoted its attention for many years to the manufacture of farm implements, has taken several large contracts to manufacture automobile devices for patentees who do not desire to establish works of their own. One order is for 60,000 self-starting devices for Ford cars, to sell at $30 each, and another order is for a large production of road surfacers and other light road machinery. Extra help has been engaged and the facilities extended to fill the orders.

The Roebken Garage at Cedarburg has been purchased by the newly organized Boerner Automobile Co., which takes immediate possession. The Boerner company proposed to build a new garage, but the project is indefinitely postponed because of the purchase.

Trade Happenings

Willson Heads Brooklyn Chevrolet—J. H. Willson has been made manager of the Brooklyn Chevrolet branch. Willson comes from the New York City branch.

Krueger Owns Milwaukee Cole Branch—W. H. Krueger, who recently went to Milwaukee to assume charge of the Cole company's distributing branch in that city, has purchased outright the Milwaukee business, and is not connected with the Cole Motor Co. of Chicago, as reported.

Detroit Changes—H. F. Hartman, who has been identified with the service activities of the Studebaker Corp. for the past five years, has just been appointed superintendent of the Detroit Studebaker service station. Previous to his present appointment Mr. Hartman was in charge of service at the Philadelphia branch, and before that supervisor of service for the States of Texas and New Mexico.

L. S. Weeks, formerly factory representative of the Studebaker Corp., has been appointed manager of the Atlanta, Ga., branch, and J. B. Dub, formerly salesman for the Detroit retail branch, has been made manager of the retail department at Atlanta.

Cyril O. Assmus has been appointed export representative in Detroit of the Maxwell Motor Co., succeeding A. S. Stevens, export manager of the company, who will hereafter have his headquarters in New York, and who will shortly leave there for South America.

Goodyear Trade Notes—R. W. Rost, Newark, N. J., salesman, has been promoted to manager of the Goodyear branch at Albany, N. Y., succeeding E. B. Sigerson, recently appointed manager of the Buffalo branch.

J. A. Leathermen, Portland, Ore., salesman, has been promoted to manager of the branch in that city.

L. H. Vaughan, former manager at Utica, N. Y., has been appointed manager of Goodyear's branch at Newark, N. J. He is succeeded at Utica by F. G. Richards, who has been connected with the Newark branch as salesman.

R. S. Herman, formerly a salesman with the Joplin, Mo., branch, has been transferred to Salina, Kan., as manager of the new Goodyear branch there.

Knepper a Factory Rep.—H. H. Knepper has withdrawn from the Knepper-Knight Co., Detroit, and has opened an office at 967 Woodward Avenue, that city, where he will continue to handle the account of the Marshall Ventilated Mattress Co., maker of the Marshall springs for automobile backs and cushions; the Polson Mfg. Co., auxiliary seats, and windshields, and the Lipman Air Appliance Co., maker of air, water and oil pumps. He is also handling the account of the M. J. Whittall Associates, makers of automobile carpets.

The name of the Knepper-Knight Co. has been changed to the Knight Co., the latter company having taken over all the interests that H. H. Knepper had in the former company. The company has the distribution of Soss hinges, Eaco horns, Inland piston rings and Boston gasoline gages.

Cowie Electric in Wichita—The E. S. Cowie Electrical Co., Kansas City, Mo., maker of electrical motor appliances, has acquired a lease on a building in Wichita, Kan., and will establish a branch house there before June 1.

Canadian Trade Items—The Dominion Automobile Co., handling the Hudson and Peerless cars, is installed in its bright and commodious new quarters at 146, 150 Bay Street, Toronto, Ont. A complete service department with a full compliment of parts has been installed.

S. Trusler, Hupp agent for the counties of Essex and Lambton, has formed a new company to be known as the Trusler-Carrick Co. This company has rented a fine showroom at 63 Ouellette Avenue, Windsor, besides show rooms and garage at Sarnia. In addition to the Hupp, the full line of the Gray-Dort Co. will be handled. Mr. Trusler will manage the Windsor business and Mr. Carrick will look after the business in Sarnia.

Northwest News—The Mitchell Motor & Service Co., Seattle, will shortly begin the construction of a new home at East Pine and Summit Avenue. The new Mitchell Building will provide 12,000 sq. ft. of floor space.

Hugh Chalmers, president of the Chalmers Motor Co., spent the past week in Seattle as the guest of J. C. Garner, local Chalmers representative. He was also the guest of the Seattle Ad Club, to whom he gave an intensely interesting and instructive address, which was heard by more than 300 prominent Seattle business men.

G. N. Bussell and A. Goodrick, proprietors of the Glendale Auto Brokerage Co., Tacoma, have taken the Western Washington distribution for the Trailmobile.

The AUTOMOBILE

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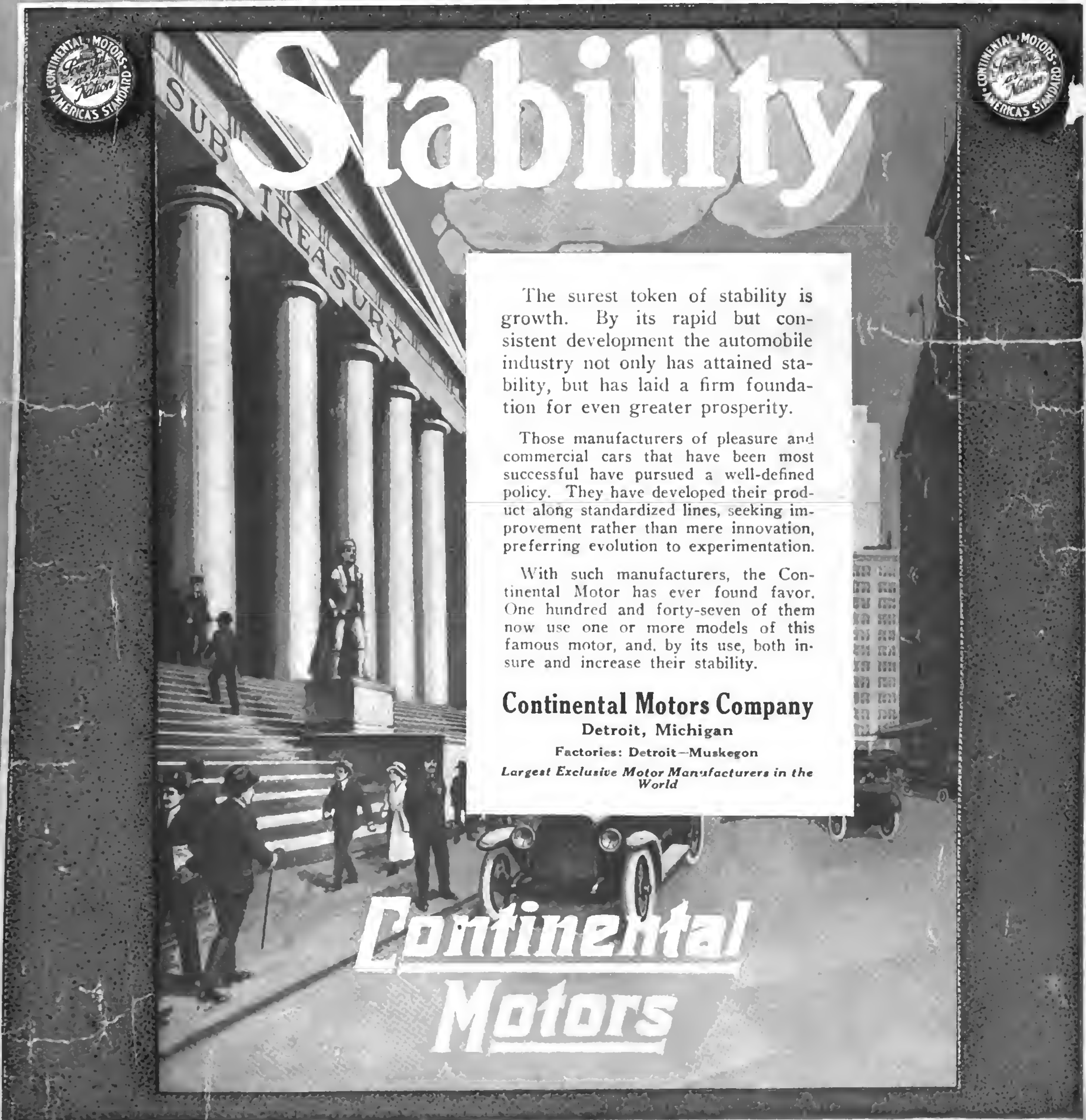

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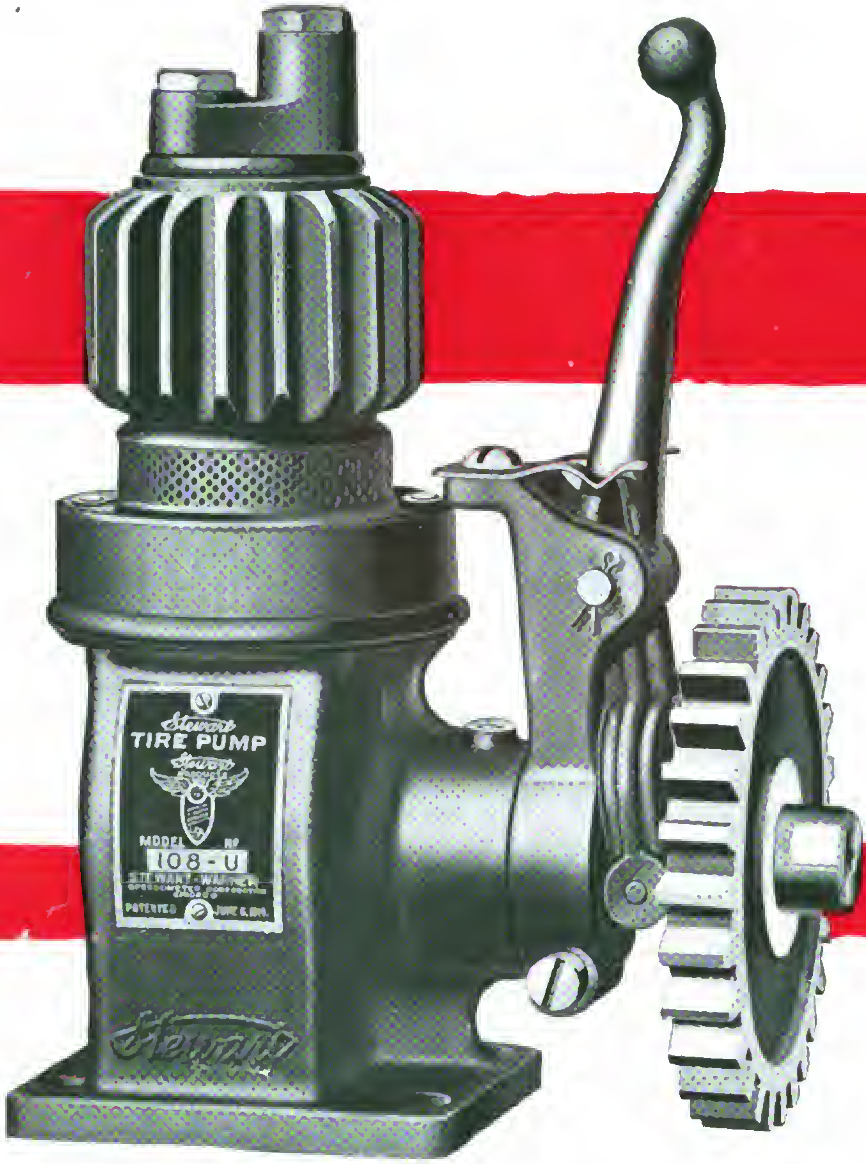

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Motor Driven

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Motorists are becoming more and more educated to the conveniences of the Stewart Tire Pump.

They also must better realize what a superior pump it is to all others.

We judge this from the splendid condition of our pump business.

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Are you?

"No car is better than its accessories"

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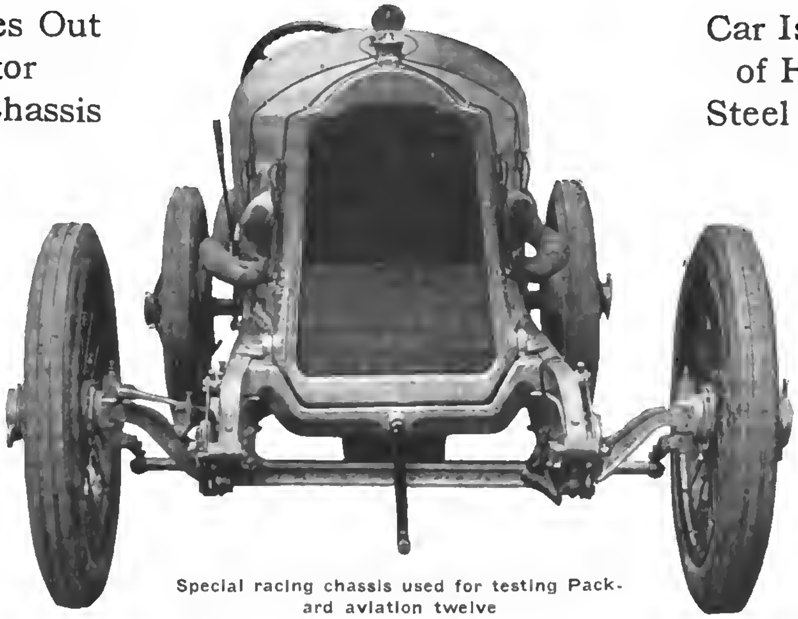
Vol. XXXIV New York—Thursday, May 4, 1916—Chicago No. 18

The Automobile

300 Cu. In. Twelve for Aviation

Packard Tries Out New Motor In Special Chassis

Car Is Masterpiece of High Tensile Steel Construction



Special racing chassis used for testing Packard aviation twelve

THAT the Packard Motor Car Co. has for some time been developing a twelve-cylinder aviation engine has been well known, and as was announced last week in THE AUTOMOBILE, the first of these motors is now being tried out for endurance in a special chassis. It is now several years since the Packard engineers began to study and develop high speed engines and the research work which led up to the aviation engine was commenced long before the appearance of the Packard twin six.

J. G. Vincent, engineering vice-president of the Packard company, has several times stated publicly that all their experimental work led them to believe that there were advantages in the twelve-cylinder engine which made it the best type for endurance at high speed. The production of the 3 by 5-in. twin six motor used in the Packard car vindicated many of the theories, since the twelve-cylinder engine showed itself the superior in almost every respect of carefully constructed experimental six-cylinder engines of the same total piston displacement.

Packard Aeroplane Twelve

Piston displacement	300 cu. in.
Bore	2 21/32 in.
Stroke	4½ in.
Normal hp	100 at 2300 r.p.m.
Four valves per cylinder	
Valve diam	1 7/16 in.
Valve lift	0.34 in.
Piston speed at 2300 r.p.m.	1725 ft. per min.
Weight	500 lb.
Ignition	Delco
Lighting and Starting	Delco

Practically as soon as the success of the twin six stock motor was assured designs were started for two other engines intended solely for aviation. One of these was designed to produce about 100 hp. and since this required approximately 300 cu. in. Mr. Vincent decided to limit the displacement to exactly this volume, as it facilitated ready comparison with other types of high-speed motor developed for racing car work. Therefore, the dimensions chosen for the small engine were 2 21/32-in. by 4½-in. and this is the size of engine with which experiments are now being made. The large motor which is under course of construction has a bore and stroke of 4 in. by 6 in., giving approximately 900 cu. in. piston displacement. Both the large and small motor follow the same general lines so the description of the little engine which follows applies in the majority of respects to the large one which will be ready for testing in a short time.

For aviation work regular torque and absence of vibration are very important. The regularity of torque has a value in increasing the efficiency of the propellor while vibration, if present, is destructive to the necessarily somewhat fragile structure of the aeroplane. Light weight is, of course, essential, but it is now customary to consider engine weight inclusive of the fuel, oil and water required. That is to say, it is the weight which must be carried for a flight of several hours' duration which is important and an engine which is economical of fuel and oil can easily be light when weighted together with supplies for a long flight as compared with another engine which is actually lighter so far as the metal part is concerned, but which is more extravagant in operation.

The small Packard aeroplane engine develops its requisite

There is no prettier racing car than the vehicle the Packard company has built to test its aeroplane engine. All the body is detachable in an instant. There is a 40-gal. gasoline tank inside the tail

100 hp. at 2300 r.p.m., and its weight is almost exactly 500 lb. The 100 hp., however, is very considerably less than the total ability of the engine, which will run and show increasing power up to speeds in the neighborhood of 4000 r.p.m. At 3300 r.p.m. the first engine gives 130 hp. The power curve is quite smooth as the motor speed falls off and the engine will run quietly and regularly at 300 to 400 revolutions.

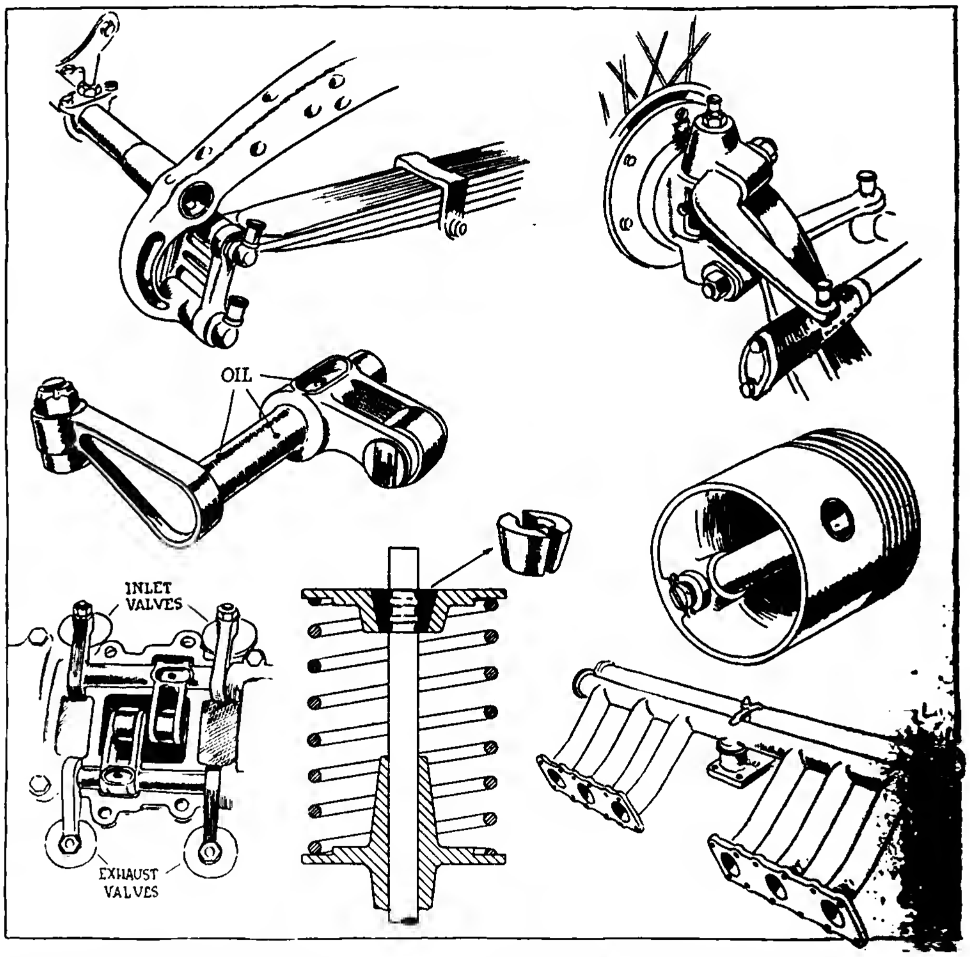
It is now several weeks since the first engine was put on the test block and at first it appeared difficult to find spark plugs which would withstand the very high explosion temperature which is obtained in the cylinders. This trouble has been entirely overcome and the test block failed to show any specific weakness in any part.

This being the case, Mr. Vincent decided to take a leaf out of the book of the Mercedes company and obtain his duration tests by putting the motor in a chassis which would permit it to run at full power for hours on end while exposing it to the shock and other indefinite circumstances that accompany a track test which seem impossible to imitate on the test block. It will be remembered that the Mercedes cars which won the French Grand Prix in 1914 were all fitted with the aeroplane engine which is generally regarded in Europe as being about the best that has yet been constructed. The Packard company has no intention of doing any racing, and it has been necessary to build a special chassis to enable the motor to be tried out properly. For about a week the chassis has been at work at Sheepshead Bay speedway showing lap speeds between 100 and 110 m.p.h. and speeds of 116 m.p.h. on the straightway. This is with a gear ratio giving less than 3000 r.p.m. at 100 m.p.h. No attempt has been made to check the speeds very accurately or to discover the maximum, the bulk of the running being done at about 100 m.p.h., a speed at which the motor is working just a little harder than it would have to work when its speed was held down by the proper size of propeller in an aeroplane.

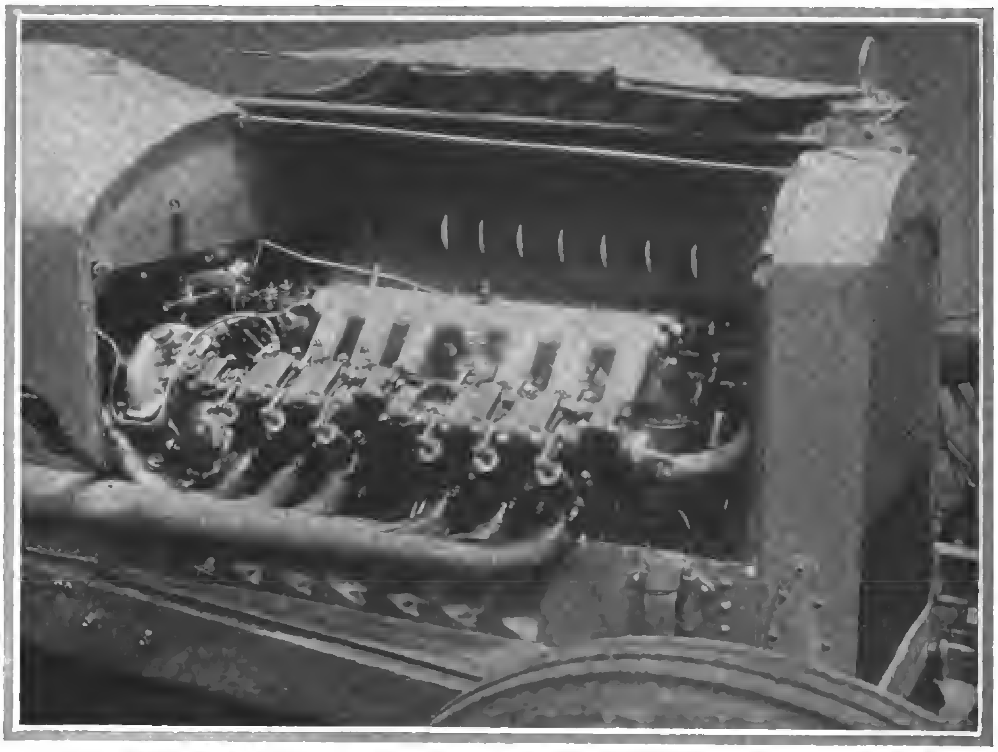
No one can possibly see the car which is being used to test this motor without regretting very greatly that it will not be seen in competition, since it is one of the prettiest racing machines that has ever been made.

In designing the chassis the endeavor has been to render it very highly efficient while making it strong enough to provide absolute safety, the object being to test the motor, and the greatest possible care has been taken to have the chassis perfect.

Coming to the mechanical detail of the engine, its design is based upon that of the stock twin six, but it differs very greatly in detail. Firstly, the cylinders are cast in blocks of three and have four overhead valves apiece. Possibly it is in the operation of these overhead valves that the most striking engineering advance is to be found. There is, of course, an overhead camshaft to each set of cylinders. With a camshaft above the cylinders it has always been troublesome to find means for operating the valves without at the same time losing quantities of oil. If rockers are used there is always a slit in the side of the casing through which the rocker operates and it is impossible to make this oil-tight. If the operation is direct as in the Peugeot or Sunbeam then there must be



Some mechanical details of the latest Packard twelve. The valve rocker in the center is machined from one piece and has a hollow shaft through which the oil flows from the small well at the top. Below is shown the arrangement of the rockers in position over the camshaft. A special form of split conical retainer is used to hold the valve spring seat on the valve stem as shown below in the center. The aluminum inlet manifold is in two halves, clamped together at the center, from which point the carbureter is suspended holes in the bottom of the casing through which the tappets pass to reach the valve stems. In the Packard design this trouble has been overcome by cranking the rockers. The lever which rests on the cam and the lever which touches the valve are at opposite ends of a short shaft. This means that the bearing of the rocker comes between the cam end, which is in an oil box, and the valve end which is outside. The length of the bearing provides a perfect oil seal so that the cam mechanism can be lubricated copiously and yet the valves will remain perfectly clean. This layout can be readily understood by referring to the photograph of the motor.



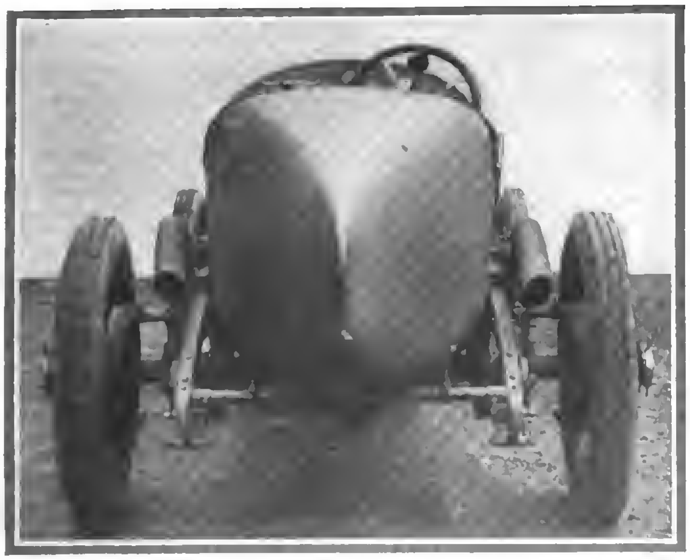
The Packard small size aviation engine fitted in a special chassis for testing it out on speedways. Note the overhead camshafts with the special form of rocker which prevents any loss of oil. Also the Delco ignition distributer and camshaft drive at rear end

Uses Spur Camshaft Drive

Considerable thought was given to the best methods for driving the camshaft, and, by making comparative layouts, it was found that the balance of the advantages favored the use of trains of spur gears. One of the most important advantages is that the parts of the spur gear trains are very simple and there are no thrust bearings required. Spur gears can be cut from very hard material and finished very highly so that there is no error in the timing due to backlash. Actually in this Packard motor when erected it was found that the maximum error in valve timing was 1 deg. on the flywheel which, as any engineer knows, is a remarkable achievement.

For a variety of reasons the rear location is chosen for the spur gears, the crankshaft pinion coming just in front of the flywheel bearing. Owing to the high grade of material the gears are quite narrow, that on the flywheel being only ⅝ in. wide.

For the connecting-rods the stock arrangement has been abandoned and the forked type used instead of the side by side. The reason for this is that the former arrangement is lighter. With an L-head twelve-cylinder engine, if the valves are well proportioned, the length becomes such that there is plenty of room for side-by-side rods. With the overhead valve, four-valve type of cylinder the length is so greatly reduced that there is not even room for forked rods, if the valves are taken as the limiting factor. Thus, having commenced with the valves the engine was lengthened just enough to give proper bearing surface for forked rods. These rods are made from very high tensile steel of I-beam section and are machined all over; an oil tube carries the lubricant to the piston pin.



Tapered tail of special Packard chassis. Note the two exhaust manifolds

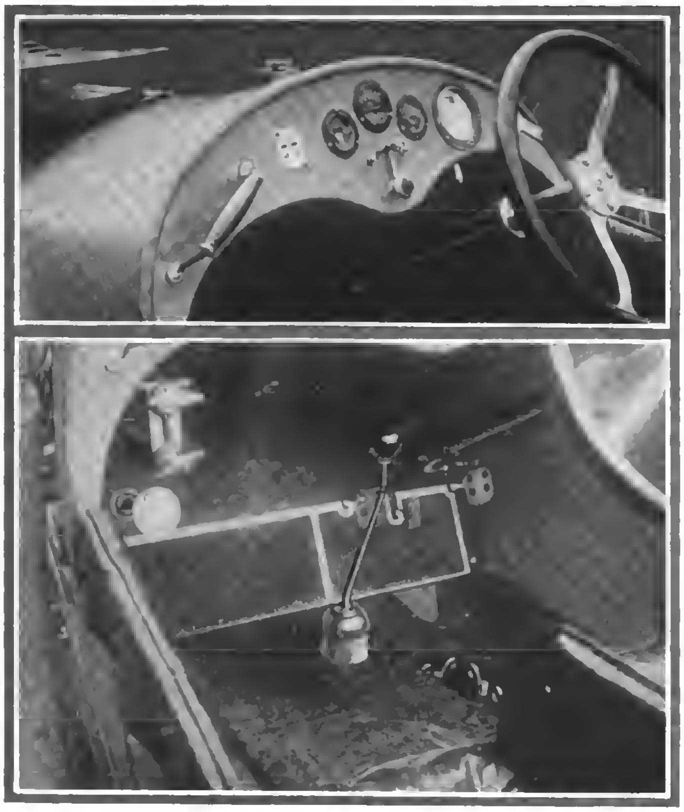
Has Unique Crankshaft

The crankshaft is very unusual as the webs are triangular in end elevation. This design was developed by experiments made to discover the design which would provide the greatest rigidity with the least weight. For both the main bearings, of which there are three, and the crank pins, the diameter is 1⅞ in., but the triangular webs are so strong that the shaft is completely free from whip throughout the whole speed range. It has already been stated that the connecting-rods are very light and this lightness extends to the pistons. These are die-cast aluminum alloy and the whole piston assembly with four rings and piston pin complete weighs 11 oz.

It is when the valves are examined analytically that one of the advantages of the twelve-cylinder construction appears. In these little cylinders, 2 21/32 bore, there is room for four valves 1 7/16 in. in the clear. The angle of seat is 45 deg. and the lift 0.34 in. This gives 1 sq. in. of valve opening for each 17 cu. in. of piston displacement. The 300 cu. in. Mercedes four-cylinder aeroplane engine has the largest valves which can be accommodated, and the valve opening in that engine is 1 sq. in. for each 25 cu. in. displacement.

Another advantage appears when the piston speed is studied since a 4½-in. stroke at the normal running speed of 2300 r.p.m. gives a piston speed of only 1725 ft. per min.

A detail which shows up well in the illustration and yet may appear peculiar, is the design of the intake manifold. This is the result of much experiment and is giving better service than designs which appear to be a theoretical improve-



Above—The dashboard equipment of the Packard is in strong contrast with many cars designed for racing in that it is provided with very few gages. On the right is a revolution indicator, no speedometer being fitted. In the center is an ammeter, on the right a voltmeter, and at the left is the oil gage. The centrally placed lever controls the ignition, a hand advance being superposed; ordinary variations are cared for by the automatic advance within the timer

Below—Although not intended for actual racing, the brake equipment is very complete, to insure safety. This view shows the hand adjusting nuts accessible to the mechanic, and the pressure pumps. As in the view of the cowlboard, the absence of superfluous fittings is very noticeable

ment. Mr. Vincent explains the success of its design as follows:

In an intake the resistance to gas flow comes at the corners or bends and the resistance of the bend is much greater than the resistance in straight pipe. It is thus important that if there be any bends they should all be in the same position relative to the valves served. In this particular manifold the gas rising from the carbureter impinges against the top of the fore and aft pipe, where it spreads, and the distance from each valve to the main header is the same. As a method of demonstrating the accuracy of carburetion and the evenness of charge obtained with this manifold, the fact may be mentioned that when the engine is run without the exhaust manifold the length of the jet of flame from each cylinder is the same. You could hold a straight edge to the tips of the flames and none would overlap it any more than another.

Electric Starting for Air Work

All Packard aviation engines will be supplied with starting and lighting equipment. For this purpose Delco has developed a special small generator design for the high average speed of aeroplane service. This is mounted accessibly between the cylinder blocks. Having the generator and a small battery there seemed no need for any other ignition device than the Delco distributer, which has given such complete satisfaction on the stock twin six. Consequently, one of these is mounted at the rear end of the V. As soon as these engines are ready for delivery, which will be in quite a short time, they will be offered either with the starting and lighting equipment with Delco ignition or without any other electrical equipment but two magnetos. Up to the present the distributer has shown itself well up to the demands made by continued high-speed running.

For cooling, there is a single pump with a double outlet and this is mounted at the front of the crankcase, having its spindle vertical and a bevel gear drive from the front end of the crankshaft; there is no thermostat control. The lubrication system is on the same lines as the stock Packard motor, that is to say, each main bearing of the crankshaft is fed with high pressure oil, which is then taken to the crank pins and passes up to the piston pins. The various auxiliaries are fed independently and the two camshafts are fed from inside.

Has High Compression, Timing Normal

Two other facts about this engine which have a bearing on the power are the compression and the timing. The compression volume is designed to be 17 per cent of the total volume, giving a gage compression of about 110 lb. This high compression pressure is rendered possible by the small size of cylinder and the high thermal conductivity of the pistons, but it has a very destructive action on the spark plugs. The plug, with which all the tests have been made and which appears to be entirely satisfactory, is the Rajah, this being an ordinary stock pattern and not a special model. Mr. Vincent stated that one of these plugs could be heated red hot with a blow torch and then dropped into cold water without any damage to the porcelain.

The timing is quite ordinary:

Inlet opens 5 deg. after top center.
Inlet closes 40 deg. after lower center.
Exhaust opens 47 deg. before lower center.
Exhaust closes 5 deg. after top center.

It will be noticed that the exhaust closes and the inlet opens at the same instant, but there is no overlap.

It is well understood that one of the advantages of four-valve construction is that the smaller valves need but light springs. This is particularly true with the very small parts in the Packard engine since the valves are so light that the spring pressure required is quite small. Actually the pressure of the spring when the valve is fully open is only 52 lb., this falling to 38 lb. when the valve is closed.

Rear Axle Cost $1,000

A few words may be added about the chassis in which this engine is being tested for it is no less remarkable a piece of work in its way. The gearset bolts to the crankcase and the steel flywheel contains a single disk clutch of very light construction. Back of the gearset there is a large and very powerful transmission brake, this being metal-to-metal, as are the rear wheel brakes, all the shoes being cut out from high tensile material so as to obtain great rigidity with minimum weight. The rear axle has a chrome nickel steel housing in two parts split vertically in the center and each half is turned from a solid billet of steel. It is stated that each of these halves cost over $350, bringing the price of the axle to $1,000 or over. The steering gear has been specially designed also and, like the rest of the chassis, is made of the strongest steel that can be obtained.

There is no need to say anything about the shape of the body as this is sufficiently described by the illustrations. Its method of attachment, however, is not so obvious. At the tip of the tail a small socket will be noticeable. This contains a bolt which holds the top part of the body in place. At the front end by the cowl there is a pair of hinge clips. The pins for these form the attachment for the two ends of the rear hood strap. Thus, to remove the body the hood strap is taken off, the two hinge pins unhitched and removed, and the single bolt at the tip of the tail taken out; the body can then be lifted off complete. To give it ample lateral security a steel sill is carried along the top of the frame, the body setting into this, and there are a number of dowel pins along each side.

The chassis altogether represents a distinct advance upon the best work which Europe has so far produced.

24-Hour Record Gained by Hudson

Mulford, Driving Whole Distance, Covers 1819 Miles at Average Speed of 75.8—Old Record Beaten by 238 Miles

Ralph Mulford at the wheel of the Hudson Super Six ready to start on his trial for the twenty-four hour record

SHEEPSHEAD BAY MOTOR SPEEDWAY, May 2—The twenty-four hour record which has stood for nearly eight years has been beaten by Ralph Mulford driving a Hudson Super Six. The new record is a trifle over 1819 miles at an average speed of 75.8 m.p.h. The original record was made by S. F. Edge driving a Napier on the occasion of the opening of Brooklands track in England, June, 1908. Like Mulford, Edge himself drove throughout the entire time, covering 1581 miles, his intention being to better 60 m.p.h. Since this time the twenty-four hour record has stood unattacked.

Mulford's fastest lap was made at 89.4 m.p.h. after covering 1526 miles. He made sixteen stops, of which the longest was 6 min., this being for gasoline and oil and to tighten the grease cups. Throughout the entire distance only one tire was changed; one of the most remarkable features of the run. The tires used were Goodrich Silvertown cords.

Up to the sixteenth hour Mulford had averaged 77 m.p.h. and 10 m.p.g. of gasoline and 150 m.p.g. of oil. His average speed at 500 miles was 77.1; at 900 miles, 77.2; at 682 miles, 77.5; at 1100 miles, 77.04; at 1200 miles, 77.33; at 1000 miles, 76.4.

He had changed mechanicians several times but intended to drive the whole distance himself. The stops made, with the duration of each, were as follows:

First stop on the seventy-first lap or 142nd mile, taking on 13 gal. of gasoline, 1 gal. of oil. Time, 1 min., 21 sec.

Second stop was on the 151st lap where he took on 5 qt. oil, 14 gal. of gasoline and water. He also oiled the shock absorbers. Time, 1 min., 35 sec.

Electric timing device used for Hudson twenty-four hour run

Third stop was on the 226th lap where he snatched a mouthful of food and stocked his car with 12 gal. of gasoline and 1 gal. of oil, also 1 qt. of water. Time, 3 min., 15 sec.

Fourth stop, 302nd lap, gas 13 gal. oil 1 gal. Changed mechanician. Time, 3 min., 8 sec.

Fifth stop, 378th lap, oiled the shock absorber, 12 gal. of gasoline, 7 qt. of oil. Time, 4 min., 2 sec.

Sixth stop, 453rd lap, 13 gal. of gasoline, 5 qt. oil. Food and coffee for driver. Time, 4 min., 4 sec.

Seventh stop, 530th lap, mended bonnet clip. Took on 14 gal. of gasoline, 1 gal. of oil. Time, 4 min., 6 sec.

Eighth stop, 601st lap, 12 gal. of gasoline, 1 gal. of oil. Time, 3 min., 30 sec.

Mulford slowed down on the 622nd lap and stopped on the 623rd lap for a short time because the officials wanted to de-

(*Continued on page* 834)

The old and new records for distance covered hour by hour are as follows:

	Distance—Miles	
Hours	Old Record	New Record
1	70	77
2	144	154
3	207	233
4	271	308
5	342	389
6	407	463
7	474	542
8	537	616
9	609	698
10	670	770
11	737	850
12	799	923
13	866	1004
14	938	1078
15	1006	1158
16	1068	1233
17	1139	1310
18	1203	1382
19	1263	1461
20	1327	1532
21	1390	1597
22	1458	1669
23	1519	1740
24	1581	1819

Electric Transmission Is Indiana S. A. E. Subject

Animated Discussion Follows Presentation of Paper by J. B. Entz Giving Details as Applied to Owen Magnetic Cars—Tests Held on Speedway

INDIANAPOLIS, IND., April 28—The Entz system of electric power transmission as applied to the Owen Magnetic car engaged the attention of the Indiana section of the Society of Automobile Engineers this afternoon and this evening. R. M. Owen and Justus B. Entz turned an Owen Magnetic car over to the research division of the section for a series of tests on the speedway. This was followed by a presentation of a paper in the evening by Mr. Entz before 200 members of the section. This paper was entitled The Electric Transmission on Owen Magnetic Cars and gave in brief the design and operation of this transmission, together with a presentation of its advantages. Inasmuch as the subject matter of the paper was more for the purpose of bringing out discussion and has been published in somewhat slightly different form in previous issues of THE AUTOMOBILE, a brief summary of the paper will be sufficient.

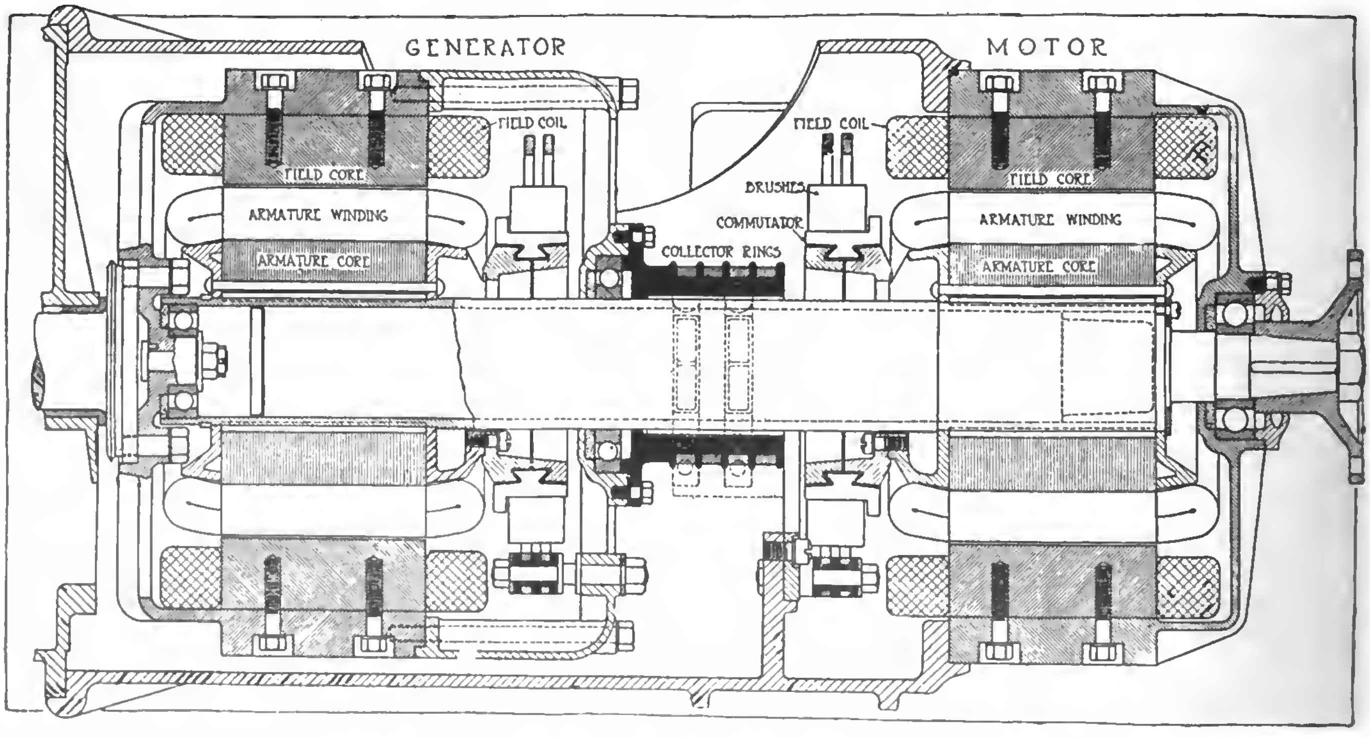
Summary of Paper

In place of the flywheel clutch, gearset, starting and lighting system and their auxiliary parts, two direct current dynamo machines and a drum controller have been substituted. One of the dynamo machines has its field magnet frame directly connected to the engine crankshaft, taking the place of the ordinary flywheel. The armature of this machine is mounted on a large, hollow shaft, which is directly connected to the propeller shaft. This machine is called the clutch generator, as it acts both as a clutch and a generator. The second dynamo machine has its armature mounted on the same hollow shaft as the first, and its field magnets are stationary; it is called the motor, as it is generally used as a motor to help drive the propeller shaft, and boost the effort of the engine as transmitted through the clutch generator, which, like any clutch, can only transmit the engine effort or torque.

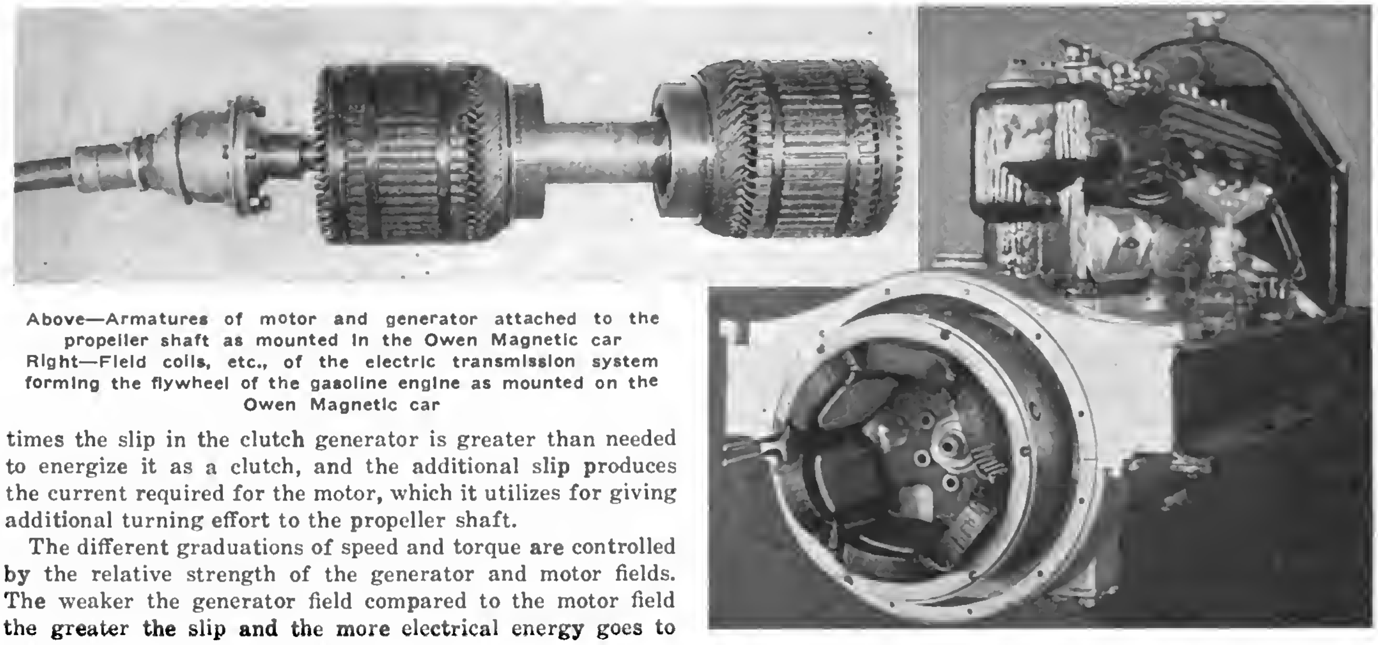
The clutch generator is used as a clutch alone, on the high speed, when it is short circuited upon itself, and a small speed difference between armature and field, or a small slip is necessary to establish the current in its windings which energizes it and causes it to act as a clutch. On the high-speed position the motor plays no part in the transmission of power, but is used as a charging generator for the storage battery, which latter is used for cranking the engine and for the electric lights.

Electric Motor Aids Propulsion

On all other power control positions but the high the motor helps turn the propeller shaft, by taking current from the clutch generator in which circuit it is included. At these



Section through Owen-Entz electric transmission. Generator field cores and coils form the gasoline engine flywheel and the collector rings shown are for the purpose of connecting the field current of the generator to the various circuits. The brushes of the generator revolve with the field. The two armatures are identical and both are keyed to the hollow shaft which is attached to the propeller shaft and has no connection with the gasoline engine



Above—Armatures of motor and generator attached to the propeller shaft as mounted in the Owen Magnetic car
Right—Field coils, etc., of the electric transmission system forming the flywheel of the gasoline engine as mounted on the Owen Magnetic car

times the slip in the clutch generator is greater than needed to energize it as a clutch, and the additional slip produces the current required for the motor, which it utilizes for giving additional turning effort to the propeller shaft.

The different graduations of speed and torque are controlled by the relative strength of the generator and motor fields. The weaker the generator field compared to the motor field the greater the slip and the more electrical energy goes to the motor for producing greater torque.

Besides the positions of power control, there is a neutral position in which the clutching effect is cut out, but the motor is so connected through a resistance as to act as an electric brake, in which case it becomes a generator, taking power to drive it, and so braking the car. This brake is not effective when the speed is highest and is ineffective below 15 m.p.h.; it will hold the car on any mountain grade to 20 m.p.h. without wear of any parts and can be applied with the car going 60 m.p.h. It cannot hold the wheels and there is little danger of skidding, as the braking effort disappears at speeds below 15 m.p.h.

Outside of the simplicity of the system and the fact that it displaces complicated and objectionable parts of the prevailing type of motor car, there are features that appeal to those that drive and ride in a car.

Power Impulses Eliminated

In the first place, all power impulses of the gas engine are eliminated, and the turning effort impressed on the propeller shaft is as uniform and smooth as that from an electric motor; in fact, it is exactly the same. No jars or shocks can be transmitted through the elastic means of transmitting the engine power, as there is no mechanical connection at all between the engine and driving shaft.

In the second place, from the time of starting the car from a standstill until maximum speed is reached and through all the range of power required from level road to the worst hills, the power between the engine and propeller shaft is never disconnected, as is the case where clutch is thrown out, a gear change made and clutch engaged again. This is all controlled by the small lever on top of the steering wheel and allows the car to be manipulated in traffic and on winding, irregular grades in a way to call forth all the power of the engine at just the instant and for just as long as it is needed. The car can be held on a grade by its engine power, the clutch generator slipping and holding with the aid of the electric motor, ready at once to go forward upon opening the throttle or by closing the throttle slightly, the car can be allowed to back, then hold, then forward again, and then up to the maximum speed the grade allows; all without disconnecting the power of the engine from the driving shaft.

Acceleration Is Smooth

From a standstill with the engine idling, the car can be smoothly and rapidly brought up to the speed of traffic in cities, 20 to 25 m.p.h. without a jar or jerk. Acceleration is so smooth as to seem less rapid than it really is, and it is accomplished without any previous speeding up of engine before dropping in of clutch and gear changes made at high engine speed, as is the case when a rapid get-away is made in a geared transmission car.

Another feature is the coasting of the car upon closing the throttle, the principle of operation of the clutch generator being that it will only clutch when the engine is running faster than the driving shaft, so upon closing the throttle the car coasts or drifts perfectly free, with the engine idling. idling.

Discussion of Paper

Chairman F. E. Moskovics, Nordyke & Marmon, opened the discussion by reading a letter from David E. Gallup of the Worcester Polytechnic Institute and chairman Research Division of the Standards Committee of the parent society, asking a number of questions as to the efficiency and torque of the transmission system. In reply, Mr. Entz stated that the efficiency was very high, that the apparatus is similar to a dynamometer in which the losses must be minimum. The only speed difference is that due to the losses and according to tests made by the General Electric Co., the transmission is without loss at the point of maximum torque of the engine. On ordinary level road work the torque required calls for a slippage of about 55 r.p.m. By that is meant that the crankshaft of the engine revolves about 55 r.p.m. faster than does the propeller shaft. At the point of maximum torque, it called for a slippage of 92 r.p.m., but this speed loss is a help at times, as it permits a higher engine speed and thus greater power development when the pull should be greatest. On hills the car does not run more slowly on account of engine slip, but the engine runs more rapidly, thus developing greater horsepower and torque. The principle is the same as slipping the clutch in the conventional type of car with the difference that instead of the energy due to the slip being used up in the form of heat in the clutch which in time will destroy it, the energy thus generated in the electrical transmission by this slippage is used in the motor portion of the electric machine to boost the driving effort.

Up to the point where the engine runs to the speed of maximum torque more power is developed than in the conventional type and the efficiency at 1000 r.p.m. of the engine is 93 per cent.

There can be no loss in friction, the only loss being in speed, and that is not so much a lower car speed as a higher engine speed.

In the matter of economy Mr. Entz stated that parallel tests using cars similar in every respect except the transmission showed better economy of fuel with the electric transmission. This is due chiefly to the saving effected in coasting.

Asked as to a surging effect at certain speeds, Mr. Entz said that this was a matter of expertness of the driver, that because of the complete mechanical disconnection between engine and propeller shaft and the cushioning effect of the magnetic clutch, no inequalities of engine running could be transmitted to the rear axle nor could the road surface cause uneven running. If the car were drifting and the controller handle placed in the wrong place, there might be a slight surging effect.

Asked by R. W. Knowles of the Milburn Wagon Co. as to the amount of added weight and cost in a car equipped with the Entz transmission and also if it were possible to employ an electrical method for reversing instead of the gear reverse employed in the Owen, Mr. Entz stated that electrical reversing mechanism could be employed but the mechanical method gives all the speeds in reverse.

Weight Difference Negligible

As to the difference in weight, there is practically no difference. In some installations the weight has run a little higher for the electric and in others it has run a little lower. The price question is one of quantity production, but the electric system has the advantage of providing directly a method of running in the engine by using the electrical apparatus on the car and shop current also providing a direct dynamometer test. It has been found that the complete apparatus can be assembled in two and a half hours on the bench.

Guy B. Wall, chief engineer of the National Motor Vehicle Co., stated that to adopt the system it would be necessary to give up a thoroughly trustworthy and satisfactory apparatus, the present gear transmission and friction clutch, and suggested that it would be interesting to make some experiments in driving cars under tests such as those performed to-day on the speedway, first with the electrical transmission and then with the gear transmission and friction clutch substituted.

He also thought there was an advantage in the conventional type of drive in being able to use the momentum of the flywheel in getting out of a hole. The effect with the electric transmission would be like using a lead hammer instead of a hard steel hammer. With the same energy applied, the effect would be considerably different.

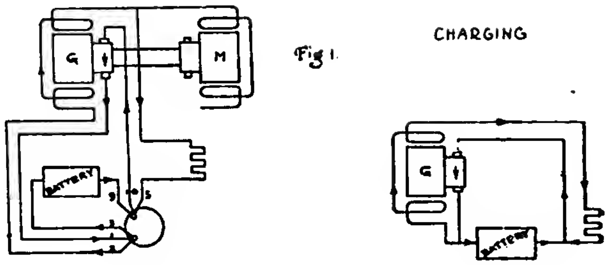
No Changes Made

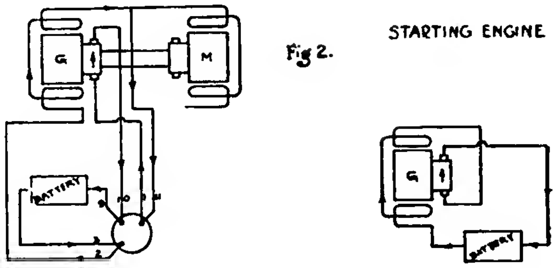
Mr. Wall asked what change had been made in the system during the past two years, to which Mr. Entz replied that there had been no changes in that time.

Asked as to whether the drag of the electric motor was perceptible at high speed, as had been charged against the electrical starting and lighting apparatus, Mr. Entz stated that the drag in charging the battery is considerably less than that of most lighting generators on cars to-day, because the small size of those units prevented their efficiency being high. In regard to pulling out of a hole, Mr. Entz said that the transmission would handle the maximum torque of the engine, which is all any transmission can do, and that the maximum with drawbar pull with the Entz system can be obtained even with the car at a standstill.

A Road Test

George W. Weidely of the Weidely Motors Co. reported on some comparative tests he had made of the Entz transmission, stating that a year ago last September he drove a car from New York to Indianapolis with the conventional gearset transmission and Ray Owen drove another car which was a duplicate in every respect except it had the Entz transmission. In order to make sure that conditions were identical throughout the run, the drivers were interchanged at times, and when one shield went up or down both went up or down, tops were put up and down at the same time, and so on. They covered the 1059 miles in thirty-nine hours, during all but six of which it rained. The geared car weighed 42 lb. less than the electrically equipped car.





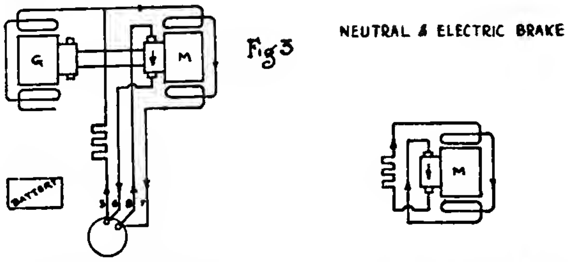


Fig. 1—Connections showing one way of charging the battery with the electric transmission system while the car is standing; this is done from the generator and a much higher rate of charge is possible than would be safe to establish for running conditions. Thus, if the battery is run down it can be brought up in a short time as a high rate of charge is permissible for a battery that has not reached the gassing point and is not warm

Fig. 2—Connections when the clutch generator is being used as an engine starter; in this case the field and armature connections are reversed so as to turn the engine forward, and the starting battery is included in its circuit

Fig. 3—Connections when in neutral position when the clutching effects is cut out but the motor is so connected through a resistance as to act as an electric brake in which case it becomes a generator taking power to drive it and so braking the car. The brake is not effective when the speed is highest and is ineffective below 15 m.p.h. It cannot hold the wheels and there is little danger of skidding as the braking effort disappears below this speed

On level roads there could be noticed no difference in speed capability. On most hills the electrically equipped car could run away from the gear-driven car on account of its ability to change the gear ratio to suit the hill. There was so little difference in the ability on the road that it was not measurable. Both cars obtained a speed of 64 miles an hour. As to fuel economy, Mr. Weidely stated that there was so little difference in the figures of the fuel consumption for the run that had they been interchanged it would be impossible to tell which was which.

R. H. Combs, manager of the Traffic department of the Prest-O-Lite Co., and secretary of the section, asked as to the current and voltage in the system, Mr. Entz replying that the current depended upon the torque and the voltage depended upon the slip and torque.

Asked by Darwin S. Hatch, editor *Motor Age*, as to the possibilities of eliminating slippage completely at high speeds by the introduction of a friction method of clutching by centrifugal or other means, similar to that which has been suggested by another company, Mr. Entz stated that it was his belief that he suggested it originally a good many years ago, in the form of a centrifugally-operated mechanism but found it necessary to discard the system, because with it the smoothness and cushioning effect was lost. He said it was the endeavor to eliminate the possibilities of wear in the transmission, and as proof that the purely electric transmission is free from wear cited the old Columbias which were made in 1907, nine years ago. All turned out are still running and the electrical transmission has never been touched or even oiled.

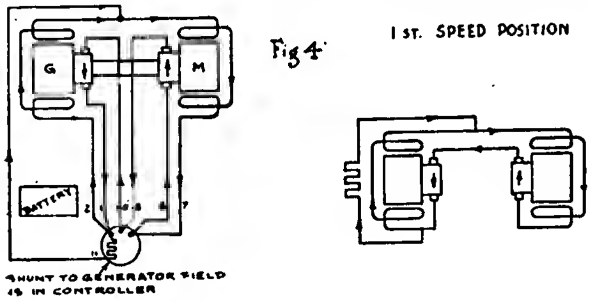


Fig 4

1 st. SPEED POSITION

SHUNT TO GENERATOR FIELD IS IN CONTROLLER

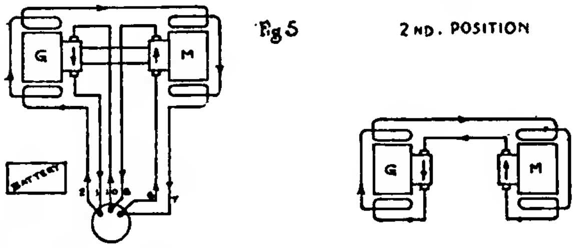


Fig 5

2 ND. POSITION

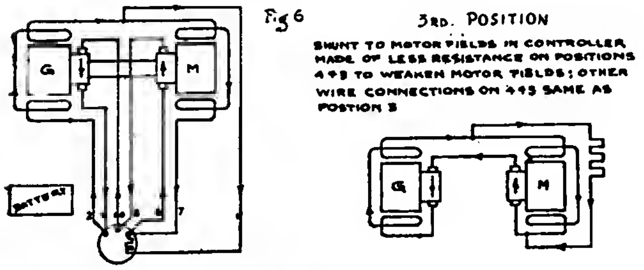


Fig 6

3RD. POSITION

SHUNT TO MOTOR FIELDS IN CONTROLLER MADE OF LESS RESISTANCE ON POSITIONS 4 & 5 TO WEAKEN MOTOR FIELDS; OTHER WIRE CONNECTIONS ON 4 & 5 SAME AS POSTION 3

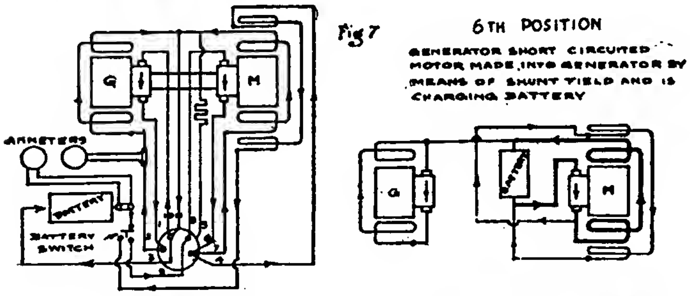


Fig 7

6TH POSITION

GENERATOR SHORT CIRCUITED MOTOR MADE INTO GENERATOR BY MEANS OF SHUNT FIELD AND IS CHARGING BATTERY

Fig. 4—In the first power control position the generator field is shunted so as to weaken it while the motor field is full strength, being unshunted

Fig. 5—Both fields are unshunted but the motor field is still the stronger, due to its being wound with more turns

Fig. 6—The generator field is unshunted but the motor field is shunted by means of which it is weakened as compared with the generator field, in which case it gives less torque for a given current but also less counter electro-motive force and therefore less slips at the generator

Fig. 7—The motor on this position has a shunt field opposed by a series field in the battery circuit, making it a differential generator with an inherent self-regulating characteristic. On all other power control positions but the high the motor helps turn the propeller shaft by taking current from the clutch generator, being included in this circuit. At these times the slip in the clutch generator is greater than needed to energize it as a clutch and the additional slip produces the current required for the motor which it utilizes for giving additional turning effort to the propeller shaft

Use of Two-Speed Gearset

G. P. Dorris, president of the Dorris Motor Car Co., considered that in the present condition of the automobile industry that the demand was for abnormal power and all high gear work and asked as to the possibility of using the two-speed gearset in conjunction with the electric transmission in order to get flexibility. In reply Mr. Entz stated that they had built some cars with two-speed gearsets of this sort which gave double the number of speed changes possible with the direct drive only.

Suitable for Trucks

R. M. Owen explained that they realized the possibilities of the truck field but up to the present had preferred to develop the passenger car end, although they expect definite data on cost of operation and maintenance in about two months from a number of trucks they have in service.

Tests on Indianapolis Speedway

Preliminary to presenting the paper some tests were made on the Owen Magnetic equipped with the Entz transmission and driven by R. M. Owen, president of the original Owen company. These tests were run on the Indianapolis speedway by the research committee of the Indianapolis section S. A. E., and under Charles P. Grimes of the National company and Chester Ricker of the Stutz company. These tests were made to determine the current required at different speeds and also acceleration and deceleration tests from which the drawbar pull and horsepower used to propel the car were calculated by the following formulæ:

$$F = \frac{5170 \times 10}{t \times 21.95} = \frac{2357}{t}$$

$$Hp. = \frac{FV \text{ mean}}{375}$$

It was shown that at a car speed of 10 m.p.h. the current was 35 amp., at 15 it was 35 amp., and from that speed to 50 m.p.h. increased gradually to 77.5 amp. The drawbar pull was shown to vary from 69.9 at approximately 20 m.p.h. to 109.6 at a speed between 30 and 40. Acceleration figures gave 4.3 sec. from standstill to 10 m.p.h., 3.8 from 10 to 20, 7.1 from 20 to 30, and 11.9 from 30 to 40.

REPORT OF TEST ON OWEN CARS ON INDIANAPOLIS MOTOR SPEEDWAY, APRIL 28

Gear ratio, 3½ to 1.	Barometer 29.39 in. hg., 35-in. wheel.
Weight of empty car, 4540 lb.	Temperature, 64 deg. Fahr.
Weight of loaded car, 5170 lb.	

First Test

Car Speed M.P.H.	Amp.
10	35
15	35
20	45
25	52.5
30	55
40	55
45	60
50	70
55	77.5

Second Test—Deceleration (Neutral)

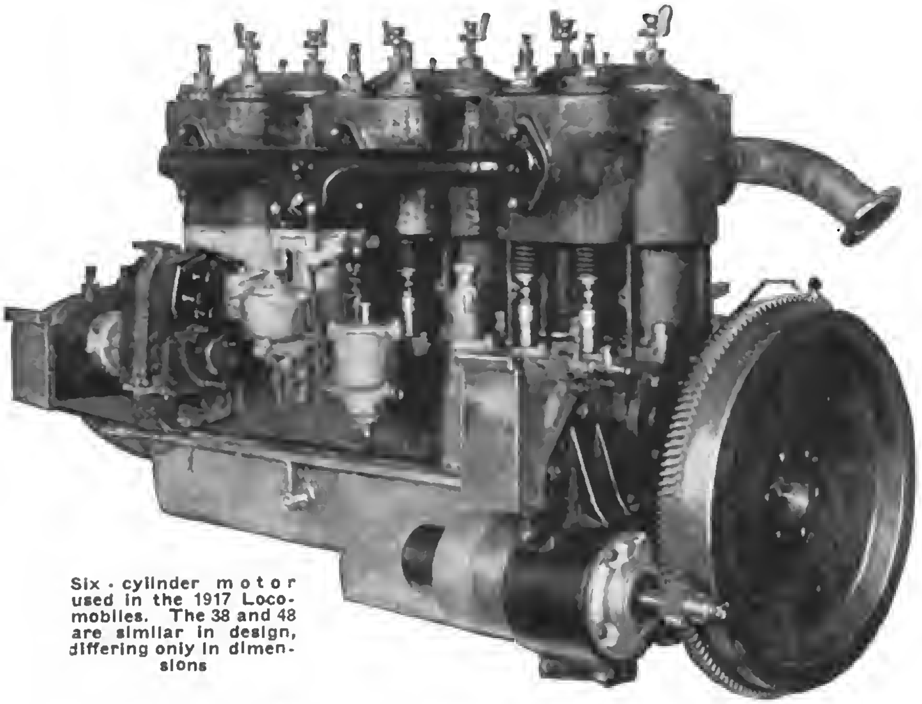
M.P.H.	Mean Time, Sec.	Draw Bar Pull, In.
15-5	25.6	92.0
20-10	31.9	73.8
25-15	33.7	69.9
30-20	27.9	84.3
30-25	21.5	109.6

Third Test—Acceleration

M.P.H.	Mean Time, Sec.	Draw Bar Pull
0-10	4.8	548.0
10-20	3.8	620.0
20-30	7.1	331.9
30-40	11.9	197.8

Locomobiles Improved in Detail

38 and 48 Chassis Continued for 1917—Bodies Are Lower—Starting Motor Re-Designed



Six-cylinder motor used in the 1917 Locomobiles. The 38 and 48 are similar in design, differing only in dimensions

LOCOMOBILE chassis and bodies for 1917 follow much along the lines of the past six years except for detail changes intended to give the final touch of refinement to cars which are designed specifically to be the last word in beauty and luxury. At first sight the two sixes which are now in their seventh and sixth years, seem little changed as compared with a year ago. A detail study, however, shows perhaps sixty alterations which, although none are fundamental, combine to make the Locomobile for the coming season a product improved in many particulars as compared with its predecessor.

New two-stage carbureter made under the Ball patents, which will be a feature of the 1917 Locomobiles

Cars Are Lower

Broadly speaking, Locomobile cars for 1917 are more beautiful in appearance because they are lower. They are more easy-riding due to a re-arrangement of the suspension and they are faster under all sorts of conditions, having better acceleration and a higher maximum speed due to a new carbureter, lighter reciprocating parts and a better balanced motor. Taking the car as a whole in every feature of value to the owner the 1917 Locomobile is a better car than that of 1916, due simply to a greater attention to detail which renders every step in manufacture a matter of painstaking care on the part of each individual workman.

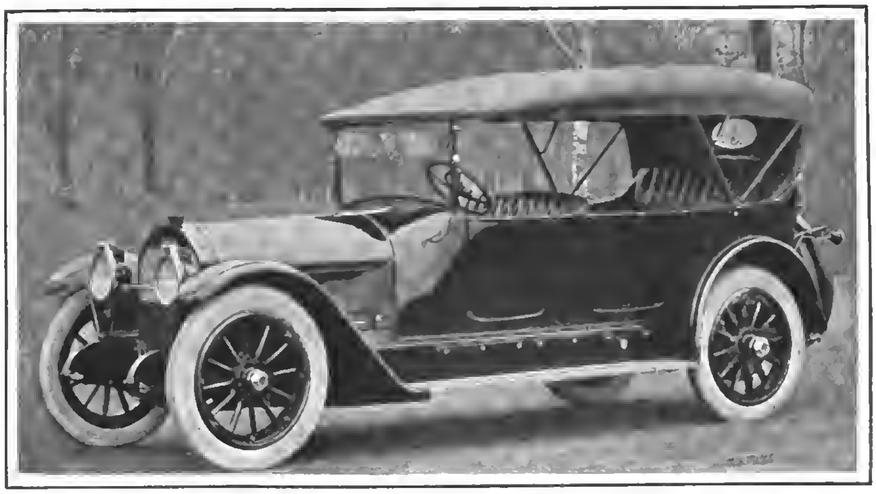
Prices Are Higher

These refinements have been accompanied by a change in price due to the increased cost of material. The seven-passenger on the larger six-cylinder chassis, which will continue to be known as the 48, sells for $5,400. The 38, also a six-cylinder chassis, lists at $4,600 in the seven-passenger size. The other cars listed for 1917 are six-passenger bodies on both the 38 and 48 at the same price as the seven-passenger, a limousine selling for $5,600 on the 38 and $6,500 on the 48, a landaulet at $5,700 on the 38 and $6,600 on the 48 and berlines selling for $5,900 on the 38 and $6,800 on the 48. In addition, there is a four-passenger special car at $4,750 on the 38 chassis. This four-passenger job is a new product and only a limited number will be built.

Mechanically a number of detail refinements will be found throughout the car, although none of them rank as radical. Probably the change having the greatest effect on the car is the re-arrangement of the spring suspension in which the front springs have been increased to 40 in. in length, whereas they were 38 in. They are considerably flatter and are a factor in giving the car a lower appearance. The re-arrangement of the front spring mounting has also had the effect of shortening the wheelbases 1 in. on both the 38 and 48 cars, making the smaller car 139 in. and the larger 142. This shortening of the wheelbase is not perceptible as, owing to the fact that the cars are lower, they give the impression of being longer and

To aid in making the Locomobile lower the front axle sweeps in a continuous curve between the steering knuckles instead of dropping abruptly the shortened wheelbase has not in any way decreased the body space.

Another factor in giving the car a lower appearance is that the front spring supports are lower than they were on the previous models and the front axle is swept in a continuous curve from steering knuckle to steering knuckle instead of having an abrupt drop. To balance the lowering of the front of the car the rear springs have been made very much flatter although of the same dimensions as previously. The lowering of the spring pads on the front axle has totaled 2 in., but, owing to the curve of the axle, no reduction in clearance has been made. Changes in the axle have necessitated other changes in the car particularly in the pivot tie rod which has been flattened out to harmonize with the curve of the front axle. Again, in changing the tie rod it has been necessary to shorten the pivot steering arms. At the rear an additional 2-in. kickup in the frame takes care of the lowering of the rear end of the car.



Locomobile six-cylinder touring car for 1917, showing the new body lines

Body Lines Altered

All the changes above outlined have given a total lowering of the frame of the car of 2 in.; but this is not all that has been done to produce a low appearing design. The body lines themselves have been altered so that the total height of the body has been reduced by about 3 in. These changes have been effected so that the continued line of the bonnet now harmonizes with the lines of the car, considerably flattening out the curvatures at the top of the body.

In carrying out this alteration in lines the shape of the top of the radiator is changed, the curve being flattened to harmonize with changes in bonnet and cowl. The bonnet is altered in size and shape, the width at the rear being increased while the horizontal lines at the side are raised 2 in. to match the change in the radiator and the top curve has been flattened for the same reason. The upper curved surface of the cowl is flattened and the instrument board is brought nearer to the driver. This series of changes has been carried back through the windshield, on which the curve at the lower part is changed to meet the curvature of the cowl and the windshield is now supported by special one-piece forged side braces built up inside the cowl.

Forward compartment of 1917 Locomobile, showing wide door and arrangement of levers to right and left of driver

Probably the most radical changes are in the starting system, of which the motor has been entirely redesigned and is an entirely inclosed unit. In place of the former double reduction of approximately 35 to 1 it now has a reduction of 10 to 1, giving a much lower armature speed. The pull-in switch is placed on the rear end of the armature shaft and is entirely enclosed. It is quieter than the former model and is now located on the left side below instead of the right side above the crankshaft.

An interesting change in connection with the installation of the starting motor is the fact that the teeth on the flywheel ring gear are now cut on a spiral at an angle of 13 deg. instead of being a straight spur gear as heretofore. This gives a silent and more positive engagement, and a quicker and easier disengagement, due to the shape of the tooth tending to push the pinion out of mesh.

The generator is now of the voltage control type and has been reduced to conform to existing 6-volt standards. The voltage of the 1916 generator was seven. Another electrical change is the installation on all models of the dual Eisemann magneto.

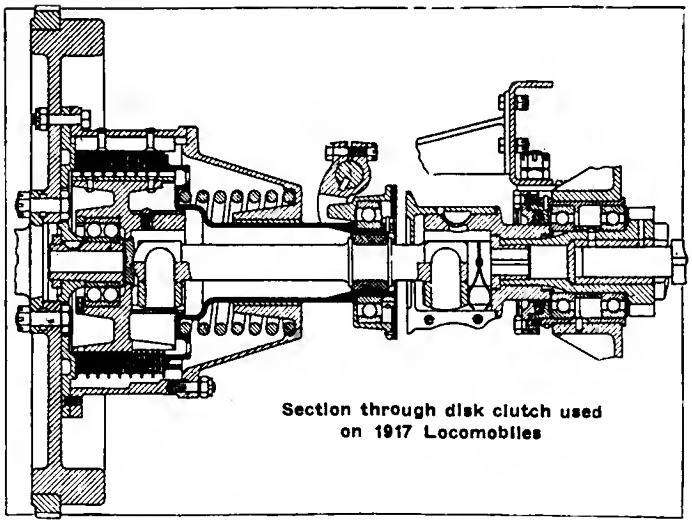
Other mechanical changes are even more of a detail nature than those mentioned. More forgings are used now than a year ago on the small parts. The pedals are now equipped with renewable rubber pads of rectangular shape, the ball bearings on the clutch pinion are enlarged in diameter and spaced farther apart.

Detail body changes are numerous, the bodies have been made stronger by means of special channel construction. There are now curtain compartments in the backs of the front seats which are quite different from those of last year. Instead of the two large pockets there is one large central pocket and two smaller ones on each side. This change is due to the new arrangement in having the auxiliary seats fold into the backs of the front seats.

The carpet used to form the covering for the floor of the tonneau is now Wilton instead of velvet on account of durability. The tonneau light is an entirely new type, being practically flush with the back of the front seats. The step light has also been improved by using a plain instead of a cut lens and the top is lighter in weight and more easily operated.

Chassis Are Similar

Practically exact similarity of design is used for the two Locomobile six-cylinder chassis. They are designated respectively as the N-7 and the R-7. The former has a 4½ by 5½ in. motor and the latter a 4¼ by 5 with maximum horsepower ratings of over 82 and 65 respectively. Wheelbases of the two cars are 142 and 139 in., and with these major differences the two chassis are the same throughout save for a few unimportant and minor details.



Section through disk clutch used on 1917 Locomobiles

Locomobile cylinders are T-head in shape, cast in pairs. The cylinders are of gray iron which has been aged before manufacture. Two rings are used in the pistons with an oil ring at the bottom. This is a change over 1916 when five rings were used. In fact, the whole piston design has been lightened materially, one of the ribs being taken out of the head and the rib around the middle between the piston pin bosses also removed. The inside of the piston is now machined as far as possible, still further reducing the surplus weight and in the weighing process they are checked to 1/16 oz.

Alloy Steel Connecting-Rods

Alloy steel connecting-rods of H section are used. These rods are also lighter as compared to a year ago, this reduction in weight having been accomplished by machining and hand filing. In checking the weights of the connecting-rods they are weighed to within 1/16 oz., and in balancing this work is carried out more carefully and accurately than in previous models as newly-designed special machinery has been introduced for balancing of crankshafts and flywheels.

One of the Locomobile features which has been continued through many years is the government bronze crankcase, which has a tensile strength of 80,000 lb. per sq. in. The oil pan is of cast aluminum and the four arms for the motor support are a part of the bronze casting forming the upper half of the crankcase.

Special chrome-nickel steel is used for the crankshaft and this is carried on seven main bearings. Bearings are all hand-scraped by men who specialize in this type of work. The scraping of the bearings is one of the points of pride of the Locomobile concern. The bearings are accessible by dropping the lower part of the crankcase.

Chrome-nickel steel forgings are used for the crankshafts and the cams are integral with the shaft. The exhaust camshaft is 1 1/16 in. in diameter and the intake ⅞ in. They are each carried by five bronze bearings, and in the hardening of the cams all parts of the camshaft except those to be hardened are copper plated and asbestos-wrapped to resist carbonizing action. The surfaces are rendered glass hard with the inner structure of the cam sufficiently tough to withstand the stresses of valve drive.

The gears for the camshaft are helical and are driven by an alloy steel pinion on the crankshaft. Chrome nickel steel gears are used for the water pump shaft and the magneto shaft.

Tungsten Valves Used

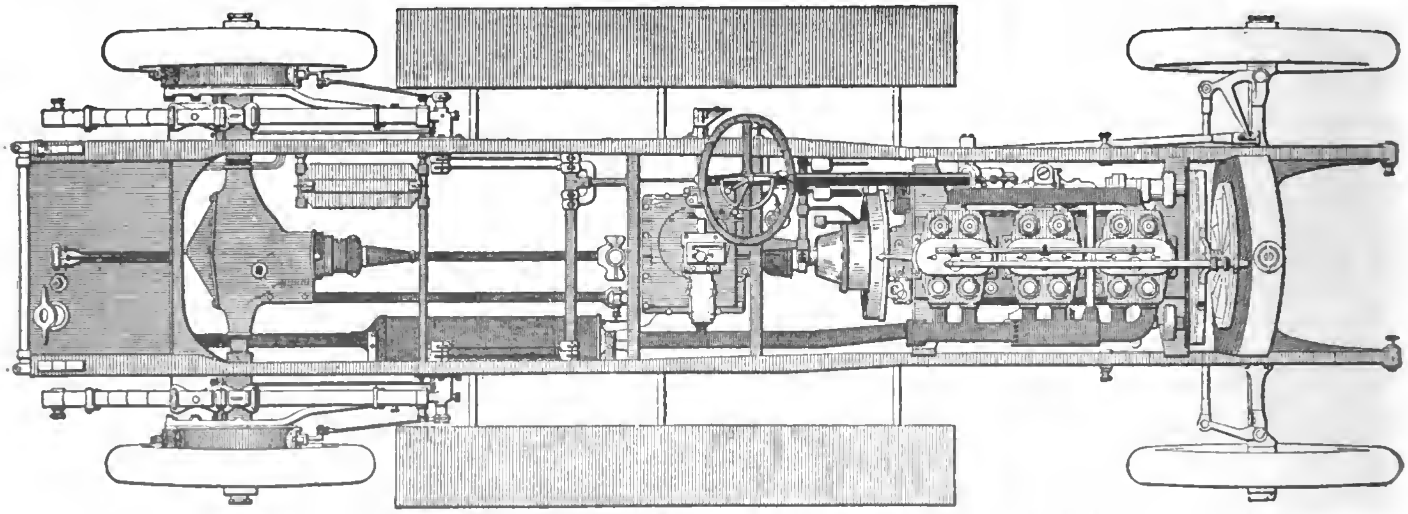
Tungsten valves are employed and these are ground to a true seat at the factory. It is intended with this material that no warpage should take place and the owner will be spared the trouble of frequent grinding. The tappets are also of alloy steel and operate in bronze guides, while the rollers are case hardened and operate on hardened pins. A new feature of the valve action is that in the 1917 cars the spring on the intake valve is just as stiff as that on the exhaust. This prevents the possibility of the riding of the valve at the higher speeds.

Lubrication is by an internal circulating system and is a combination low pressure feed and splash. The oil reservoir is in the aluminum oil pan at the bottom of the crankcase. The capacity of the 48 is 7 qt. and on the 38 it is 6 qt. The gear-type oil pump forces the lubricant up through an external pipe which has two connections. The first of these is to the oil feed pipe in the lower half of the crankcase. This has six outlets which feed the six splash troughs respectively. They are located under each cylinder and are arranged so that the trough wall is higher at the back than in the front so as to give a greater depth of oil in ascending a hill.

The second oil outlet is to the oil feed pipe in the upper part of the crankcase. This has branch pipes which lead to the seven main bearings and at the forward end the pipe is continued into the timing gear housing. The oil pipe allows the excess oil which is not used through the two outlets to go through a by-pass valve and return to the oil sump in the base of the motor. The amount of oil passing through the two main leads varies inversely with the opening of the by-pass valve.

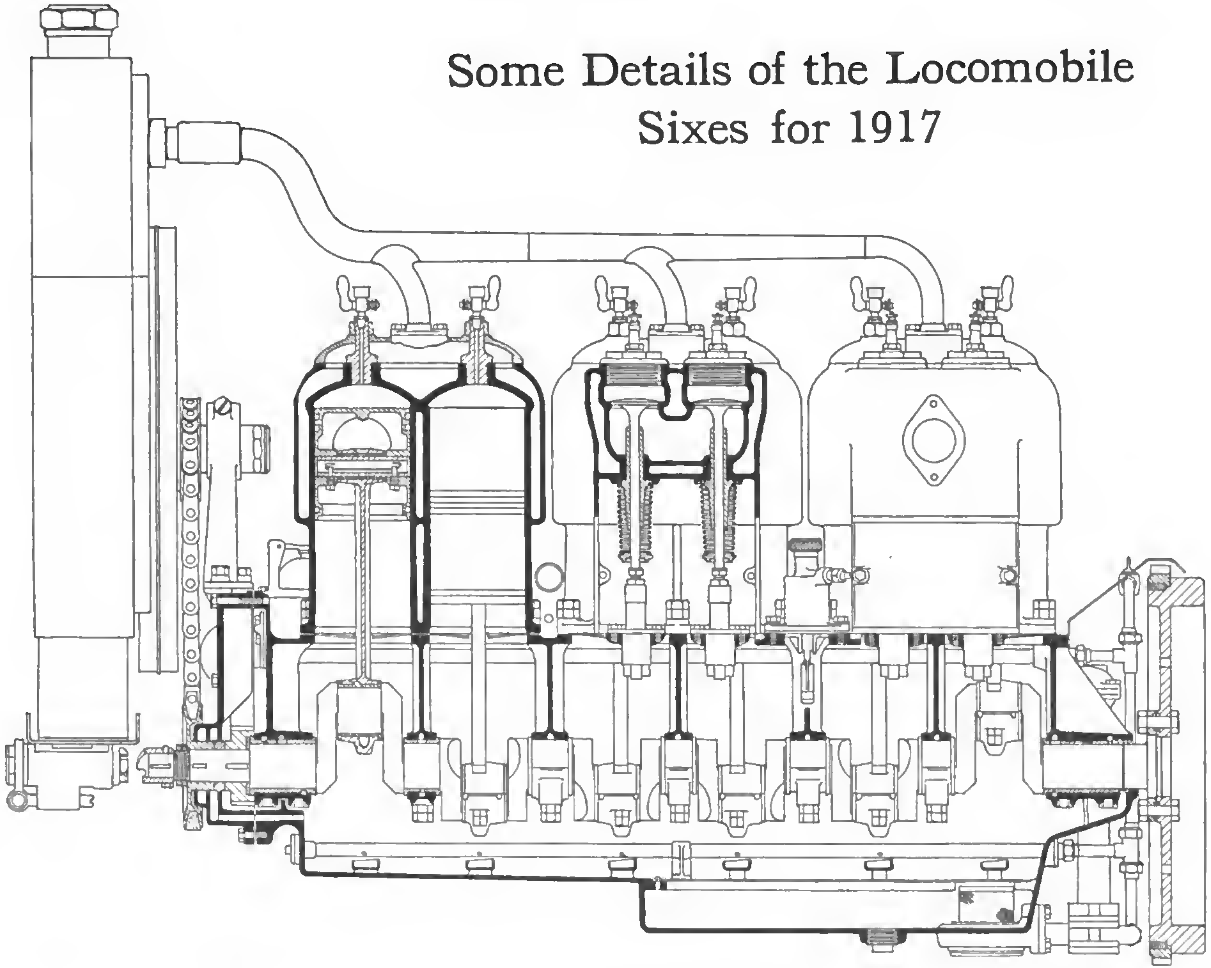
Carbureter, illustrated on page 804, is known as the Locomobile-Ball type, being made under the Ball patents. It is a two-stage type with a low speed jet for ordinary running and

(*Continued on page* 811)

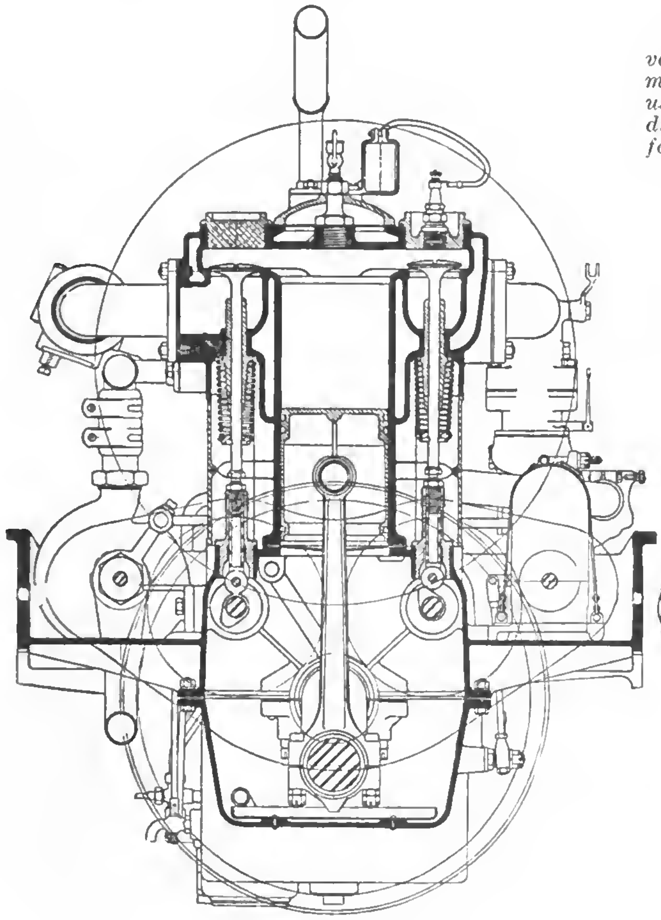


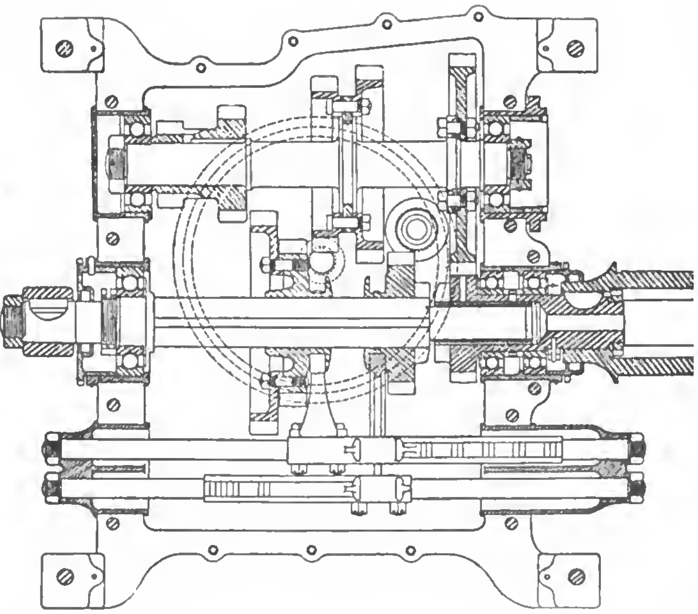
Chassis of 1917 Locomobile. The 38 and 48 are essentially similar in design, the only difference being in the dimensions

Some Details of the Locomobile Sixes for 1917



Herewith are reproduced longitudinal and transverse sections through the Locomobile six-cylinder motor for 1917. The design is similar for the motors used in the 38 and 48 chassis except for differences in dimensions. Below is illustrated a section through the four-speed selective gearbox used on these cars.





Possibilities of Double Expansion Engine

Economical Power Obtainable from Engine Using Full Power of Explosion and Exhausting at Low Pressure

By James Langmuir Napier

AT this moment, when the question of economy of fuel is so general a topic of discussion, anything relating to means for getting the last ounce from the expansion stroke is interesting. In the current issue of our British contemporary, *The Automobile Engineer*, appears the article reprinted hereunder, from the pen of a well known writer on the fundamental theory of the internal combustion engine. Mr. Napier is an engineer of a very wide and varied experience and his views are usually regarded as authoritative. Mr. Napier's article follows:

Effect of Compounding

The possibility of compounding the internal combustion engine is far from a new idea, but the question may appositely be raised at the present time on account of the growing importance of economy in all matters. Theoretical economy is a consideration to be approached with caution, and even practical economy in fuel may be of little value if it should be associated with expensive complication of construction or with a demand for extraordinary accuracy of workmanship, or if the engine of cheap construction and economical in running costs should be found to be of limited application by reason of undue inflexibility of power output. The present article is an attempt to consider whether, keeping all such considerations in view, the compound internal combustion engine may have a practical future or whether it must be relegated to the category of things desirable but inexpedient.

The compound steam engine struggled for existence for more than half a century in opposition to the established "expansive" engine, in which the whole expansion of the steam was effected in one cylinder. Scientific and sham-scientific, practical, and visionary arguments must have been freely used and misused in the discussion, which appears to have been reduced finally to the question of whether expansion conducted in two cylinders, as represented in Fig. 1, could possibly be more economical than similar expansion of an equal original to an equal final volume in a single cylinder, as shown to the same scale by Fig. 2. The logical device known as *petitio principii* was probably frequently in evidence (as it is in the suggested comparison of these two diagrams), and it appears likely that the discussion might have developed into a British institution if progress in boiler-making had not caused its collapse by permitting the use of pressures too high for convenient use in a single cylinder or even in two. Coal economy also, while it might be explained away for purposes of argument as a by-product, became too marked for effective concealment from steam users generally; and even the Admiralty, without any virtuous pretensions to retrenchment and reform, but with an eye to the strategical value of coal endurance, and after prolonged experiment, became convinced of the advantage of the compound engine.

I have made no study of the progress of invention in the matter of the compound internal combustion engine, but I have no doubt that early attempts in this direction failed or were impracticable, owing to following too closely the analogy of the compound steam engine and ignoring the physical differences between the working fluids employed. Thus the diagram, Fig. 1, which represents the theoretical combination of indicator diagrams from the high and low pressure cylinders of a two-cylinder compound engine, assumes the existence of a receiver of infinite capacity between the two cylinders. The steam exhausted from the high pressure cylinder enters the receiver without change of pressure, and the same quantity of steam is subsequently admitted to the low pressure cylinder for further expansion. Obviously it would be possible to maintain such a receiver at a constant temperature in the case of the steam engine, and equally obviously impossible in the case of internal combustion. Apart from other considerations the mere difference of exhaust temperatures imparts an insuperable difference of conditions to the two problems, and is sufficient to negative entirely the admission of any receiver between the cylinders of a practically possible compound internal combustion engine.

In the latter case the conditions of theoretical perfection are not only that there shall be no receiver, but also that there shall be no clearance in the low pressure cylinder; and the compound diagram from both cylinders would thus take the form indicated in Fig. 3, the high pressure cylinder exhausting direct into the low, and the high pressure piston being subject to the back pressure due to the continued expansion of the products of combustion in both cylinders together. The pistons are assumed to be connected to diametrically opposed cranks, and the obliquity of the connecting-rods is neglected. Expansion is supposed to continue to atmospheric pressure.

In the diagram, Fig. 3, the curve of expansion *abc* is continuous, expansion proceeding first in the h.p. cylinder from *a* to *b*, and thereafter in both cylinders combined from *b* to *c*; the volume of the h.p. cylinder decreasing and the l.p. cylinder increasing until the expansion is completed at *c* in a volume consisting of the l.p. cylinder alone plus the clearance in the h.p. cylinder. Exhaust from the l.p. cylinder follows the atmospheric line from *c* to *d*; and, as the cylinder is assumed to have no clearance, the l.p. diagram is completed by the ordinate *bd*.

Since the cylinders are in communication during the exhaust from the h.p. cylinder, the h.p. exhaust curve *be* is similar to the l.p. pressure curve *bc*, and the mean pressures of the areas *bed* and *bcd* can be shown to be equal. Compression takes place only in the h.p. cylinder as indicated by the curve *df*. The curves *be* and *df* intersect at o. As indicated in the diagram, the volume of the h.p. clearance is unity, the total volume of the h.p. cylinder is *n*, and the volume of the l.p. cylinder plus the h.p. clearance is *m*. The areas of the h.p. and l.p. cylinders are, therefore, in the ratio $(n-1)$ to $(m-1)$.

It is clear, of course, that in this diagram the work done in the h.p. cylinder is graphically represented by the area *abof* less the negative area *eod*; or, which is the same thing, by the area *abdf* less the area *bed*, which latter area represents the work done in expelling the exhaust. The relation between the area *bcd*, or any part of it, and the work done in the l.p. cylinder is scarcely equally clear, since the area of that cylinder is proportional to *ec* and not to *dc*. The relation might possibly be taken for granted, but a few words of proof will not be undesirable.

At the beginning of exhaust from the h.p. cylinder let the l.p. crankpin move from the top center so that the l.p. piston descends through a fraction 1/A of the stroke. The h.p. piston will ascend through an equal distance, and the products of combustion will then be contained in a composite volume made up of:

(1) The h.p. clearance = 1.

(2) Part of the h.p. displacement $= (n-1)\left(1-\frac{1}{A}\right)$.

(3) Part of the l.p. displacement $= \frac{(m-1)}{A}$

the whole volume being

$$1+(n-1)\left(\frac{A-1}{A}\right)+\left(\frac{m-1}{A}\right)$$
$$= \frac{A+(nA-n-A+1)+(m-1)}{A}$$
$$= \frac{nA+(m-n)}{A}$$
$$= n+\frac{m-n}{A}$$

Let $dh = \frac{m-n}{A}$ then the pressure indicated by the ordinate from h to the expansion curve bc is the pressure at the fraction 1/A of the outward stroke of the l.p. piston. But since $dc = (m-n)$ and 1/A is any fraction, it is apparent that the visible mean pressure of the area bcd is the true mean pressure on the l.p. piston; and the work done in the l.p. cylinder is represented by the area $bcd \times \frac{ec}{dc}$ or by the area bcd plus the area bed.

But the work done in the h.p. cylinder has been seen to be represented by the area $abdf$ less the area bed; therefore the whole work done in both cylinders is represented by the area $abdf$, together with the area bcd, being the whole shaded area in Fig. 4. The first question, therefore, to be decided in connection with a possible compound engine is the efficiency represented by such a diagram in comparison with that of a single cylinder under equal conditions.

Fig. 5 is practically the same diagram as Fig. 4, but drawn to scale in this instance and with some approximation to actual conditions. The compression pressure has been slightly exaggerated in order to simplify calculation, both compression and expansion curves being represented by the equation, $PV^{4/3} = C$. The volume of the h.p. clearance being unity, the total volume of the h.p. cylinder is assumed to be 4, and the ultimate volume of expansion 11.3; the ratio between the displacements of the h.p. and l.p. pistons is thus 3/10.3, the l.p. cylinder being assumed to have no clearance. In the statements which follow R represents the ratio between the absolute explosion and compression pressures; p is 14.7, the atmospheric pressure; and n is the compression ratio, or number of expansions, referred to the h.p. cylinder only, and thus representing in this instance the constant number 4. The shaded areas represent the result of assuming $R = 3$, corresponding to the combustion of a moderately rich mixture. The upper and lower dotted expansion curves correspond to $R = 4$ and $R = 2$, or a very rich and very weak mixture respectively.

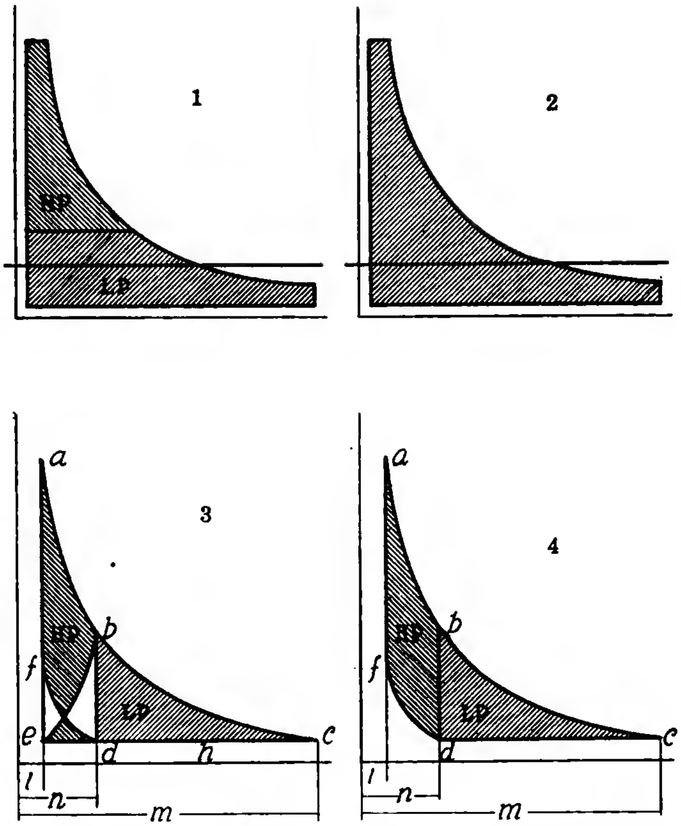
In the case where $R = 2$ the expansion curve cuts the atmospheric line at 6.7 volumes, corresponding to a fraction of the stroke equal to 2.7/7.3. If the l.p. cylinder had the full dimensions assumed it would become useless after this point in the stroke, and in the case where $R = 3$ the same condition will be seen to arise at 9.1 volumes, corresponding to a fraction of the stroke equal to 5.1/7.3. The full volume of the cylinder assumed in the diagram is utilized only in the case where $R = 4$.

The area of the h.p. portions of this diagram—that is, the area to the left of Vol. 4—may be found from the formula:

h.p. area $= 3pn\,(R-1)\;(n^{1/3}-1)$ ...... (1)

and the l.p. area (that is the positive area to the right of Vol. 4, bounded above by the expansion curve and beneath by the atmospheric line) from the formula:

l.p. area $= pn\,(3R-4R^{3/4}+1)$ ...... (2)



Figs. 1-4—Indicator diagrams from theoretical compound engines

and a comparison of these areas shows the maximum increase of power to be expected from compounding. The appropriate figures for different values of R are given in the following table, together with mean pressures calculated from the formulæ:

h.p. mean pressure

$$= \frac{3pn\,(R-1)\;(n^{1/3}-1)}{n-1} \qquad \text{......} \quad (3)$$

l.p. mean pressure

$$= \frac{p\,(3R-4R^{3/4}+1)}{R^{3/4}-1} \qquad \text{......} \quad (4)$$

In equation (3) the mean pressure is the pressure calculated from Fig. 5 as if the h.p. cylinder were the only cylinder, and without deduction for the back pressure due to the presence of the l.p. cylinder. In equation (4) the l.p. mean pressure is arrived at by dividing the l.p. area as already defined by its length along the atmospheric line in each case.

It will be noticed that l.p. mean pressure is independent of n, and it may be deduced from this that in a compound engine the relative increase of power and economy should be greater when the compression ratio in the h.p. cylinder is low. This is actually the case; but, while with $n = 2$ and $R = 4$ the maximum increase of power and economy due to the addition of a second cylinder would amount to approximately 60 per cent, the resulting power and efficiency would still be absolutely less than that of a single cylinder where $n = 4$. Compounding, at the best, is only a substitute for high compression, and it is, therefore, of little interest to consider its effect in conjunction with compression lower than that which is easily attainable in practice.

TABLE I.

R.	n.	Maximum Additional Power, Per Cent	H.P. Mean Pressure	L.P. Mean Pressure	Limit of Expansion Volumes
2	4	15.4	34.57	5.86	6.728
3	4	25.0	69.15	10.16	9.116
4	4	31.8	103.72	13.53	11.316

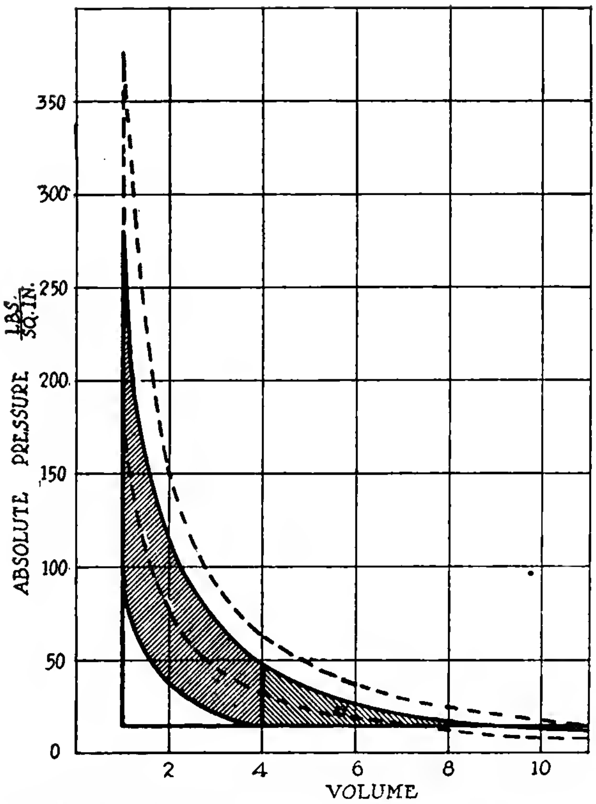


Fig. 5—Same diagram as Fig. 4 but drawn to scale and with actual working conditions considered

An increase of power approaching 25 per cent without additional cost of fuel is worth having if it is real and if it does not involve an extravagant capital outlay. I have therefore prepared Fig. 6 as an indication of probably the simplest type of engine capable of embodying the compound principle. It is to be understood, of course, that this figure is in no sense even an elementary design, but merely a skeleton diagram illustrating some features of a possible general arrangement, and serving at the same time as an indication of the difficulties that will be encountered in any serious attempt at practical design.

The engine suggested in Fig. 6 has three cylinders, two high pressure, with one low pressure between them. All the cranks are in the same plane, the l.p. crank being opposed to both h.p. cranks. Each h.p. cylinder exhausts into the l.p. cylinder, but on different strokes; thus the left-hand h.p. piston as shown may be imagined to be beginning the exhaust stroke while the right-hand piston is about to compress its charge. There is thus an impulse at each half revolution, the h.p. impulses being separated by an interval of one revolution, and each being followed, at an interval of half a revolution, by a relatively feeble l.p. impulse. The balance of such an engine presents no difficulty; and, if the power of each h.p. cylinder is augmented by 25 per cent, the whole arrangement represents roughly the power of two and a half cylinders for the capital cost and maintenance charges of three, but with the fuel cost of two, always remembering that with anything much less than a full load the capital cost and maintenance charges remain, while the fuel economy tends toward disappearance.

The exhaust from the l.p. cylinder (not indicated in Fig. 6) can be easily arranged, but it is apparent that considerable difficulty will be experienced in designing the valves and passages between the high and low pressure cylinders, and I anticipate that some arrangement of sliding valves, such as sleeve valves, might be found essential. The difficulty arises in connection with clearance in the l.p. cylinder, which must be reduced to the utmost limit of parsimony if any reasonable approach to the maximum additional power indicated in the table is expected. It may be advisable to show graphically the pernicious effect of l.p. clearance, and to form some estimate of what actual, as distinguished from maximum, additional power may be attained.

Fig. 7 is an enlarged reproduction of part of Fig. 5, the expansion curve *abg* being that due to $R = 4$, represented by the upper dotted line in Fig. 5 and cutting the atmospheric line at 11.3 volumes. The line *ad* is the ordinate at Vol. 4, forming the boundary of the h.p. diagram.

For the purpose of estimating the minimum clearance in a small l.p. cylinder I assume that the area of the piston is 24 sq. in. and its stroke 4½ in., making the volume 108 cu. in. Practically there must be some clearance between the piston and the cylinder head, and this may be estimated at $24 \times 1/16 = 1.5$ cu. in. Assuming a sleeve valve, the clearance due to two ports may be taken at $2 \times 6 \times ¼ = 3$ cu. in., while an allowance of 0.9 cu. in. should be sufficient for clearance due to the exhaust valve if that is placed in the cylinder head. The sum of these amounts is 5.4 cu. in., or 5 per cent of the cylinder volume; and that amount is accordingly represented in Fig. 7 by the length *ae*, which is 5 per cent of the length originally assumed to represent the volume of the l.p. cylinder. If expansion is still to proceed along the line *abg*, this amount of 5 per cent is taken from the original volume of the cylinder, and the volume displaced by the piston is no longer proportional to *dg*, but to *hg*.

The l.p. cylinder having clearance must have compression, and the exhaust valve is accordingly closed at the distance *ch* before the end of the stroke *gh*, so that the pressure at the end of the stroke may be $he = ad$. The compression ratio on the figures assumed being nearly 3, the gas available for further expansion at the beginning of h.p. exhaust is that which at atmospheric pressure originally occupied 4 volumes in the h.p. cylinder and 1½ volumes in the l.p. cylinder, and which now occupies 4½ volumes. If the temperature of compression of the l.p. cylinder were equal to the terminal temperature of the h.p. cylinder, that gas would expand as indicated by the line *ef;* but as their relative temperatures will be something like 1000 deg. and 500 deg., the pressure of the mixture will drop to a point which happens to coincide so nearly with the point *b* in the expansion curve that they may be considered for present purposes to be indentical. The effective added power is thus represented by the area *bcg*, and the power lost due to 5 per cent clearance in the l.p. cylinder is represented by the area *abcd*.

The area *abcd* is 36 per cent of the area *agd*, and it follows, therefore, that unless clearance in the l.p. cylinder can be reduced to a figure materially less than 5 per cent of its total volume the previous table must be supplemented as follows:

TABLE II.

R.	n.	Probable Effective Additional Power, Per Cent	L. P. Probable Effective Mean Pressure
2	4	9.85	4.00
3	4	16.00	7.00
4	4	20.35	9.50

These figures are less imposing than those previously given, but they are subject to no discount, and may even be considered capable of improvement, as, for instance, by increasing the stroke, which would correspondingly diminish the

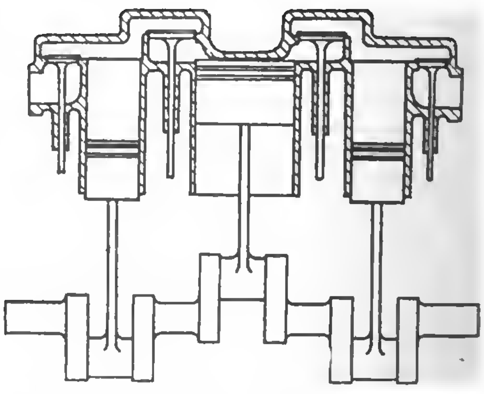


Fig. 6—Section through a simple type of engine embodying the compound principle

percentage of clearance. A relatively long stroke would also be desirable for motor car purposes, since it is practically certain that until motor cars become ordinary acquisitions of the governing classes a low pressure cylinder would be liable to be taxed as if it were subject to explosion pressure.

It seems doubtful, even omitting consideration of extra taxation, whether a compound engine would appeal to the private motorist, who is not commonly exigent in the matter of miles per gallon. Some few scientific enthusiasts would respond promptly, but the great majority would look coldly on a probable increase from 25 m.p.g. to 29 m.p.g., which corresponds to 16 per cent additional efficiency, and which would mean a saving of 5½ gal. per 1000 miles with a premium on gear changing. With an engine large enough for top gear runs, the l.p. cylinder would too often be acting as a glorified silencer. The circumstances are radically different in the case of motor omnibuses and lorries, normally under heavy load, doing at the outside 8 m.p.g., and running perhaps 24,000 miles a year. The saving in such a case might be expected to amount to 17¼ gal. per 1000 miles, or fully 400 gal. a year per vehicle. The question of whether any, and how much, capital charges should be debited against this saving would depend upon the type of engine scrapped and the type of engine adopted. The substitution for a worn out four-cylinder engine of a three-cylinder compound with somewhat larger h.p. cylinders should not increase the cost of renewal.

It should be noted, in conclusion, that the lost area *abcd* of Fig. 7 is due, not only to cylinder clearance, but also to the inevitable external cooling of the cylinder during the l.p. exhaust stroke. If there were no clearance the temperature of that portion of the exhaust remaining in the l.p. cylinder would be of no importance since it would have no volume. If, on the other hand, there were no loss by cooling, expansion in the l.p. cylinder would follow the line *ef* as already described, and the lost area *abcd* would be balanced by the gain of mean pressure.

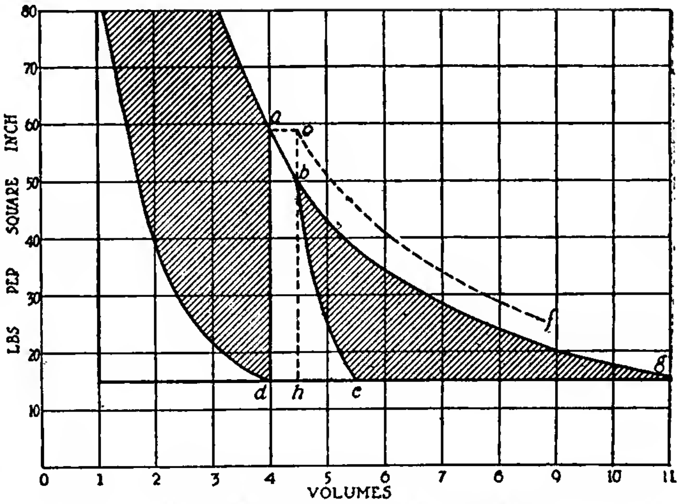


Fig. 7—An enlarged reproduction of part of the expansion curve shown in Fig. 5

The deduction from maximum efficiency, as recorded in Table II, is based on an ample allowance for water-cooling as in the case of an ordinary h.p. cylinder, but since the l.p. cylinder is subject to no higher temperature than the h.p. terminal temperature, it would appear that a very moderate degree of air-cooling should suffice for the low pressure cylinder, and that moderation in this matter should conduce to the general efficiency and to improved l.p. mean pressure. It would be unwise to expect material increase in the maximum additional efficiency, as stated in Table I, from such a modification, since the gas expanding in the l.p. cylinder remains in communication with the water-cooled h.p. cylinder. During l.p. exhaust that communication naturally ceases, and it may therefore be assumed that Table II represents the least favorable results.

Locomobiles Improved in Detail for 1917

(*Continued from page* 807)

a high speed jet for wide open throttle. When this jet comes into action an additional air valve is also opened, giving practically an entire secondary carbureter. The carbureter is not waterjacketed but is provided with a hot air attachment. An adjustment on the steering column actuates a metering screw which determines the amount of fuel entering the low speed jet.

A special design of Westinghouse electric lighting and starting system is used on the Locomobile. The generator is a 6-volt unit located on the right side of the motor behind the water pump. It is regulated automatically by a differential field winding and the field winding is made of special wire which as the generator becomes warm the resistance increases tapering down the output. Single wire system is used.

The starting motor is series wound and is capable of turning the 38 over at about 125 r.p.m. and the 48 at about 115 r.p.m. This is fast enough to start on the magneto. Starting motor engagement is effected magnetically. In the magnet pinion shift is a powerful electro-magnet having a pull-in coil. This becomes magnetized and acts to engage the starting pinion. The engine is first turned over slowly and then rapidly picks up speed and cranks the engine. When the engine commences to fire and speed up the voltage of the generator builds up and the starting motor circuit is opened automatically.

The clutch is a disk type with steel disks, but between each pair of disks is a floating ring of fabric. The gearbox is connected to the clutch by a universal. The gearset is a four-speed selective type contained in a manganese bronze case bolted to the frame at four points. The entire upper half is a light weight cast aluminum housing which can be quickly removed. The gear ratios are first 15.4 to 1; second, 7.39 to 1; third, 5.38 to 1; fourth, direct, 3.85 to 1; reverse, 21.75 to 1.

Power is transmitted from the gearbox to the rear axle by a chrome-nickel steel propeller shaft having a ball bearing full universal at the gearbox end and a block and pin type of universal at the rear end. The rear axle is floating, the housing consisting of a hollow steel casting into which seamless steel tubes are forced under heavy pressure. A truss rod is passed under the housing and anchored at the outer end. The frame of chrome-nickel steel is of pressed steel channels with 6-in. side members of chrome-nickel steel. The members are hot-riveted together and all the holes are drilled in ream.

In equipment Locomobiles are particularly complete. The bodies are of sheet aluminum, beaten into shape and fastened to a wooden frame. The instrument panel is located in the hood and the same panel is used on all 1917 models. It is held to the front cowl frame by two bolts at each side. Besides the liberal equipment of tonneau, cowl and step lights and other requisites of a luxurious car, Locomobiles are fitted with power tire pumps which are capable of pumping up a 37 by 5 tire to 90 lb. in about 4½ min. with the engine running at 1200 r.p.m.

The top is a one-man type which this year has been made very simple to operate. A handle is conveniently fastened to one of the bows and the top can be raised by one hand.

Tracing the Why of Carbureter Parts*

Part II

Comparisons of Carbureters in Regard to Range of Capacity Through Which They Supply a Normal Quality of Mixture—Atomizing, Pick-Up, Fuel Efficiency—Two-Stage Carbureter

By F. H. and F. O. Ball

THE preceding instalment was devoted to an analysis of theoretical diagrams from several types of carbureters. It is now proposed to investigate the diagrams actually produced by these instruments, which will be found in Figs. 9, 10, 11, 12, 17, 18 and 19, all published last week.

Comparisons of Quality Diagrams

Comparisons will first be made between these several types regarding uniformity of quality. The several diagrams referred to speak for themselves regarding this feature. Each type of carbureter produces its own characteristic diagram, which cannot be greatly modified by changes of adjustment, as the peculiarities are inherent. In most cases the carbureters had been adjusted by the manufacturer for test purposes.

It is, of course, understood that a desirable diagram is one that runs parallel to the zone of best quality.

Working Range

One of the most important comparisons of carbureters is in regard to the range of capacity through which they furnish a normal quality of mixture. For the purpose of making this comparison, a uniform standard has been adopted in which the maximum in every case is determined by measuring the quantity of air the carbureter will deliver with a manifold vacuum equal to 30 in. of water, and the minimum is located at the point where the quality passes out of the quality zone.

With this basis of comparison, it matters not what the nominal size of the carbureter may be nor whether all the carbureters to be compared are of the same size.

In this case, however, all the carbureters used were of the same nominal size and therefore the quality diagrams may be plotted on charts having the same scale of capacity.

The differences of maximum capacity shown by the different types means little or nothing unless considered in connection with the minimum capacity because a carbureter with limited working range may be made to show large capacity by making great sacrifices of good performance at slow speed.

A clearer idea of the effect of large capacity may be obtained by taking a practical example. The carbureters used in these investigations were all of the 1¼-in. size, which is the size ordinarily used on motors having a piston displacement of 275 to 300 cu. in. Motors of this size, when supplied with a normal quality of mixture, require from 3 to 4 cu. ft. of air per minute when idling or driving a car at its slowest speed on high gear.

Looking over the several diagrams, it is evident that in most cases the idling and slow running must be done with a much larger quantity than 4 ft. per minute, and that the slow speed is partly due to the very lean quality of the mixture.

This is not a desirable condition because the running of the motor is weak and uncertain and is more susceptible to changes of temperature than when a normal quality is used.

Before leaving the subject of working range, attention is called to the showing made by the several diagrams under consideration.

The smallest range is 1 to 11 in Fig. 10, and the largest, 1 to 47 in Figs. 18 and 19.

The explanation of the large range of Fig. 18, will be found in Fig. 15. It will be seen that because the gasoline curve and air curve are so nearly parallel a very small primary fixed orifice may be used and the quality diagram therefore maintains a normal quality to a very small minimum. In view of the remarkable showing made by this friction control type, it is unfortunate that fluctuations in the temperature of the gasoline should change the quantity flowing through the annulus to an extent that makes it undesirable.

Atomizing

The question as to the most practical maximum in each case is not decided wholly with regard to the quality for idling and slow running, but the question of atomizing at slow motor speeds must also be considered.

When it is remembered that the atomizing energy of an air stream varies as the square of its velocity, it is evident that large capacity and the low air velocity that accompanies it inevitably means very little atomizing energy when small quantities are being used. It therefore becomes necessary to keep in mind the desirability of good atomizing.

Pick-up

The question of pick-up must also be considered in determining the most practical compromise in the matter of capacity. It is, of course, possible to obtain good pick-up by reducing the capacity to a point where the atomizing energy

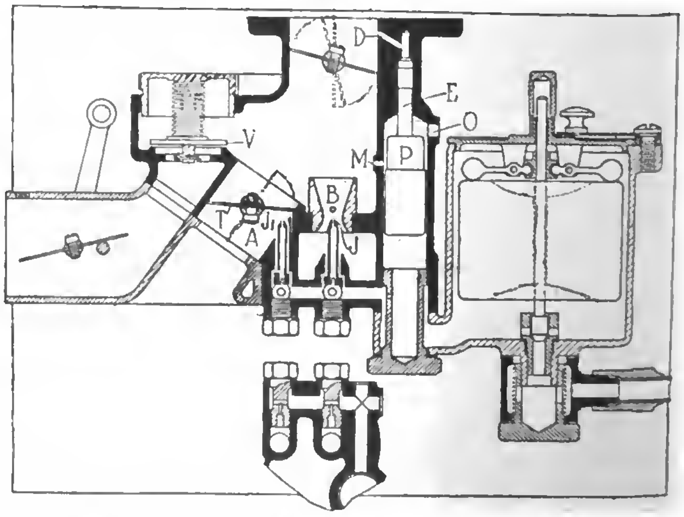


Fig. 20—Carbureter actuated by fluctuations of the vacuum in the manifold and discharging a predetermined quantity of gasoline whenever the throttle is suddenly opened at slow speed

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*Paper presented before the Cleveland section of the S. A. E.

is so high that no pick-up device is necessary. This is done by some manufacturers, but with the better grade of instruments, some kind of pick-up device is incorporated in the structure. Quite a variety of such devices are in use. The one most commonly found in carbureters is the liquid dashpot attached to the air valve. This device prevents a rapid movement of the valve and consequently when the throttle is suddenly opened, there is a lack of air and also an increase of gasoline until the valve has opened to its normal position.

Fig. 20 represents a very good device which is actuated by fluctuations of the vacuum in the manifold, and discharges a predetermined quantity of gasoline whenever the throttle is suddenly opened at slow speed. This device consists of the plunger *P*, having an extension, *E*, on its upper end, which acts as a piston to move the plunger under the influence of the fluctuations of the manifold vacuum communicated to the piston through the passage, *D*. The plunger is fitted loosely in a cylindrical chamber having a restricted passage at the bottom communicating with the float chamber so that the level of gasoline in the plunger chamber is maintained at the float chamber level. The plunger chamber has an atmospheric opening, *O*, and a passage, *M*, to the mixing chamber.

The operation is as follows: When the throttle is nearly closed, the vacuum in the manifold lifts the plunger to the position shown, and the space below the plunger fills with gasoline. The device is now ready for action. A sudden opening of the throttle breaks the vacuum in the manifold, which releases the plunger and it drops by gravity, causing the gasoline to pass up to the space above the plunger, where it is swept into the mixing chamber by the air entering through the passages, *O* and *M*. This operation is repeated as often as the throttle is suddenly opened from a nearly closed position.

Two-Stage Carbureter

Many of the difficulties that have been shown to be inherent in the several types of carbureters described on the preceding pages may be minimized by dividing the carbureter into two stages. This type is illustrated in Fig. 20, in which *B* is the primary fixed orifice for air, and *J* is the gasoline jet located as usual in this passage. A spring-opposed valve *V* controls the flow of air through the valve passage to the mixing chamber.

These parts, when connected to a gasoline supply and an outlet to a motor, constitute a simple air valve carbureter such as has been described and analyzed on the preceding pages, and this simple carbureter is called the primary stage of the instrument.

Associated with this in the structure is the air passage, *A*, containing the gasoline jet *J1*.

These parts, when in action, constitute an elemental fixed orifice carbureter, such as has already been fully described. This fixed orifice carbureter is the second stage and its capacity is generally somewhat more than half the total capacity. Normally, this second stage is closed by the butterfly valve, *T*, and held closed by a spring. A connection to the throttle is so arranged that when the throttle is nearly open, the final full opening throws the valve *T* wide open, thereby more than doubling the capacity of the carbureter.

Without going extensively into a consideration of this type, a few features may be briefly noted.

Obviously the working range of a two-stage instrument should be greater than a single stage because it is the summing up of the ranges of both stages.

The atomizing of the primary stage must necessarily be high, even when the total capacity of the instrument is very great because the dividing of a carbureter into two equal stages makes the atomizing energy of the primary stage four times as great as with the full capacity. This high atomizing facilitates the pick-up to such an extent that it is fairly good practice to make the capacity of the primary stage so small that no pick-up device is necessary. All things considered, however, it is better to divide the two stages more evenly and incorporate a pick-up device.

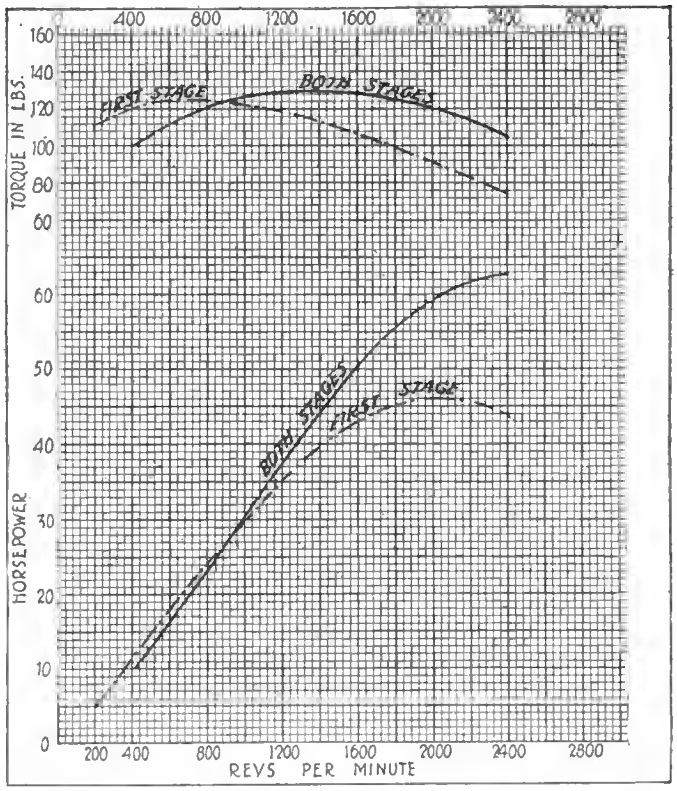


Fig. 21—An illustration of the effect of dividing a carbureter into two stages

The two-stage instrument is peculiarly adapted to obtaining high fuel efficiency, as will be seen by referring to Fig. 19.

In this case the setting of the primary stage is such that the mixture is very lean. The high atomizing of this stage and the pick-up discharge make this practicable, and the resulting fuel efficiency is very high.

Under these conditions, the setting of the second stage is made for a rich mixture so that when it is brought into service for maximum power, the resulting quality from the combined jets will be rich enough for maximum torque.

Fuel Efficiency

Inasmuch as more than 90 per cent of the running of the motor is done with the primary stage, the fuel efficiency is practically determined by the quality of mixture used in this stage.

Referring again to Fig. 19, it will be noted that the quality diagram of the primary stage differs somewhat from the quality diagram of the simple air valve carbureter in the preceding pages. This is explained by calling attention to the restricted air passage, or throat, under the air valve, which becomes a fixed orifice control of air when the valve has opened slightly.

With this arrangement, the air valve simply bridges over from the primary venturi throat to the largest fixed orifice under the air valve.

This arrangement limits the capacity and could not be used with success with a single stage carbureter of normal capacity.

Power and Torque Curves

Fig. 21 is an interesting illustration of one of the effects of dividing a carbureter into two stages.

The torque curve shows this effect most clearly. It will be noted that at about 900 r.p.m. the torque is the same whether the single stage or both stages of the carbureter are in service.

At this speed, the loss of atomizing of the large capacity offsets the gain due to low resistance, and with the primary stage, the gain due to higher atomizing is offset by the higher resistance.

Below this speed the primary stage shows the higher torque because of the superior atomizing, and above that speed, the lower resistance of the full capacity results in the higher torque. It will be noted that a proper use of the two stages produces in effect a very flat torque curve.

Heretofore it has generally been customary, in running power curves, to make the minimum speed 300 or 400 r.p.m. It is now becoming common to drive cars on high gear at a minimum speed corresponding with 100 r.p.m. or less, and it is required to pick up promptly on open throttle from these low speeds, therefore, because of this exacting service, power curves should be continued to 100 r.p.m.

There are other phases of the relation of a carbureter to the performance of a motor that might be interesting, but the authors of this paper will feel well repaid for their work if it results in showing a little more clearly the peculiarities of each type of carbureter that has been discussed. The discussion on this paper will be reported in THE AUTOMOBILE for May 11.

New Motor in Sunbeam Six Racer

THE Sunbeam Six racer entered for the opening races at the Sheepshead Bay motor speedway, May 13, has arrived at the track, and its driver, Joseph Christiaens, is tuning it up for the race and getting accustomed to the track. The chassis of this car is the same that appeared in races in this country in previous years, but the motor is entirely new. Since its arrival at the Sheepshead Bay track it has been possible to secure photographs showing both sides of the motor with its overhead valve mechanism, and these are reproduced herewith.

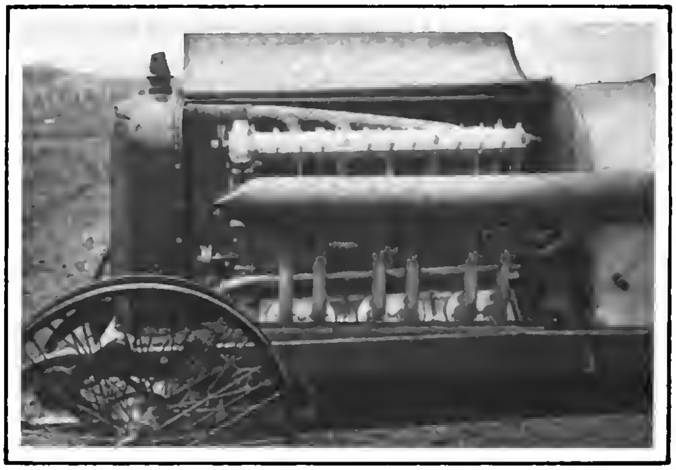
Details of specifications and equipment of the new Sunbeam motor which it was previously impossible to obtain are now available. The motor is a six-cylinder type with a bore of 81 mm. and a stroke of 150 mm., or 3 3/16 by 5⅞ in. One set of spark plugs is used, ignition being by a single Bosch magneto driven at three-quarter engine speed. There are two oil pumps, one for the ball bearing crankshaft and the other for the two camshafts. At present it has not been decided whether to use aluminum or steel pistons. The motor has a single breather pipe to each cylinder as shown in the illustrations.

There are four valves to each cylinder, making twenty-four valves in all. The camshafts are mounted overhead, the valves being set at an angle in the top of the cylinder head and the camshafts are driven by a vertical shaft and gears from the front of the engine.

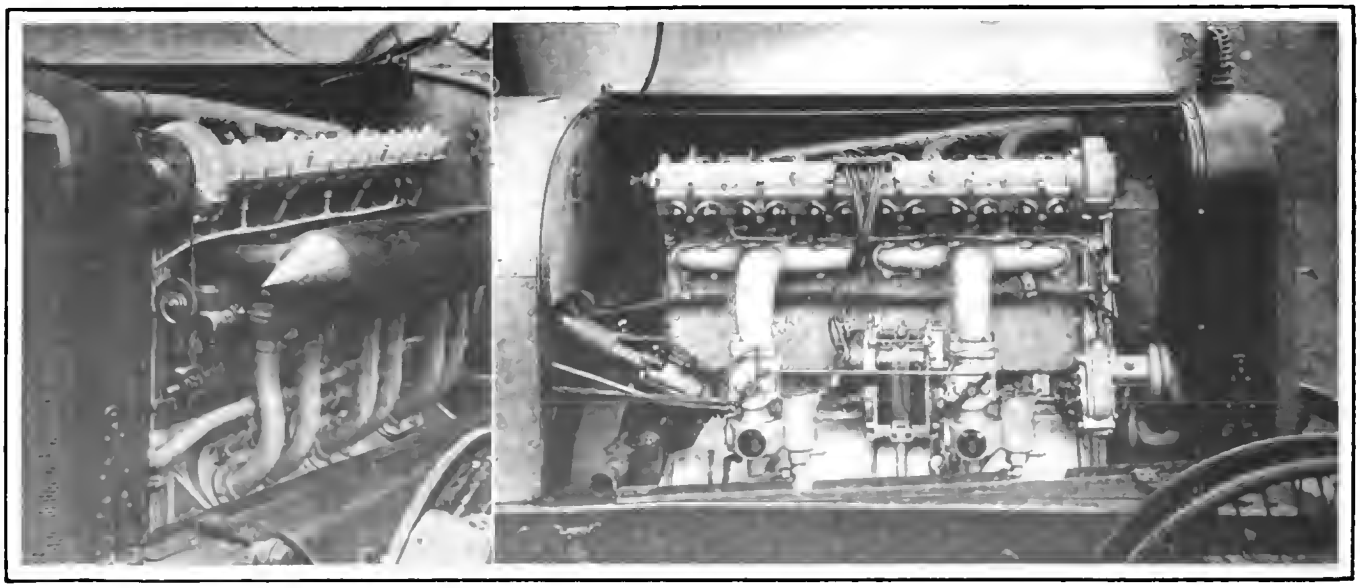
Two carbureters are used, as shown in the illustration at the bottom of the page, with a separate intake manifold for the three forward and three rear cylinders respectively.

A four-speed gearset is employed and the gear reduction on direct drive is 2.7 to 1. There is a revolution counter fitted. The exhaust manifold is carried outside the hood and is pointed at the forward end.

The car has been driven for about fifteen laps on the Brooklands track in England but no high speeds were made due to the bad condition of the track caused by army trucks, and neglect.



Sunbeam racing motor showing mounting of exhaust manifold, individual breather pipes and double set of shock absorbers



Left—Sunbeam racing motor showing revolution counter drive from camshaft, individual breather pipes and pointed exhaust manifold. Right—Intake side showing the two carbureters and the single Bosch magneto

The History of the Pneumatic Tire

Tires Constitute One of the Most Important Factors in the Development of the American Automobile Industry—Discovery of Vulcanization and Invention of Pneumatic Tire

The History of the American Automobile Industry—

By David Beecroft

HAVING traced the thread of growth in the gasoline field from the sinking of the first well in 1859, it is now necessary to make another historical detour before beginning the modern period of automobile building from 1890 up to the present. The rubber tire, in solid and pneumatic types, has been such an essential of the practical automobile that the true estimate of car progress would be impossible without following the trend of rubber and rubber tires from the earliest date up to the present. The practical automobile did not arrive until the pneumatic tire was developed, and the tire has played a much greater part in the evolution of the automobile than it is given credit for. Tires and roads have been great factors in automobile development.

Milestones in Tire History

The automobile tire, like the internal explosion engine, and like the petroleum industry, had its great milestones during the period of its development.

We saw how 1876 gave us compression in an engine, which was the missing link in its development. So it was in gasoline. So it was in tires. Tire history has its epochal points, nuclei around which broad activities of progress are clustered.

Three epochal dates should be borne in mind:

First was the discovery of vulcanization in rubber manufacture, and which process is the warp and woof of rubber manufacture. The credit goes to Charles Goodyear. The date was 1835.

Second came the invention of the pneumatic tire in 1845, by an Englishman named Thompson.

Third came the practical production of pneumatic tires in 1889, after the pneumatic having spent forty-four years in relative obscurity, until Dunlop, an Irishman, re-invented the pneumatic, from which date its growth has kept pace with car development.

Here again we have an example of an invention lying dormant, arriving before its time. In 1845, when Thompson invented the pneumatic, the explosion engine was in the dark ages of its development, oil wells had not been started, and roads were bad. There was little need for the pneumatic. Later, in 1889, after the practical explosion motor was built, the pneumatic came into its own. The country was ready for it.

Tires might seem to be more properly treated under wheels, but since the modern tire represents such a considerable development, it has seemed best to treat them as a separate device. They were originally simply made for tying or holding the parts of the wheel together, whence their name, and were not used on wheels that were solid, as were some of the earlier cast wheels and wooden wheels. An ancient chariot wheel said to have been dug up in Ninevah and believed to date from about 2000 B. C., has six spokes which carry the load and twelve thongs which bind the rim to the spokes and hub. These thongs are radial, whereas most tires depend upon their strength in the circumferential direction. Iron has been a very favorite material for tires because of its tensile strength and its ability to resist wear.

There have been many attempts in later years to secure elasticity from iron or steel springs, most of which have been so unsatisfactory as to have been found no use and even the better forms have not remained in use very long.

Patents Ice Cream Truck Design

OMAHA, NEB., April 29—A motor truck body for a special service, unique in construction, yet apparently the last word in efficiency, is the design recently patented by Howard B. Graham, wholesale ice cream manufacturer of Omaha.

The body is built of sheet iron, with cork insulation, and it eliminates at once the unsightly load of boxes, cans, ice and tarpaulins which are so frequently met with on the streets of any large city. Also the driver or his helper can do about 90 per cent of the work on the ground.

At the rear of the body, toward which the metal floor slopes, there is a chute with a baffle door, from which ice may be taken with a shovel as desired, and a similar arrangement on a smaller scale is provided for the salt, thus disposing of the awkward shoveling of ice and salt while the man stands upon the top of the body or on the cans themselves.

Running boards 15 in. wide are provided for the whole length of the body on both sides, and cans are simply lifted from the tank to the running boards and thence to the ground, thus cutting this phase of the work to a minimum. A drain hose with a valve connection is attached to the bottom of the tank, and this is laid upon the ground to avoid splashing salt water on the body or chassis.

A half ton of extra ice on rush days may be carried in the collapsible bin on the top of the body, which folds within the trap doors when not in use. The whole body, made of automobile iron and very well finished, costs but little more to construct than the ordinary truck body, says the inventor.

The FORVM

FURTHER DISCUSSION OF ABANDONING DIFFERENTIAL IN TRUCK DESIGN—MAY GIVE SOLID AXLE A TRIAL—TIRES MUST SHOW UNIFORM WEAR—MODIFIED TYPE OF DIFFERENTIAL POSSIBLE

Intends to Try Out Solid Type of Axle

By H. G. Burford,
H. G. Burford Co.

I HAVE read THE AUTOMOBILE for April 13 and the interesting article on the question of the possibility of disposing of the differential in motor trucks and passenger cars with very great interest.

The answer to anyone who had questioned me on this important matter prior to my visit to the Sheldon Axle Co.'s works at Wilkes-Barre last week, where the company's engineer, Mr. Laycock, demonstrated to me that it not only was a question of experiment, he, however, demonstrated beyond all dispute that it is possible to run a truck and a pleasure car successfully without this fitment which all manufacturers have been burdened with since motor traction became the world-wide usage which it enjoys to-day.

G. A. Greene, who is a personal friend and whose opinion I value, undoubtedly speaks with authority and with the knowledge of facts which it would be very hard to dispute.

I am certainly of the opinion that the experiment which has begun will have far-reaching results, especially for service conditions similar to that performed by the omnibus company of which Mr. Greene is the engineer.

The impression made by Mr. Laycock on me is such that I am making a similar experiment at once on the Burford 2-ton truck and should be pleased to let you know the results of my application of an idea which I am indebted to the engineer of the Sheldon company for bringing to my notice.

Points Out Need for Equal Tire Size

By John Younger,
Pierce-Arrow Motor Car Co.

THE article in THE AUTOMOBILE for April 13, dealing with the possibility of eliminating the differential from trucks, is interesting. It is somewhat early, however, to draw any conclusive results from these tests.

The differential, it will be remembered, was used on road vehicles for steam tractors or steam road rollers with a comparatively short wheelbase. It was then used on the ordinary pedal tricycle, also with very short wheelbase. The automobile has been gradually evolved from the short wheelbase tricycle, and each step taken has really tended toward a lengthening of the wheelbase, the differential being retained. The absence of a differential has never been tried out exhaustively until Mr. Laycock did so, and it is difficult to say at present exactly what will be the results.

The absence of a differential is attended with some disadvantages, notably an increased tendency for front wheel skids and also an increased tendency for wear on one set of tires, if a vehicle is always making corners one way, as occasionally happens, and we think these disadvantages would offset the advantages of having the power conveyed to the wheel of greatest resistance.

There is one point in truck use which must be remembered and that is, that truck tires on both wheels are not always changed simultaneously, and occasionally a new tire will be met with in conjunction with a half-worn tire.

There are still a number of these points to be considered, and only a free discussion of the subject can hope to bring them out.

Would Like Modified Mechanism

By E. H. Farmer,
H. E. Wilcox Motor Co.

WITH reference to eliminating the differential from trucks, we have tried out trucks without differentials and found them satisfactory in a great many ways. But taking everything into consideration, we found that the conventional differential gave us the most satisfactory results under all conditions. There is no question but that on the straightaway the truck without the differential has more power and greater tire and gasoline mileage. For a truck operating on very bad roads and with a very few turns to make, the solid axle is the best, but for trucks operating in the city where there is a great deal of turning to do, the solid axle is not very satisfactory; the main trouble encountered being the wear on tires and jackshaft breakage.

In our opinion the nail would be hit on the head if a modified mechanism could be substituted that would allow a positive drive on the straightaway, but would act when turning sharp corners. Such a mechanism we are sure would give satisfaction.

Fears Effect of Maneuvering in Cities

By H. D. Church,
Packard Motor Car Co.

WE have been following, with a great deal of interest, the experiments which are being conducted on chassis without differentials, but we feel that the information as yet available, is not complete enough to warrant any prediction as to whether or not the differential can be completely done away with.

It seems to us that the main question with reference to the elimination of the differential is that of tire wear, and it is our opinion that the tire results obtained on a test conducted by the Fifth Avenue Coach Co. would be conclusive, only as regards bus operating conditions. A truck in ordinary commercial service, which has much maneuvering around in freight yards and alleys, and at loading platforms, would undoubtedly have to do a great deal more short-turning-radius work than would a chassis in bus service, and to our minds a differential-less truck ought to be tested in this class of service to obtain the real answer on tire wear.

Elimination of the differential would not only result in a very material weight saving, particularly on worm-driven trucks, but would also do away with from six to eight gears and their bearings, with the attendant necessity for lubrication.

Present Differential Far From Satisfactory

By Lewis P. Kalb,
Kelly-Springfield Motor Truck Co.

REGARDING the possibility of eliminating the differential from trucks, the writer holds the same opinion that most engineers do in regard to this point. That is, that the differential is a necessary evil. It is questionable, however, whether it could be completely discarded.

In the article no mention is made of fuel economy, although the tire wear is stated to be no greater than when the differential is used. It would seem, however, that the power loss involved in the slippage of one wheel would amount to a considerable item.

The present style of differential is far from satisfactory, and there is a crying need for a successful mechanism that will compensate for the unequal travel of the wheels, and yet be able to transmit power to one of the road wheels when the other has lost its traction.

Differential Troublesome When Traction Is Poor

By C. C. Clayburg

I AM much interested in the discussions in THE AUTOMOBILE of the rear axle question. This question has been before the automobile engineers ever since the conception of the industry. It has laid dormant for some time because of the belief of very many that an axle could not be designed that would drive both wheels when rounding corners without frictional losses, and would also be able to drive car on one wheel should occasion require without hand-controlled mechanism.

A chain is judged by its weakest link, so an axle system is judged by its failings. The ordinary geared differential will drive on curves and corners with practically equal power on both wheels, and very little wasted energy. On a well-balanced, well-sprung car, at reasonable speeds, the amount of slip of wheels is very little and its tendency to cause side sway is very problematical. But should you lose traction with one wheel in hole or sand, and you do not have momentum enough to carry you across, ask any man who has been there.

A geared differential that will perform all its usual functions when turning, etc., but will automatically transmit practically all the power to the wheel that retains traction when one wheel slips, and as automatically readjust itself when the slipping wheel regains traction, and this action occurs when driving either forward or backward, seem to me to be the logical solution of the problem.

I understand such a differential system has been designed and patented, and will soon be put upon the market.

For boulevard driving such an axle system is not an absolute necessity. If the car manufacturers would use an axle with the usual geared differential features, but so designed that with very little work the extra mechanism required to make the car suitable for touring and rough country work, could be attached or detached, I believe it would be a very great improvement.

Tire Wear Serious Without Differential Device

By C. C. Hancock

THE article by A. L. Clayden on differential-less trucks is one of considerable interest. While the conventional differential has many disadvantages, it does not appear that we can get along without some device which will allow of a small variation in the speed of the rear wheels.

It is not pleasant to imagine what is happening to the slipping tire, or tires, of a heavy truck, taking a sharp curve, without a differential on a perfectly dry road, when one considers the flat on the tires which results from only one application of a fierce brake. The acceleration of such a mass as a truck rear tire, during the small interval of time it is off the road, cannot be sufficient to affect the tire as seriously, even though it is taking place frequently, as a few right-angle turns.

Two years ago I designed a runabout with live axle and without differential. I ran this 2700 miles and found the tire wear to be extremely rapid, the rubber studs being completely worn off the rear tires in less than 100 miles. The plain surface did not wear so rapidly, due partly to the greater surface in contact. Two sets of tires were worn down in this mileage, or rather, the tires were reversed, the unworn fronts were put on the rear, these wore down at the same rate as the first set. It took two persons to push the car, with the wheels fully locked, although the weight unloaded was only 950 lb., and from examination of the tracks it was easy to account for the state of the tires. There was never a sign of side slip, even on snow and ice-covered roads, and I never got stuck through want of traction.

Steering is undoubtedly harder, and there is a queer sensation of the back of the car swinging out when turning at any speed, due probably to the rear wheels not following in concentric tracks. It is necessary to allow for this swinging out in steering.

Apparently the serious objection, from my somewhat limited experience, is the tire wear, and it is difficult to understand how this can be anything but serious on tires of a heavy vehicle with a very wide track.

I believe a mechanism which would allow a variation in wheel speed, limited to 180 deg. travel, would give very desirable results. The M. & S. differential, due to its friction element, gives valuable results, and is a step in the direction of differential elimination.

Experiments in this direction will be watched with interest.

Truck Differential Unnecessary

By M. K. Woodford

ELIMINATING the differential from trucks, the subject of the interesting discussion now being carried on in The Forum, seems to me a very timely and constructive bit of agitation. The modern motor truck has progressed so far in its field of design that it seems deplorable that it should be tied down to the limitations which should be left behind as characteristics of its experimental stages. In other words, we should not continue to incorporate in our truck axles that heavy, expensive and unnecessary mechanism which, under the name of the differential, has been uncomplainingly carried around by our trucks since the inception of the industry, increasing cost of operation and maintenance for the owner and manufacture and service for the manufacturer.

The Rostrum

Low-Test vs. High-Test Gasoline

EDITOR THE AUTOMOBILE:—Is low-test gasoline the best for touring work? If so, why is high-test most sought?

2—How many cubic feet of vapor will a gallon of gasoline produce, and how is this calculated, having given the ratio of mixture and the test or gravity of the gas?

3—How is drawbar pull calculated?

4—What became of that synthetic gasoline man who claimed that he could produce fuel so cheaply? What was the drawback to this fuel?

Frankfort, Ind. T. W.

—While there are more heat units in low-gravity gasoline than in high the high-gravity is sought because of its easier vaporization.

2—The amount of vapor that will be produced from a given quantity of gasoline depends on the composition of the gasoline and the temperature. It is not affected to any definite degree by the gravity, as you seem to indicate. The calculation is one which is very lengthy and involves a great many theoretical formulæ. A vapor is the gaseous or elastic fluid which emanates or evaporates from the surface of a solid or liquid at temperatures below its boiling point. Gasoline, being volatile, evaporates rapidly at ordinary temperatures. When the vapor is allowed to accumulate in a closed space such as in a carbureter or a motor the saturation point will be reached when the vapor pressure is sufficient to prevent further evaporation of the gasoline. It has then reached its saturation pressure. The volume that a given amount of gasoline will occupy at its saturation pressure is a definite quantity and depends altogether on the temperature and the volatility of the gasoline.

The formulæ involved in the calculation of saturation pressures and volumes are so complicated and require such a fundamental comprehension of the basic laws of thermodynamics that space does not permit a complete review of the entire subject. The fact is that actual results do not coincide with the theoretical due to losses of heat in changing from the liquid to the vaporous state. The changes in the specific heat of a liquid undergoing vaporization are also very complex and indeterminative. For actual calculations data regarding water and steam is more reliable than other vapors due to the extended amount of study which has been put upon this particular topic. The calorimetric data is very difficult to secure, but if you desire to go into the subject deeply a great volume of material has been collected on this subject in Winkelmann's handbook and in Landolt's and Bornstein's tables. Even these results show great variations in accuracy and show that even the best observers vary among themselves.

3—Regarding your question as to how draw-bar pull is calculated, the following is a formula which has been in use for two or three years on trucks:

$$P = \frac{5.18364\, B^2\, SNR}{D}$$

When P is the drawbar pull in pounds, B is the engine bore in inches, S is the engine stroke in inches, N is the number of cylinders, R is the gear reduction and D is the diameter of the driving wheels in inches.

4—The drawback to the synthetic gasoline so far put on the market is that when it actually came down to commercial practice the cost of manufacture was much higher than that of natural gasoline.

Lapping in New Piston Rings

Editor THE AUTOMOBILE: What is the proper way of lapping new piston rings in one-year-old cylinders, also the best type of piston ring to use, whether a patent type or the old style?

White Plains, N. Y. J. McG.

—In lapping piston rings great care must be observed by any amateur. The objection to allowing a novice to lap piston rings is that he is apt to push the piston too far into the cylinder, causing it to stick or break a ring or possibly both. To overcome this difficulty the rings can be clamped between two wooden disks slightly less in diameter than the cylinder. The rings are arranged between the disks, a rod is slipped through and the nuts at each end tightened. A handle on one end of the rod is used for the lapping process which consists in moving the rings slowly in and out with a rotary motion. The lapping compound can be secured from any well-equipped supply store or emery dust and oil may be used.

Kerosene and Carbon Deposits

Editor THE AUTOMOBILE:—I note a statement by an engineer a few days ago that the use of kerosene instead of gasoline will really decrease the carbon deposit.

Others have observed that a lean mixture overheats worse than a rich one. A car came in one cold morning last winter boiling so badly that the driver had to stop several times on the way. I asked about his needle valve. He examined it and found he had left it as he had started it open above two turns. He reduced it to the normal opening and had no more trouble. Will the lean or rich heat most?

Connersville, Ind. H. L. F.

—The rich mixture will heat most.

Adjusting Schebler Model L Carbureter

Editor THE AUTOMOBILE:—Kindly give directions how to adjust the model L Schebler carbureter.

Thompson, Pa. C. A. L.

—Connect carbureter to intake pipe so that it sets about 6 in. below bottom of gasoline tank, that the bowl may be filled by gravity. For best results the carbureter should be as close to the cylinder as possible, and in case of multiple cylinders, equidistant from each one. Connect a pipe or tube from gasoline tank to gasoline pinion. Pipe to be brass or copper and not less than ⅛-in. hole. Do not use rubber tube, as float chamber will not fill properly and rubber makes a sediment in gasoline. Be sure, before connecting, that the gasoline tank has no scrapings, filings or other particles of dirt on the bottom and that the tube or pipe is thoroughly free from dirt or corrosion.

Before adjusting the carbureter make sure that your ignition is properly timed, and that you have a good hot spark at each plug; that your valves are properly timed and seated, and that all connections between your intake valves and carbureter are tight, and that there are no air leaks of any kind in these connections.

In adjusting the carbureter, first, make your adjustment on the auxiliary, air valve *A* so that it seats firmly, but lightly; then close your needle valve by turning the adjustment screw *B*, Fig. 2, to the right until it stops. Do not use any pressure on this adjustment screw after it meets with resistance. Then turn it to the left from four to five complete turns and prime or flush the carbureter by pulling up the priming lever *C* and holding it up for about 5 sec. Next, open your throttle about one-third and start the motor; then close your throttle slightly and retard your spark and adjust throttle lever screw *F* and needle valve adjusting screw *B* so that the motor runs at the desired speed and hits on all cylinders.

After getting a good adjustment with your motor running idle, do not touch your needle valve adjustment again, but make your intermediate and high-speed adjustments on the dials *D* and *E*. Adjust pointer on the first dial *D* from 1 toward 3, about half way between. Advance your spark and open throttle so that the roller on the track running below the dials is in line with the first dial. If the motor backfires with the throttle in this position and the spark advanced, turn the indicator a little more toward 3, or if the mixture is too rich, turn the indicator back or toward 1 until you are satisfied that your motor is running properly with the throttle in this position or at intermediate speed. Now, open the throttle wide and make your adjustment on your dial *E* for high speed in the same manner as you have made your adjustments for intermediate speed on dial *D*.

Steamers Require Pilot Flame

Editor THE AUTOMOBILE:—Why is it that gasoline cars are more popular than steam? Does the steam car not possess the qualities that manufacturers of gasoline cars are to-day working for, namely, the most power for the amount of expense and care required to maintain same?

Los Angeles, Cal. W. H. H.

—Necessity for maintaining a pilot flame to always have heat in the boiler and the more complicated system of control have militated against the extensive use of steam cars. Basically with steam there always remains the necessity for having some type of boiler outside the engine itself.

Oiling Diagram of Duesenberg Racer

Editor THE AUTOMOBILE:—Kindly publish oiling diagram of the Duesenberg racing cars, giving direction of oil travel, check vales, etc., to come from reservoir tank on rear of car, position of inlet and outlet pipes in tank and internal oiling arrangement of motor.

2—What year was the Coca Cola trophy race run?

3—Is this trophy still competed for?

Providence, R. I. H. C. O.

—The diagram you request of the Duesenberg oiling system is given in Fig. 1. Duesenberg motors are all lubricated by a double oil pump carrying fresh oil from the tank at the rear of the car to the motor from which the hot oil is forced by the exhaust pump to the tank again. You will note from the sketch that the exhaust oil pipe extends up into the tank for a considerable distance in order that the hot oil may be let out on top. The pump, in addition to maintaining a constant level in the crankcase, also forces oil to the rocker arm chair and to a distributer pipe, giving a small stream to each connecting-rod. The level in the crankcase is controlled by a level tube which is under constant control of the operator. There are no check valves in any of this piping to the rear tank, these being only used when a hand pipe is connected up.

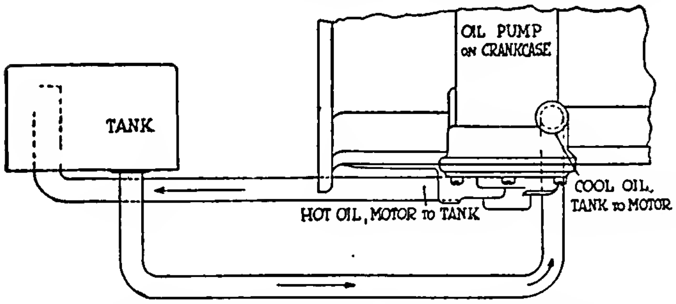


Fig. 1—Diagram of oiling system used on the Duesenberg racing cars. A double oil pump lubricates the motor

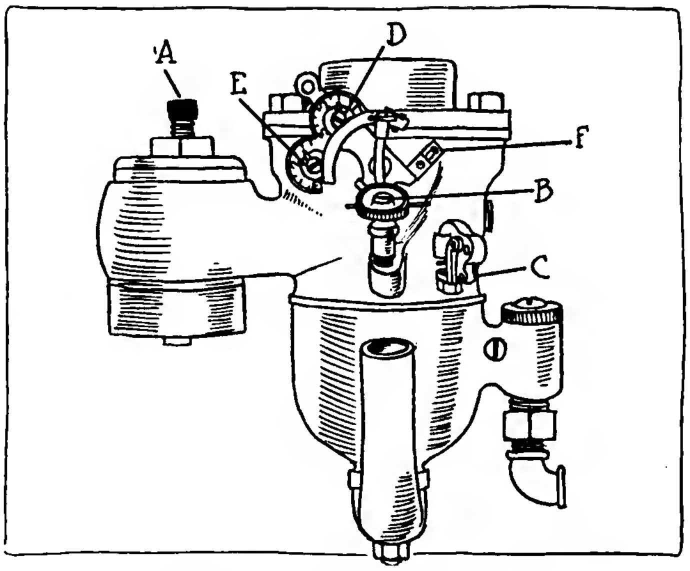


Fig. 2—Schebler model L carbureter, showing the various points at which adjustments may be made

2—The last Coca Cola race was run in Savannah, Ga., in the spring of 1912.

3—This trophy is no longer competed for.

Composition of Freak Fuels

Editor THE AUTOMOBILE:—Kindly state the main factor in the new fuel such as was used in Marmon car on the Indianapolis speedway, whether it was camphor, naphthaline, etc., and water.

2—What are most of the tablets made of which are intended to put in gasoline to increase mileage?

Newark, N. J. G. H. M.

—This was a secret compound.

2—Naphthaline, ether and picric acid are most used. THE AUTOMOBILE does not recommend any of them.

Putting Ammeter on 1913 Studebaker

Editor THE AUTOMOBILE:—Is there any reason why an ammeter may not be installed on our 1913 model 35 Studebaker with a single unit starter and generator, and if not, what scale should the instrument have for the 12-volt system used?

Cherry Valley, Ohio. J. F. H.

—An ammeter may be satisfactorily installed on this model, but it should not be placed in the heavy cables leading from the starter to the battery, since these carry a very heavy starting current. A 20-amp. scale will be sufficient if the ammeter is installed only in the generator circuit which may be done by disconnecting one of the wires leading to the relay contact points and inserting the ammeter in this circuit.

Grinding Is Due to Worn Parts

Editor THE AUTOMOBILE:—I have a Ford car that when I run in high there is a grinding but as soon as I throw it in neutral the grinding stops. I have had the motor a transmission out and there is nothing that is cutting out or seems to be wrong. I have noticed this noise for more than a month. What is the trouble?

Laceyville, Pa. B. W. F.

—As far as can be determined from the data furnished by you, the grinding noise probably originates in the rear axle assembly. There is also a probability that it is more noticeable at certain speeds. Noisy rear axles as a rule result from worn parts which cause play resulting in improper meshing of the gears. The usual remedy is the complete overhauling of the rear axle with replacement of all the worn parts, including the differential, drive gear and the driveshaft pinion. There have also been cases of a rasping or grinding noise especially noticeable with turning corners or traveling on the rough road. This follows universal ball cap gear being too tight and in such a case a shim 0.005 in. thick can be installed between the ball cap rear and front.

Working Out Generator Gearing

Editor THE AUTOMOBILE:—I am installing a lighting system generator and would appreciate your advice as to the ratio of dynamo to engine speed. The manufacturers recommend 100 r.p.m. per mile per hour car speed. Thus 15 m.p.h., 1500 r.p.m. I use 37-in tires and the gear ratio of engine to wheels is 2½ to 1.

Brooklyn, N. Y. A. B. N.

—This altogether depends on the design of the generator and how it is wound. Some generators are intended to be driven at engine speed and others at three times that amount. From the information you give with your generator the gearing could be worked out readily. A 37-in. wheel at 15 m.p.h. makes 136.3 r.p.m. At a gear ratio of 2½ to 1 the engine on your car at 15 m.p.h. would be turning over 340.75 r.p.m. If you wish to have your generator revolving at 1500 r.p.m. at 15 m.p.h. it would have to be geared at about 4.4 to 1. This seems rather high.

Adjusting 1910 Buick Differential

Editor THE AUTOMOBILE:—I have a model 17 Buick 1910, which had a continuous grind in the differential, so I took it down to find the trouble. I found that the bearing on the shaft near the differential was broken in pieces and before I put it back I would like to know the proper way to line up and adjust the differential, also the wheelbase of same.

Newark, N. J. R. T.

—The position of the pinion can be changed by removing the adjusting cover on the pinion flange and the snap rings on the adjusting nuts at either end of the pinion shaft. To adjust the pinion toward the gear loosen the nut on the outer end of the shaft and tighten the nut on the inner end with a spanner. Position of the ring gear may be adjusted by removing bolts and separating the two halves of the gearcase, then remove the snap rings on the adjusting nuts on either side of the inner main shaft bearing.

Formula for Car Performance

Editor THE AUTOMOBILE:—Referring to your issue of March 23, 1916, will you kindly advise if the 40 late closing of exhaust on Sheepshead Bay Packard is correct?

2—Kindly give one or two ability ratio formulæ, when factors of car weight, horsepower, gear ratio, wheel diameter, etc., are given?

Detroit, Mich. R. C. L.

—Yes.

2—The formula for measuring car performance is as follows:

Roadability $= A$

$B =$ Bore of engine.

$S =$ Stroke of engine.

$N =$ Number of cylinders.

$R =$ Final gear ratio.

$D =$ Diameter of wheels.

$W =$ Total weight moved.

$$\frac{B^2 \times S \times N \times R}{W \times D} = A$$

Ability figure—good	0.00105—for American conditions
Ability figure—low	0.00065—for European conditions

Wants Data on Mercer 22-72

Editor THE AUTOMOBILE:—In regard to the Mercer 22-72 four-passenger sporting model, kindly give me the weight of this car ready for the road with water, oil, gas, tools, etc. About how many miles may one expect per gallon of gas on good country roads?

Minneapolis, Minn. W. S. H.

—The weight of this model is given by the Mercer company as 3400 lb.

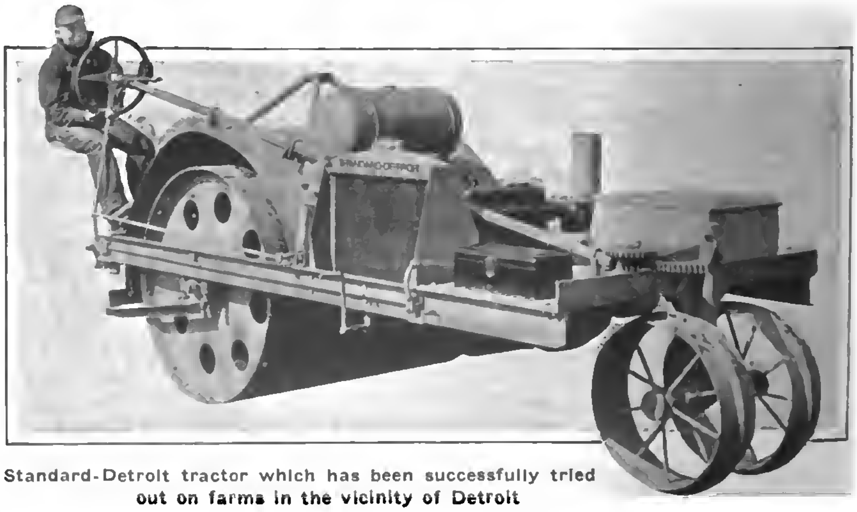
Its average gasoline mileage is 12 to 14 m.p.g., according to the same authority.

Piston Displacement Formula

In the Rostrum for April 20, page 730, appears an error on the method of finding piston displacement. The entire formula given should be divided by four, and the correct reading of this is bore × bore × 3.1416 × stroke × number of cylinders divided by four = piston displacement.

Standard-Detroit Tractor for Farm Work

THE Standard-Detroit Co., Detroit, Mich., of which M. L. Pulcher, vice-president and gen. mgr. of the Federal Motor Truck Co., is president, has brought out the Standard-Detroit tractor which has a drawbar pull of 2000 lb., weighs 3900 lb. and sells for $1,065. It is built largely along automobile lines, having a 10-20-hp. valve-in-head motor in unit with clutch and transmission, the entire assembly being oiled from the engine. All parts are inclosed and hung from the frame so that no misalignment of the bearings can occur. Only three controls are used in the operation of the tractor, which has a speed of 2½ to 3 m.p.h. One hand lever does all ordinary work and automatically disengages the gears and throws in the clutch for belt work. The radiator is unusually large and is of the cast tank type.

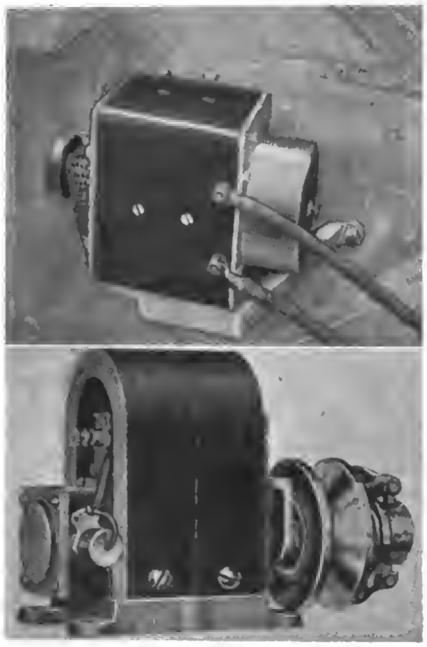


Standard-Detroit tractor which has been successfully tried out on farms in the vicinity of Detroit

ACCESSORIES

Henricks Electric Systems

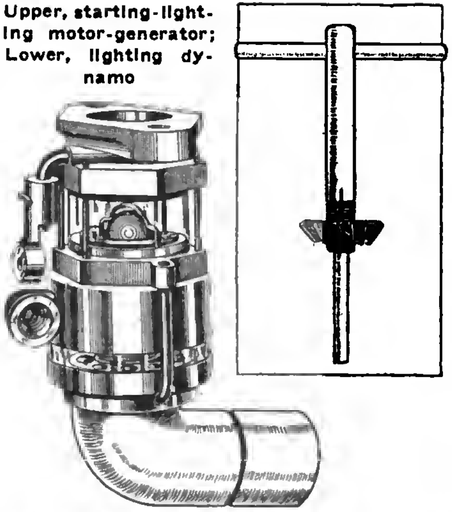
THIS company specializes on starting and lighting equipment for existing cars. The Light-a-Ford is a magneto type generator for Ford cars and has a V-grooved pulley with governor, cut-out and ball bearings. It will charge a storage battery at 6 or 7 amp. and will light lamps of an aggregate candlepower of 35 to 40. The price is $30. A complete outfit is sold, consisting of the generator, a 6-volt 60-amp. battery, a pair of 9-in. headlights, a Cutler-Hammer dimming switch, tail light and all minor equipment, such as belt, wiring, connectors, terminal blocks, etc., at $65. Special outfits for lighting are manufactured for Marmons, Overlands, Premiers and Hupmobiles, models from 1909 to 1914. The Henricks single-unit motor-generator will spin a Ford motor at about 200 r.p.m. and weighs 50 lb. Complete starting and lighting outfits for Fords cost $75, including motor-generator, storage battery and all accessories; outfits for Marmons, Overlands, Hupmobiles and Premiers cost $125.—Henricks Magneto & Electric Co., Indianapolis, Ind.



Henricks apparatus; Upper, starting-lighting motor-generator; Lower, lighting dynamo

Shain Ball Carbureter

In this carbureter the fuel supply is through fixed nozzles, and air through ports, both of which can be adjusted by screwing in plugs with holes of various sizes. Directions are furnished with each carbureter for fitting air and fuel nozzles of the proper capacities. The spraying device consists of a ball resting on a seat by gravity, there being no spring; a yoke limits the rise of the ball under suction. The fuel nozzles open under the ball; when the engine is running part of the air is taken up through the opening left by the ball, which is raised by suction, and part through ports around the ball seat. Fuel spreads in a thin layer on all sides of the ball and is readily vaporized by the air passing up at high velocity. The ball automatically shuts off the fuel when the engine stops. Glass cylinders are used around the air ports and the ball valve, so that the carbureter can be seen in actual operation. The 1 1/16-in. size weighs 1½ lb., complete with hot air horn. Price, 15/16-in., 1 1/16-in. or 1 3/16-in. outlet, $10.—Charles D. Shain, Brooklyn, N. Y.



Left — Shain ball carbureter. Right—Noonan valve-seating tool

Ton-Ford Truck Attachment

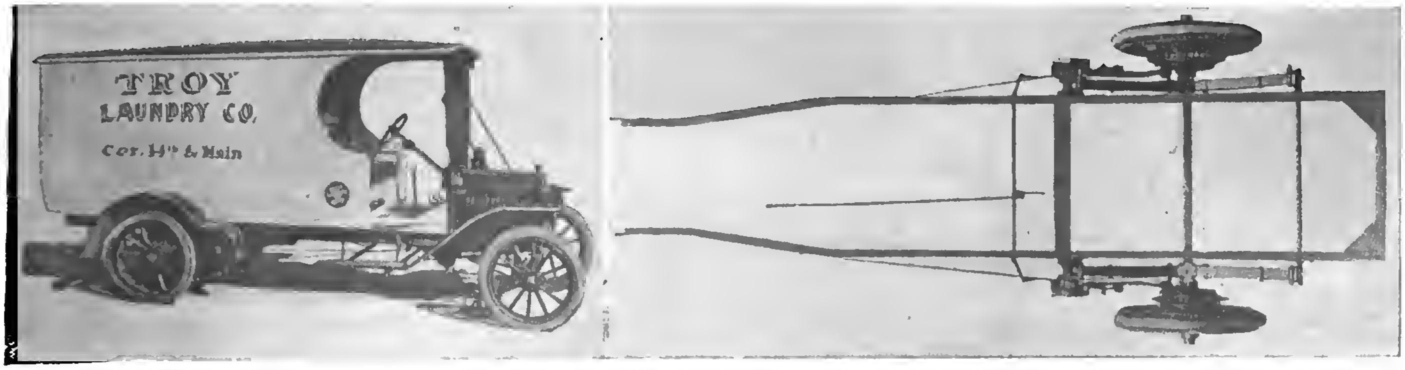
A Ford may be converted into a 1-ton truck by replacing the rear portion of the running gear with a heavy frame, driving gear and wheels. The sprockets are placed on the regular Ford axle ends and these drive to the rear wheels through chains. The frame is a 4-in. channel section. The axle is a forging 1¾ by 1⅞ in. and the wheels are mounted on Timken bearings. The brakes are of the expanding type acting on the rear wheel drums and on drums on the jackshaft. The gearing is 6 to 1 or 7 to 1 as desired. The body space is 8 ft. 4 in. long and 34 in. wide, and the wheelbase is 124 in. Price, $385.—Woodward Truck Attachment Co., Los Angeles, Cal.

Noonan Valve-Seating Tool

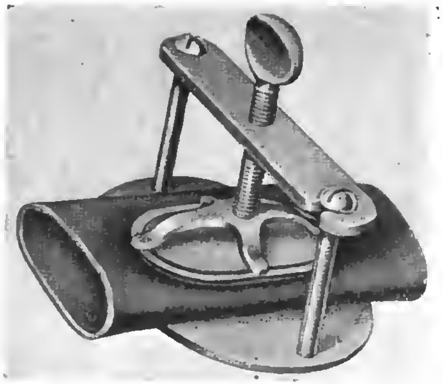
The tool is made in twenty-five sizes, and there is one that will fit each make of car. Price, $5.—D. R. Noonan, Paris, Ill.

Mutual Starting Switch

This is a starting switch of the plunger type which is designed to pass the current to the starting motor in a particular way when the plunger is operated. At first just sufficient current is sent to the motor to start the armature turning; secondly, the current is cut off long enough to allow the pinion time to mesh with the gear; and thirdly, the full current is turned on for the actual starting of the engine. This is all done at one stroke of the plunger. The throw of the switch is short, 1⅜ in., the mechanical action is smooth and easy, the parts heavy and durable and the working parts



Ton-Ford truck attachment. Right—Additional gear furnished to transform Ford into 1-ton truck. Left—Appearance with change made



Five-minute tube vulcanizer

are surrounded by a thick wall of a composition which resists both heat and electricity. The switch can be mounted on top of the electric motor or in any other desirable location. Contacts are of pure copper, very heavy and readily accessible. The makers state that the most important feature of the switch is its extremely low millivolt drop when carrying currents greatly in excess of its rated capacity; the drop on 160 amp. is given as 15 millivolts.

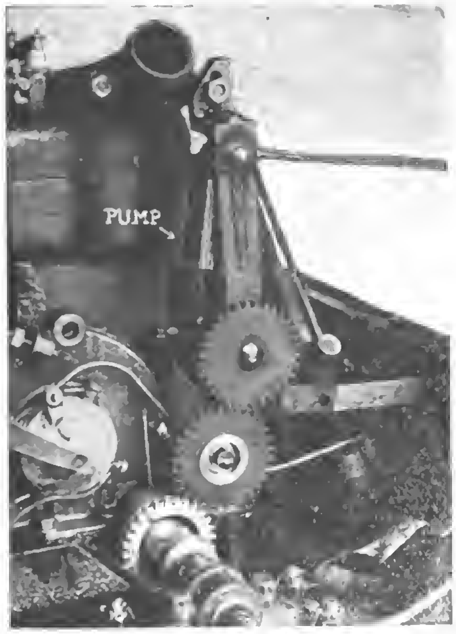
Another product is the Mutual foot switch, designed to complete the circuit between the battery and starting motor when the foot button is depressed; it contains no resistance. Each terminal is connected with four Vandam bronze finger springs and each spring carries a solid copper contact button; the eight contacts are arranged in a ring. A central cone of copper is forced into the circle by the foot button and takes current from one set of contacts and delivers it to the other. The cone is mounted so that it can turn freely; in use it gradually works around so that the wear is distributed around its surface. By removing two screws the inside of the switch can be removed and inspected without disturbing any permanent adjustments. No adjusting is needed.—Mutual Electric & Machine Co., Wheeling, W. Va.

Low's 5-Minute Vulcanizer

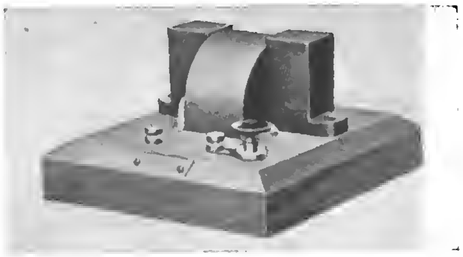
This is a tube vulcanizer of the simplest possible construction. Its claim to superiority is based not so much on the apparatus as on the principle involved in the application of the patch. The vulcanizer is merely a screw clamp with a three-armed spider on the end of the screw. The patch is of pure gum rubber and comes set into the concave side of a metal pan; a rim around the pan forms a shallow cup on the side opposite to the patch, and in this cup is a disk of cardboard impregnated with a chemical substance which causes it to burn without flame and with exactly the amount of heat required to vulcanize the patch. Thus the patch, the patch mold and the fuel are combined in a unit; the metal pan is thrown away when a patch has been applied. To apply a patch the metal pan is clamped on the tube, rubber side next to the tube, the cardboard disk is lighted and allowed to burn out and the job is finished in five minutes. The gum rubber is liquified by the heat and runs to a feather edge all round, making a permanent repair. Long rents in a tube can be repaired by applying a row of patches with overlapping edges. Price, with twelve patches, $2; extra patches, $1 per doz.—5-Minute Vulcanizer & Auto Supply Co., Kansas City, Mo.

Mutual regulating starting switch

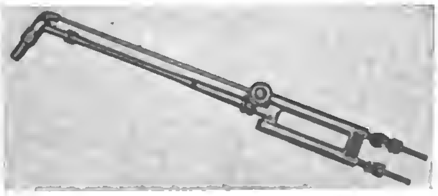
Mutual plain starting switch



Juleco F pump for Fords



Teco remagnetizing device



Meco welding torch for all work

Juleco F Pump for Fords

This motor-driven tire pump is installed permanently on the Ford engine, taking its power from the forward end of the crankshaft. A thumb-screw pushes the pump gear into mesh, and, upon attaching the hose, it will pump the tires to the required pressure in two to three minutes, it is claimed. A whistle gage gives warning when this point is attained. No change is necessary in installing the pump, a process which can be completed with a wrench and a screwdriver. The pump lists at $4.50, including hose and whistle gage.—Judd & Leland Mfg. Co., Clifton Springs, N. Y.

Teco Magnetizer

This magnetizer has a single magnet with pole-pieces projecting from opposite ends of the core mounted on a wood base; binding posts for connecting the lead wires and a switch for controlling the current are provided. The magneto magnets to be recharged are placed against the pole-pieces and the current passed through the winding of the magnet. The pole-pieces are sufficiently broad to take any standard magneto magnet. There are no moving parts other than the switch. The makers state that with a fully charged 6-volt 60-ampere storage battery from 75 to 100 magnets can be recharged. Price, $10.—Tritt Electric Co., Union City, Ind.

Meco Welding Torch

This model C welding torch is said to give a neutral flame of 6300 deg. Fahr. Tips supplied range from No. 1 to No. 10 and will do any work which can be done by the oxy-acetylene process. The cutter attachment to the torch is very simple, there being no necessity to remove the hose connections. Two operations are required, removing the nut on the oxygen valve and the union nut on the gas conduit and the torch is ready for the cutter. Other features are a thumb-controlled needle valve, automatic check valve system and a one-piece handle.—Modern Engineering Co., St. Louis, Mo.

C-Cleer for Wet Windshields

When this compound is applied to glass it is claimed that rain, snow or steam will not settle on the surface. Price, 25 cents per can.—Sole Mfg. Co., New York City.

The AUTOMOBILE

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The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Aviation and Automobiles

THE Packard twelve-cylinder aviation engine described in this issue of THE AUTOMOBILE is the first aeroplane motor to be manufactured by one of the great automobile firms of America. It is interesting to speculate upon the probability of others following the lead and making the needs of air craft a part of their business. Packard is following the lead of Mercedes in Germany, of Sunbeam in England and several of the first rank French makers of automobiles. Like these foreign firms Packard has taken the engine which it believed to be the best for high power, light weight and dependability, reproducing the stock design in a stronger and lighter form. The results so far are, of course, only experimental, but this stage has long since been passed by the European manufacturers whose confidence in their original designs has been proved correct and justifiable.

The production of good aeroplane engines is almost a toolroom job; it demands greater accuracy than is necessary for automobile work, but the production of very high-grade engines in small quantity is an excellent thing for the *morale* of any automobile factory. In the near future it is certain that there will be a good market for the best possible aviation machines; it may not be a very large market, but it will be large enough to be worth sharing. There are many firms in the American automobile industry well suited to turn out the right sort of engines and it seems that they will not be slow to grasp the opportunity.

Compound Engines

THE compound engine has been a dream of many a gas-engine engineer and a good many motors of this sort have been developed. Where weight is not important, and where slow speed is all that is required, an engine with a very long stroke allows sufficient expansion of the burning charge to prevent much waste in the exhaust, but with engines for automobiles the requirements of the case have made the stationary type of gas engine impossible.

The truck, however, has followed the passenger car, and the truck engine has been developed from much smaller sorts intended for passenger car use. Economical operation being so all-important in heavy truck service, there does appear to be a possibility, however, that the automobile type of motor is not entirely the best. The question at present is whether we can afford to add somewhat to the weight of a big truck in order to obtain a better fuel economy.

There is more than one kind of engine wherein the expansion stroke can be carried far beyond the usual automobile limits, and its natural compactness encourages the idea that much might be said in favor of a double expansion design. In any case the experiment should be worth trying.

1819 Miles

THE congratulations of the whole automobile world are due to Ralph Mulford and the Hudson Motor Car Company to-day. Man and machine covered more miles in two rounds of the clock than ever any man or any car have done before. In these days of wonderful speeds the senses become dulled to mere figures, but if New York is taken as a center and a circle struck of 1819 miles radius the prodigious length of Mulford's journey can be appreciated.

Striking from Sheepshead Bay along a straight line he could have run past Denver. Another line would have seen him in Santa Fé before the twenty-fourth hour had expired. Southward, Nicaragua would have been reached, and to the north the 1819-mile circle cuts deep into Greenland.

In thinking of this run the splendid endurance of the man is the uppermost thought, just as it was eight years ago when S. F. Edge bettered 60 miles an hour for the whole twenty-four, but the endurance of the car must not be forgotten, as this is quite as splendid. Only a very few years ago 500-mile races were run and won at speeds less than 75 m.p.h., and the cars that took part mostly broke up under the stress. All the mechanical trouble that the Hudson suffered was the destruction of six spark plugs and a couple of pins in the carbureter. Yet again, three of the four tires endured for the whole distance, which is conclusive testimony to the efficiency of the cord principle of construction and to the virtues of wood surfaced speedways.

Albright Locomobile President

A. L. Riker and J. F. Roche Are Vice-Presidents—F. R. Hickman, Sec.-Treas.

Bridgeport, Conn., April 21—At a recent meeting of the directors of the Locomobile Co. of America, this city, the following officers were elected: Raymond K. Albright, president; Andrew L. Riker, vice-president, James T. Roche, vice-president, and Frank R. Hickman, secretary and treasurer.

Boston, Mass., April 26.—The Locomobile Co. of America has filed with the Massachusetts Secretary of State a statement of its financial conditions, dated March 31, 1916, which compares as follows:

Assets	1916	1915
Real estate	$186,500	$186,500
Machinery	2,452,697	2,029,527
Merchandise, material, stock in process	4,148,055	4,235,684
Cash and debts receivable	830,554	1,049,014
Patent rights, trademarks and good will	5,515,952	5,310,798
Sundries	206,921	203,511
Total	$13,340,681	$13,015,031
Liabilities		
Capital stock	$6,250,800	$6,250,800
Accounts payable	317,673	897,426
Funded debt	2,018,500	1,176,000
Floating debt	2,775,681	2,789,448
Reserves	670,437	559,469
Profit and loss surplus	1,307,589	841,886
Total	$13,340,681	$13,015,031

100 Armored Locomobiles for U. S.

Bridgeport, Conn., May 3—It is reported here that the United States Government has ordered 100 armored cars from the Locomobile Co. of America. The cars are to carry two machine guns, the chassis used being six-cylinder types strengthened and heavily armored. They are to be equipped with pneumatic tires and will be capable of 60 m.p.h. on the road, according to the report, which credits A. L. Riker, vice-president and chief engineer of the Locomobile company and a member of the Naval Consulting Board, with the design of the cars.

In response to an inquiry as to the reliability of the report, Mr. Riker stated that he could neither affirm nor deny it.

Allen Controls Fuel Pump Co.

New York City, May 1—Wm. A. Allen, head of the Allen Auto Specialty Co., and who formed last January the Allen Pressure System Co., with a capital of $10,000, to produce gasoline and oil-storage equipment for garages, has come into full control of the latter company, having recently taken over the half interest held by F. F. Davis, who with Mr. Allen started the company.

Mr. Allen's latest product is called the Apsco system and is applicable in the pumping of gasoline or other liquids on any floor of a garage by means of pressure. This means that by leading pipes from the main tank under the garage to any part of the building, gasoline or any other fuel may be had at any time.

Few Changes in 1917 Crow

Elkhart, Ind., May 1.—The present Crow Motor Car Co.'s chassis will be continued practically without change for 1917. It will be furnished with five-passenger touring body at $725, and with special three-passenger clover-leaf body at $795. The motor is a 3½ by 5-in. L-head block with dry-plate clutch and three speed gearset on the rear axle. Specifications include: Connecticut ignition, Zenith carbureter, Dyneto two-unit starting and lighting, 112-in. wheelbase and 32 by 3½-in. tires.

New Worm-Driven Brockway

New York City, April 29.—The Brockway Motor Truck Co., Cortland, N. Y., is making deliveries on its new Model O, which is a worm-driven 1-tonner, the chain-driven Model G, of ¾-ton capacity, being dropped. The new model resembles other Brockways, having a motor under the hood, a cast-case finned-tube radiator and a unit mounting of engine, clutch and gearbox, final worm drive being on the Hotchkiss principle.

Premier Offers $300,000 Stock

Chicago, Ill., April 30—The Premier Motor Corp., Indianapolis, is offering through F. M. Zeiler & Co., this city, $300,000 in 7-per cent cumulative preferred stock, redeemable at 110 per cent and accrued dividend. The company has outstanding $1,000,000 in this stock, its par value being $100. This stock is entitled to quarterly dividends of 1¾ per cent, payable on the first day of January, April, July and October.

Collins Joins Springfield Body

Detroit, Mich., May 2—B. W. Collins, formerly assistant treasurer of the old Lozier Motor Co., and for some time connected with the United States Tire Co., has been appointed assistant treasurer and assistant to the president of the Springfield Body Co.

Dakin with Continental Motors

Detroit, Mich., May 2—C. B. Dakin, formerly in charge of the purchasing service buying of the Oakland Motor Car Co., has joined the purchasing force of the Continental Motors Co.

Illinois Roads Day May 19

Springfield, Ill., April 29—The date of the fourth annual good roads day of Illinois has been set for May 19.

Goodyear Wins Tire Machine Suit

Court Holds Seiberling-Stevens Patent Valid and Infringed by Firestone

Cleveland, Ohio, May 2—An opinion in favor of Frank A. Seiberling, president of the Goodyear Tire & Rubber Co., has been handed down by Judge J. M. Killits in the suit against the Firestone Tire & Rubber Co., charging infringement of the Seiberling-Stevens tire-making machine patents Nos. 725,135 and 726,561. The court held the Seiberling-Stevens patents valid and infringed by the Firestone company. The suit was in the U. S. District Court for the Northern District of Ohio, Eastern Division.

The Goodyear company contended that the Seiberling-Stevens machine of 1902-1903 was the pioneer, and that it paved the way for the present-day semi-automatic tire-making machine; that it was the first machine ever produced to make automobile tires, and that while a majority of the tire manufacturers have been building their tires on machines licensed under the Goodyear patents a few, among whom was the Firestone company, refused to conceive the validity of the patents covering Goodyear machines. It was alleged that about three years ago the Firestone company installed tire-making machines in its factory without taking a license under the Seiberling patent. Goodyear maintained that the Firestone machines infringed Goodyear patents and asked Firestone to discontinue their use. The suit charging infringement followed.

Machine Patented in 1904

The machine covered by the patent in suit was built by F. A. Seiberling and W. C. Stevens and patented in 1904. Its purpose was to supplant the uncertain and inefficient results of hand work in tire casing building in stretching the fabric layers with uniform machine processes. With the hand methods the tension on the fabric layers would differ with the muscular strength or degree of fatigue of the workman. Prior to 1902 automobile tire casings were made by hand and some are still made that way. Later improvements were made upon the original machine, and by 1908 nearly all Goodyear automobile tire casings were machine-made, as is the case to-day. In 1907 the company produced 28,685 tires; in 1916 its output will exceed 3,000,000, and for 1917 facilities are being provided to produce 5,500,000. This growth the company's officials attribute in a large degree to the better and more uniform product built by the machine method than was possible by hand work.

U. S. Accepts Rittman Patent

Inventor Retains Rights on Foreign or Imported Oil—10 Licenses Granted

WASHINGTON, D. C., May 2—Professor Rittman, formerly of the Bureau of Mines, has assigned his patent covering processes of producing gasoline and other products of petroleum to the government, and the Senate yesterday accepted the assignment in accordance with the joint resolution proposed by Senator James of Kentucky and Secretary Lane.

The assignment gives the government the right and title to the process patents as applied to all crude oil produced in the United States, but does not convey the interest in patents for application to oil produced in foreign countries or imported, the inventor retaining these rights.

On the assumption that the government would accept the assignment many applications for licenses to operate under the patent already had been filed and the government had granted ten applications on condition that Congress accepted the gift. The assignment by Professor Rittman is for all time and is made to the Secretary of the Interior for the use and benefit of the American people.

Stout Is Scripps-Booth Sales Mgr.

DETROIT, MICH., April 28.—William B. Stout has been appointed general sales manager of the Scripps-Booth Co., taking the place of R. H. Spear, resigned. Mr. Spear will become general sales and advertising manager of the Gramm-Bernstein Co., Lima, Ohio.

Mr. Stout has figured prominently in the affairs of the Scripps-Booth concern since the production of light vehicles was begun. He was first known as engineer for the company during the design period, and when the car was ready for distribution he was placed in charge of advertising.

Collins To Leave Buick

FLINT, MICH., April 28—R. H. Collins, well known in automobile circles as general sales manager of the Buick Motor Co., will, on July 31, sever his active connection with the Buick organization. No announcement of future plans has been made by Mr. Collins, and it is not yet known who will succeed him in the sales work of the Buick organization.

Reeke Is Jeffery Sales Mgr.

MILWAUKEE, WIS., April 29.—Alfred Reeke, president of the Reeke-Osmond Motor Car Co., 455 Broadway, Milwaukee, State agent for the Jeffery, has been appointed general sales manager of the Thomas B. Jeffery Co., Kenosha, Wis., and assumes his duties on May 1. Mr. Reeke takes the position of Edward S. Jordan, who resigned some time ago to become head of the Jordan Motor Car Co., which now is erecting a factory at Cleveland, Ohio.

Mr. Reeke's interest in the Milwaukee company has been purchased by the other stockholders, N. E. Osmond and H. M. Vogel, who will continue the business under the same name and policies.

Riker a N. A. C. C. Director

NEW YORK CITY, May 3—A. L. Riker, vice-president and chief engineer of the Locomobile Co. of America, was elected a director of the National Automobile Chamber of Commerce, at its regular monthly meeting to-day. Mr. Riker succeeds S. T. Davis, Jr., former president of the Locomobile company, who died last September.

The chamber reports shipments of approximately 28,000 carloads during April, as compared with 18,912 in the same month in 1915, and 29,540 in March, 1916. The freight car situation is better. The traffic committee met today and reported that the increased demurrage charge of $2 after three days is now in effect, though only temporarily.

A resolution was passed opposing any legislation which was antagonistic to the efficiency in the American industries, which in itself would be effective by the passage of the Tavenner bill, introduced in the House of Representatives, claiming to stop premium work and the pay of higher wages to those who do it.

There will be a meeting in this city on June 7 of the commercial vehicle interests. This will be just one day before the annual meeting of the N. A. C. C.

Short Northway Chief Engineer

DETROIT, MICH., May 1—C. R. Short, former engineer for the Russell Motor Car Co., Toronto, Can., has assumed the duties of chief engineer of the Northway Motor & Mfg. Co., succeeding E. G. Gunn, who recently resigned to become chief engineer for the Premier Motor Corp., Indianapolis, Ind.

Wade Resigns from Maxwell

DETROIT, MICH., April 27.—F. A. Wade has resigned as purchasing agent of the Maxwell Motor Co. His future plans have not yet been announced. Mr. Wade's long connection as purchasing agent of the Ford Motor Co., E-M-F Co. and Studebaker Corp., at different times, has made him one of the prominent men of the field.

Westcott Moves To Springfield

New Plant Will Permit Doubling Output—Davis Takes Westcott Factory July 1

RICHMOND, IND., May 1—The Davis Motor Car Co. has taken over the local plant of the Westcott Motor Car Co., and will occupy it on July 1. The Westcott company will move its plant to Springfield, Ohio, and will occupy the Buckeye division of the American Seeding Machine Co. Operations in this new plant are expected to start around July 1. The company now employs about 200 men and is turning out about 1000 cars a year. In the new plant the company will have facilities to more than double its output. It is understood that the plant is to employ about 400 men. The Davis company will increase its force. The management, it is stated, will remain the same, G. W. Davis retaining the title of president and general manager, W. H. Cummins as treasurer and factory manager and E. W. Winchester as mechanical chief engineer.

Moore Vim General Manager

FLINT, MICH., April 28—The Vim Motor Truck Co., Philadelphia, has formed a connection with D. K. Moore who will be assistant general manager. Mr. Moore, who for five years was sales manager of the Weston-Mott Co., this city, and who remained in that capacity until the sales department was abolished by that concern, has long been connected with the accessory field. Recently he has been engaged in the strenuous work of purchasing and rounding up materials for Weston-Mott.

The Vim company reports a sales increase for the month of March of 702 per cent, and an increase so far for April of 722 per cent.

By June 1, the company expects to be producing 1000 cars a month. The average of its contracts with the source of supply are fourteen months in advance of date.

Schwartz Resigns from Metz

WALTHAM, MASS., May 1.—W. H. Schwartz, sales manager of the Metz Motor Car Co. since 1909, has resigned. He was very active in the affairs of the company, traveling throughout the country looking after dealers and branches when not aiding in production. Mr. Schwartz will rest for some months and then enter business for himself. There have been rumors that prominent men in the West want to back him to produce a new make of automobile.

Brunswick-Balke To Make Tires

Big Billiard and Bowling Alley Fixture Firm Plans 1400 a Day

MUSKEGON, MICH., April 28—The Brunswick-Balke-Collender Co., maker of billiard tables, bowling alley fixtures and equipment, among many other products, is going to enter the automobile tire manufacturing field, and has ordered tire manufacturing machinery which will be here within two months, it is said. The Brunswick concern will enter the tire field well equipped for such production, since careful investigation and canvass of the field was made before launching on the new plan. At the start, from fifty to 100 tires a day are to be turned out, but within twelve months, it is expected that the daily output will be in the neighborhood of 1200 to 1400 tires. Immediate addition of 100 men to the present 1200 working force at the factories of the concern here will result from the taking on of this new manufacturing activity, and within a year it is expected that the added force will be 800. Present plants will take care of the tire business, but very likely additions will be necessary later.

The manufacturing plant is to be in charge of E. L. Sherbondy, who at the present time is in the east purchasing the necessary machinery. Mr. Sherbondy was for nineteen years in the experimental department of the Goodrich Tire & Rubber Co., from which he resigned to take up his present work.

The officers of the company are: B. T. Sellers, president; E. Knickerbocker, vice-president; C. H. Nash, treasurer; E. D. Ward, secretary, and L. A. Spinelli, director.

To Make Timers in Mobile

MOBILE, ALA., April 29—The Universal Commutator Co. has been organized here for the manufacture of timers for automobiles. Capitalization is $30,000 and a plant to cost nearly that amount will be established. E. B. Marshall, is president; W. C. Bumhauer vice-president; A. M. Jackson, secretary; W. A. Dozier, treasurer.

Reeps Mfg. Co. Incorporated

NEW YORK CITY, April 29—The Reeps Mfg. Co., with offices at 50 Church Street, this city, has been incorporated under New York laws for $25,000. The company will manufacture the Reeps dashboard oil and gasoline gages for automobiles; a warning signal for bicycles and motorcycles; and several other electrical and mechanical appliances.

Chas. S. Shuman, formerly with the Western Electric Co. at Philadelphia, is president and treasurer.

Aero-Cushion Tire Gets Plant

SAN JOSÉ, CAL., April 29—A factory site has been obtained by the Aero-Cushion Tire Co., this city, which was recently formed. Installation of machinery in the old Caton foundry building on West Santa Clara Street near the West San José station is being made and the plant will be working in two months.

Rich Twist Drill Co. to Move to Battle Creek

BATTLE CREEK, MICH., April 29.—The Rich Twist Drill Co., Chicago, Ill., the bulk of the manufacture of which is automobile accessories, has decided to move its factory to this city, in order to be closer to the principal market for its products. A plant to cost $45,000 will be erected at once, the site for which is 3 acres in extent and advantageously situated on the railroad. The new plants plan to start operating here July 1, and will consist of a main building 40 by 250 ft., two stories high, and two other buildings 35 by 150 ft., in addition to an office structure.

Canadian Ford Production Passes 1915 Mark

FORD, ONT., April 29—The total production of the Ford Motor Car Co. of Canada, Ltd., figure for the entire fiscal year last year already is passed, and there are three and a half months of the present fiscal year to go. It is evident by the orders coming in at the factory that although the company will be able to turn out its estimated production of 40,000 cars, even this quantity will not begin to supply all the cars for which dealers both in Canada and in overseas territory are asking.

Ideal Co. Postpones Operations

COLUMBUS, OHIO, April 29—The promotors of the Ideal Light Car Co., this city, incorporated about six months ago with an authorized capital of $100,000, which was formed for the purpose of manufacturing a light pleasure gasoline car to sell for $750, have abandoned the project for the time being because of the high cost of materials and parts. If conditions improve the project might be taken up later.

Detroit Seamless Tube Buys Land

DETROIT, MICH., April 29—The Detroit Seamless Steel Tubes Co. has acquired a large tract of land of 12 acres at Fort and Waterman Streets, this city, on which it intends to erect a new plant for the manufacture of its product. Greatly increased facilities and a larger working force will be the results.

Federal Rubber To Expand

Company Awards Contracts for Erection of Three Large Factory Additions

MILWAUKEE, WIS., April 29—The Federal Rubber Mfg. Co. has made official announcement that a large extension program has been undertaken. The contract has been awarded to the Fred T. Ley Co., Inc., Springfield, Mass., for the erection of three large buildings, and ground will be broken as soon as sub-contracts are let.

The new buildings to be erected are: Manufacturing building, steel and brick, seven stories and basement, 112 by 235 ft.; storage and shipping house, reinforced concrete and brick, one story, 106 by 113 ft.; manufacturing building, steel and brick, 200 by 116 ft., with foundations for seven stories, of which one story will be erected now.

The Federal company recently passed into the control of the Fisk interests of Chicopee Falls, Mass. Prior to the transfer, the Federal doubled the size of the plant, established in 1911, making it one of the really important tire and commercial rubber goods manufactories in the Middle West. B. H. Pratt is general manager of the Federal company.

Lane Truck Starts Work on New Plant

KALAMAZOO, MICH., April 29—The Lane Motor Truck Co., recently organized to manufacture commercial vehicles, has begun the erection of its factory here. The plant will be one-story, 400 ft. long and 80 ft. wide. It is expected that the new concern will occupy its quarters by June 1.

Doehler Gets American Die Castings

BROOKLYN, N. Y., May 2—The Doehler Die-Casting Co., Brooklyn, N. Y., and Toledo, Ohio, has acquired a controlling interest in the American Die Casting Co., Newark, N. J., which will hereafter be known as the Doehler Die-Casting Co. of New Jersey. Its present management remains unchanged.

Strike at Westinghouse Plant

PITTSBURGH, PA., April 29—A strike occurred at the East Pittsburgh works of the Westinghouse Electric & Mfg. Co. on April 21. No reason was given as no grievances had been handed in to the standing committee representing both the company and employees. However, it has developed that the principal demand is for an 8-hr. working day, and it is understood that the management was later in receipt of a communication demanding a reduction of working hours from

52 to 48 hr. a week, with no reduction in wages, this in addition to a 10 per cent advance in wages recently granted all shop employees. The company is known to be committeed as opposed to a reduction of working hours at the present time.

All the Westinghouse company plants are closed. The main works at East Pittsburgh were closed by the strikers whereas the other plants, including the Westinghouse Air Brake, Union Switch & Signal Co., and the Westinghouse automobile equipment plant at Shadyside were closed by the management. There has been no disorder of any importance.

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Harrow Spring Completing Additions

KALAMAZOO, MICH., April 29—The Harrow Spring Co., this city, is pushing to completion the additions to its plant, and it is contemplated that the new electric furnace equipment will be in operation within three weeks. A 10-per cent wage increase was recently given the 200 employees of the spring concern.

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Liberty Co. for Preparedness

DETROIT, April 29—A spirit of patriotism and preparedness is shown in a letter written by Percy Owen, president and general manager of the Liberty Motor Car Co., to the president of the University of Michigan, in which the statement is made that the Liberty company offers to start a movement whereby it will assume the payment of all expenses incurred in giving a military training to suitable college students at the military training camp at Plattsburg, New York. This offer includes transportation expenses to Plattsburg and return and all expenses which will be contracted at the training camp by the men who may be selected.

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Jeffery Opens Athletic Field

KENOSHA, WIS., April 29—The Thomas B. Jeffery Co., Kenosha, Wis., one of the pioneer western manufacturers to establish closer relations between employees and employers, has broken ground for an athletic field, to be known as Jeffery Field, for the benefit of its 2000 workmen. The stadium will be equipped for baseball, soccer, football and other sports.

—

Motor Prevents Dort Shut-Down

FLINT, MICH., April 29—When the Flint river rose 16 ft. recently the factory of the Dort Motor Car Co. was threatened with a shut-down. The engines of two chassis attached to a 4-in. centrifugal force pump lent by the local fire department, however, kept the shops and offices free of water for several days while the water was high.

Commissary Truck Requirements

Philadelphia Section S. A. E. Hears Major Lawton of U.S.A. Commissary

PHILADELPHIA, PA., April 27—Major Francis Lawton of the Commissary Department of the East, U. S. A., was the speaker of the evening at the meeting of the Pennsylvania Section of the Society of Automobile Engineers held at the Engineers' Club last night.

Major Lawton's paper was in the nature of a presentation of facts which would inform motor truck owners, manufacturers and dealers what problems they would have to meet in taking care of the commissary department of an army in time of war. His opening remarks urged the necessity for promptness in laying out a plan of operation. He dwelt on the difficulty of transportation, especially for the fast-moving columns which are employed in modern warfare.

"No branch of preparedness has received so little attention," Major Lawton said, "and the neglect is no doubt due to the fact that few realize that conditions have changed. Animals can always be secured, but motor trucks are different. Conditions are all changed now and the lessons of Europe show that rapidly-moving troops must rely on motor trucks. The American soldiers would never be able to operate a line of communication from Columbus, N. M., to Casas Grandes without the use of motor trucks which they were obliged to purchase in order to maintain a line of communication.

S. A. E. Support Necessary

"The tactical unit of an army is the division consisting of 22,000 men. This requires 175,000 lb. of food per day. In the armies of to-day the men are numbered by millions instead of thousands, and to accomplish the great task of organization necessary to handle the problems presented by these large armies we must have the support of the Society of Automobile Engineers.

"Two methods of securing food are available to men on the march or fighting in hostile countries. First, forage, and second, by carrying. Gustavus Adolphus and Napoleon, the two great tacticians, used both methods. Modern armies rely on the country in which they are operating and also draw from the rear. The French regulations state that an army in the field must draw on the country as if it were the only source of supply and the rear must be drawn upon as if it also were the only source of supply. The amount carried on the march amounts to about 1,250,000 lb. for a division and the method is to ship from the purchase point or main base to the advance depot, from the advance depot to the refilling point and from the refilling point to the various distributing points along the firing line. The carrying is done between the refilling points by supply trains, ammunition trains, sanitary trains and engineers' trains.

"The supply train carrying the food, etc., is the most active, as it must supply provisions for both animals and men. The distance of the firing line from the advance depot determines the number of refilling points, but the distance from the firing line to the last refilling point should not be more than one day's march. Each wagon, therefore, carries two days' food per load.

"With animals, the average march is 18 miles per day, and with a total distance of 75 miles from the base 780 wagons would be required. With motor trucks of about two tons' capacity the work could be done with 120 vehicles. With 240 trucks a division could operate 150 miles from its base. A division operating 40 miles from its base would require thirty trucks.

Special Types Unnecessary

"Lessons from the present war in Europe teach us the following facts:

"1. Ordinary commercial trucks are best; the special body types not necessary.

"2. Light chassis for ambulance work is best.

"3. Best all-around car, 1½ tons.

"4. Heavy armored cars have proved satisfactory.

"5. Motorcycles on a grand scale are unsatisfactory.

"6. Passenger cars make good ambulances, but the body should be arranged so that the driver is over the engine and the wounded lie between the axles.

"7. Radiators are proving to be the weak spots.

"8. The steel plate wheel is satisfactory.

"9. Electric starting is satisfactory.

"10. Electric headlights should be mounted on universal joints.

"The United States Government favors the 1½-ton truck on account of its ability to traverse the ordinary bridges without breaking them down. This, of course, only refers to the divisional trains, as larger trucks can be used satisfactorily on the main roads. To attempt to use 3-ton and over trucks on poor roads spells disaster. It has been found an absolute necessity on stone highways, however, to use these larger trucks.

Must Be Organized

"A force of 500,000 men requires over 8000 trucks of 1½-ton capacity, and the problem is where and how to get these trucks. They must be organized into units of the same make if they are to be effective. The problems are as follows:

"1. Properly organized truck units.

"2. Correct truck specifications.

"3. Lists of where these trucks and suitable chauffeurs can be found.

"4. Determination of the best body for use.

"5. A list of the necessary repair parts for each make of truck and the equipment of the repair car.

"6. A field repair shop.

"A recommended organization of the cars is into groups of sixty cars in squads of twenty. For each squad there should be one repair car, three fuel cars, one company headquarters car, four officers' touring cars and eight motorcycles. At the head of each squad there is one captain and under him three lieutenants, one first sergeant, nine first sergeant repairmen, fifty-eight sergeant drivers, eight corporal drivers and three corporal repairmen with seventy-eight privates and three corporals. The regulations adopted by the War Department have twenty-seven cargo trucks, 3000-lb. capacity; one repair truck, 3000-lb. capacity, under an organization of one truck master, three assistants, two machinists and thirty-five enlisted men."

Economy at Posts

An interesting suggestion made by Major Lawton was that if motor trucks were substituted for the ordinary horse wagons used around the posts a saving of over $700 every five and one-half years per vehicle would be made.

New Company Will Sell Parts for Orphaned Cars

NEWCASTLE, IND., April 29—Because of the rapid increase of manufacturing operations at the plant of the Maxwell Motor Co., in Newcastle, Ind., it is announced that the sale and manufacture of parts for the Stoddard-Dayton, Brush, Columbia and Alden-Sampson cars will be taken over by the Standard Motor Parts Co., Newcastle.

Now Singleton-Hunting Co.

CLEVELAND, OHIO, April 29—The corporate name of the Singleton-Tripp Co., general advertising agents in this city, has been changed to the Singleton-Hunting Co. The change is being made in recognition of J. P. Hunting, who has been vice-president since Jan. 1.

Truck Exhibition for Savannah

SAVANNAH, GA., April 29—An exhibit of motor trucks, tractors and other road equipment will be a part of the annual convention of Georgia Society of Wardens and Road Superintendents, to be held in Savannah from May 23 to 25. Harry Rose, acting secretary of the convention, is making arrangements for the exhibit at the fair grounds.

Mack AC Averages 35 M.P.H.

Covers 90 Miles in A. C. A. Test—52 M.P.H. Is Maximum Attained

NEW YORK CITY, May 1—Loaded with 200 rear axle forgings, a Mack AC model 3½-ton truck has been undergoing some strenuous tests under the direction of the engineering department of the Automobile Club of America. These tests have been undertaken by the International Motor Co. to demonstrate the adaptability of heavy trucks to high speeds, such as demanded in fire, police, motor bus and military work; and to show what fuel consumption may be expected.

The first test was made Wednesday, April 4, on the Long Island Motor Parkway, a 45-mile stretch of speedway, after the refusal of the Sheepshead Bay Speedway Assn. to permit the truck to be tested on the Sheepshead Bay track. This test was preceded by a run from New York to Yonkers and return, under full load and with the standard sprockets. Between 45 and 50 miles were covered with an average fuel consumption of between 6 and 7 m.p.g.

The speed test on the parkway consisted of about 90 miles of running, during which time the truck averaged about 35 m.p.h., the maximum attained being 52. The total weight of the truck and its load was 16,770 lb., of which about 9000 was the weight of the chassis itself, leaving a net load of 770 lb. in excess of the rated capacity of the truck.

Few Changes from Stock

The only changes from stock were the application of an auxiliary oil tank back of the cab with a hand-pump feed, by which the oil might be pumped into the crankcase, a restricted overflow passage on the upper oil tank to increase the oil pressure and 25-tooth sprockets on the jackshaft to give a 5.42 to 1 gear ratio.

A second test is being conducted on the Motor Parkway to-day, using a different make of carbureter. The Automobile Club has not issued its report on the tests as yet and so only approximate results can be given here. In the first test a valve-stem was broken and the full distance of 100 miles was not covered, which requires that a second test be conducted.

France Bars Incompetent Drivers

PARIS, April 2—Only automobile drivers who held a Government driving license prior to the war are now eligible for truck and car service in the French army. This measure has been adopted in order to weed out incompetents. During the past twelve months an immense number of automobile schools have been formed in France and soldiers on leave have been entitled to take driving lessons. Government licenses have been granted these pupils, but very few of them can do more than hold a steering wheel and the men are really dangerous in active service among the convoys at the front. Under the new scheme men who have had three or four driving lessons and no practical road experience cannot get into the army automobile service.

Trucks for French Army Transport Supplies from Docks

PARIS, April 7—American trucks imported for the French army no longer make their initial trip from the port to the central depot near Paris without a load aboard. It has been the practice to put these trucks in charge of military crews and send them by road from Havre, St. Nazaire or La Rochelle to Paris under their own power. These trips were always made empty, as a matter of official routine, although these three ports, and particularly Havre, were congested with hundreds of tons of goods the railway was incapable of handling. Under the new arrangement every convoy going out of these ports toward Paris will pick up a load of either military material or general merchandise and will deliver it at Paris or at some point along the route.

The first two of these live convoys comprised sixty-six Whites and forty Velies, carrying between them 232 tons of general merchandise, came through to Paris this week. These 232 tons have been brought through at practically no cost; without the automobiles the goods would have still been lying on the dock side waiting railroad facilities. The system is so simple and is so satisfactory to everybody concerned that the only surprise is that it has not been adopted earlier. For over a year big convoys have been coming empty four or five days a week from Havre to Paris, while perishable goods and urgently needed material was left behind on the docks. An intelligent understanding between civil and military authorities was all that was needed to overcome the difficulty.

Westinghouse Ford Starter Now $85

EAST PITTSBURGH, PA., April 29—The Westinghouse Electric & Mfg. Co. has recently announced an increase in the retail price of their starting and lighting equipment for Ford cars to $85. This increase is due to the marked rise in the cost of raw materials.

To Discontinue Moore Truck

LOS ANGELES, CAL., April 29—The Moore truck, manufactured by the Pacific Metal Products Co., Torrence, Cal., will no longer be manufactured according to a decision recently reached.

S. A. E. Standards Appreciated

Will Be Used by National Gas Engine Assn. Wherever Possible for Tractors

NEW YORK CITY, May 1.—That the work of the Standards Committee of the S. A. E. is being appreciated widely is shown by a letter which is being circulated to members of the National Gas Engine Association, announcing that body's Summer meeting, June 27 to 29, in Chicago.

"If there should be any doubt in the minds of the users, dealers or manufacturers interested in engines and tractors," says Secretary H. R. Brate, "we would call attention to the automobile situation for 1916. It is said that of the 1,000,000 cars that will be sold during the present year, three-fourths will be standardized cars selling at less than $1,000. The standardized parts will consist of starters, carbureters, speedometers, ignition and lighting systems, transmissions, differentials, tires, wheels, axles, rims, bearings, etc. In a large proportion of these cars you may substitute one carbureter or magneto for another, you may use any make of tire you wish, you may change the spark plugs at will. And in addition to this, you would be paying at least double the price of the car were each make to have had other than a standardized dimension of rim, differential, etc. It is something along this line of work that we expect to accomplish through the National Gas Engine Assn."

Railroads Standard

"Railroads were standardized with respect to the distance the rails should be from one another. Before that time, you might be shipping a carload of stuff from Cleveland to Chicago and perhaps every hundred miles the railroad companies would change their gage. As a result, the car could not be carried through, and every time the gage changed, the car had to be unloaded and the goods loaded into another car. What more simple thing could be done than to set the rails the same distance apart from New York to San Francisco and run cars through? That is what standardization means—time and labor and expense saved.

"In the automobile lines it has come about that the Society of Automobile Engineers has adopted certain rules of this sort. No one is obliged to use them. There is no compulsion about it. Every spark plug manufacturer, for instance, can make his plugs of different dimensions and with different styles of threads. But if the owner of a car steps into an automobile supply store to get a spark plug, he wants one to fit his car. With standardized plug dimensions, any plug will go into his cylinder heads. With each manufacturer using a different thread, imagine the confusion. It might be all right for the manufacturer, provided he could tie up all his business, but he can't. What one loses, another may make, and vice versa. Therefore, the spark plug people find they sell more plugs and satisfy their dealers and users better if any plug can be put in.

Will Use S. A. E. Standards

"The work of the National Gas Engine Assn., then, along the line of standardization is not with the effort to make all engines or all tractors alike. Automobile standards do not always suit in engine and tractor design. Where they do suit, it has been the spirit of the N. G. E. A. standards committee to adopt them. Where they do not fit the conditions, it has been decided better to try to work out some size, style or condition that is fairly uniform and that may be used quite generally to the best advantage. If any particular manufacturer finds that the size recommended for standard does not meet his needs, he is welcome to use what he thinks best. Magneto standards, for instance, have been fairly well worked out, so that almost any make of magneto may be applied to an engine without changing the design. If, however, some manufacturer thinks a special design is better for him he can have it used on his outfits.

"Much of the attention of the coming convention of the National Gas Engine Assn. will be devoted to the extension of this work. A considerable interest has been created as was manifested at the recent meeting of the standards committee in Chicago, so that there will undoubtedly be opportunity for accomplishing a great deal along this line when the association meets at the Sherman Hotel, Chicago, June 27, 28 and 29."

France May Provide Compulsory Technical Education for Workers

PARIS, April 7—The French automobile industry is directly interested in a new law now before Parliament providing for free and compulsory technical education for workers under eighteen years of age. The general scheme is based on that already adopted by Germany, Austria and Switzerland. It provides for the establishment of technical schools in every district, the central and local authorities sharing the expense, which must be attended by all young factory workers. These schools can be established by employers in the factories, if desired. Lessons will be given during the legal working day, and will be four hours per week or 100 hours per year minimum and eight hours per week and 200 hr. per year maximum.

Allies' Aero Engines Water-Cooled

Fixed Cylinders Also Win Preference in France Over Rotary Types

PARIS, April 2—In the extension of the Allied aeroplane fleets, there has been an important slide to the fixed cylinder water-cooled six, eight and twelve-cylinder engines, to the detriment of the rotary types which held the board prior to the war. It is no secret that French, Italian and English firms have more or less faithfully copied the Mercedes six-cylinder water-cooled engine, which is practically identical in design to the 1914 Mercedes Grand Prix engines, one of which is now owned by Ralph de Palma. The feature of these engines is steel cylinders with steel jackets and either two or four valves in the head, operated by an overhead camshaft. While some makers have produced an exact copy of the Mercedes, others have made detail improvements, and a few have produced the same type of engine with twelve cylinders. A respectable number of captured Mercedes aeroplane engines are in use on French aeroplanes, and many partly damaged engines have been put into service again after being repaired with spare parts from the French shops.

Factors in Car Price Classes in Order of Importance

NEW YORK CITY, May 2—In the report appearing in THE AUTOMOBILE for April 20 of the paper by Paul Smith, sales manager of the Chalmers Motor Co., before the Detroit S. A. E., on Interpreting the Public to the Engineer the five most important factors in the different car price divisions were arranged incorrectly.

Mr. Smith's idea was to show the relative significance of these factors in each of the price divisions by arranging them in the order of their importance. The list is correctly given herewith:

$2,500 and up—Motor types—6, 8 and 12

Reliability
Appearance
Performance
Economy
Price

$1,750 to $2,500—Motor types—6 and 8

Reliability
Appearance
Price
Performance
Economy

$1,250 to $1,750—Motor types—6 and 8

Reliability
Performance
Price
Appearance
Economy

$850 to $1,250—Motor type—6

Reliability
Performance
Economy
Appearance
Price

$350 to $850—Motor type—4

Reliability
Price
Economy
Performance
Appearance

G. M. Sales Estimate $100,000,000

Gross Earnings for First Eight Months of Fiscal Year Ending July 31

NEW YORK CITY, May 2.—Estimated earnings of the General Motors Co. for the eight months of the fiscal year to end July 31, made public yesterday, showed gross sales of $100,000,000, an increase of $42,637,161. The balance available for the common stock for the period, based on the report, was given as $17,000,000, equal to 103 per cent on the issue for the eight months, compared with 58 per cent earned in the same period a year ago.

President C. W. Nash, president of the company, in his report says: "The demand for cars made by your companies continues strong and indications are that it will not lessen during the balance of the fiscal year. Earnings should continue satisfactory unless the difficulty in obtaining sufficient material necessitates curtailment.

"On account of the material situation, it has been necessary to stock larger quantities than in normal times, but notwithstanding our larger inventories and the disbursement of more than $12,000,000 for dividends on common stock and the retirement of the 6 per cent five-year notes since Aug. 1, the cash position of your company is very strong, showing at this date $3,000,000 in excess of a year ago."

The General Motors estimated report for eight months compares as follows:

Cars and trucks sold—

1916	1915	Changes
86,568	48,487	38,081

Gross sales, estimated to March 31—

1916	1915	Changes
$100,000,000	$57,862,889	$42,637,161

Balance available for common, estimated—

1916	1915	Changes
$17,000,000	$9,581,542	$7,418,458

Rubber Prices Lower

NEW YORK CITY, May 2—The further lowering in prices of crude rubber featured the materials markets last week. Up-river Para dropped 2 cents a pound to 71, and Ceylon, first latex, dropped 2½ cents a pound to 79. This grade dropped 1 cent the previous week.

Aside from the rubber situation, the market was steady. Lead departed from its usual high quotation and dropped 12 cents per 100 lb. to $7.38. Tin was strong at $51.50 per 100 lb.

Copper is holding strong at 29½ cents a pound. A preliminary statement, issued by the U. S. Geological Survey, gives the smelter production of primary copper in the United States in 1915 as 1,388,000,000 lb., compared with 1,150,000,000 in 1914, an increase of 21 per cent. At an average price of 17.5 cents a pound, the 1915 output would have a total value of $242,900,000, compared with $152,900,000 in 1914. Michigan has displaced Utah as the third largest producer, the latter having outdistanced Michigan in 1914. The four leading States in the order of their rank now are Arizona, Montana, Michigan and Utah.

Steel prices have remained unchanged at $45 per ton. The demand for automobile steel is forcing the steel companies to expand. Following the report that the Carnegie Steel Co. is to add to its cold rolled strip steel production by changes at the Edgar Thomson works, comes the announcement that the Trumbull Steel Co., Warren, Ohio, is also to add sixteen stands of rolls for rolling the same product. Both increases are to meet the demand of the automobile trade, which is pressing heavily for this product on all mills.

Monarch Creditors to Meet

DETROIT, MICH., May 1—First meeting of the creditors of the Monarch Motor Car Co., which was adjudicated bankrupt by Lee Joslyn, referee in bankruptcy for the eastern district of Michigan, on April 24, has been called for May 9, at which time creditors have been requested to appear and prove their claims. The company's liabilities are set at $5,753.03 and the assets at $20,833.15.

Security Prices Higher

Favorable News from Abroad Results in General Rise of Quotations

NEW YORK CITY, May 1—Automobile and accessory issues responded last week to the favorable news in regard to the amicable settlement of affairs with Germany, most of the stocks being most favorably affected. Maxwell issues recorded most substantial gains as did Chevrolet, General Motors, and Willys-Overland. Chevrolet rose 18 points; General Motors rose 26 points; and Willys-Overland went up 18 points.

The market awoke from its lethargy on Saturday with much activity on the Exchange. Apropos of the Maxwell activity, there have been two distinct well-sustained bull moves in its stocks. On the first rise last week, the pace was too fast for those inside and they dropped their stock rather too soon. Maxwell common came back some 30 points. Predictions of a 7 per cent dividend on the first preferred and 6 per cent on the second preferred, leaving a 10 per cent dividend on the common, was responsible for a quiet accumulation of that stock.

Some of the other issues which went up last week were: U. S. Rubber common, 24½ points; Chalmers common, 4 points; International preferred, 2 points; Peerless, 2 points; Studebaker common, 11 points, and Goodrich common, 2¾ points.

S. O. Doubles 1914 Earnings

NEW YORK CITY, May 2—The Standard Oil Co. of N. Y. reports net earnings after deduction of depreciation charges of $15,761,663 for 1915 as compared with $7,735,919 in 1914. This is at the rate of about 21 per cent on a capital stock of $75,000,000 as compared with 10.3 per cent in 1914. During the year it has paid out in dividends $6,000,000 leaving a surplus of $9,761,663 as against a surplus of $1,735,919 in 1914. Added to a previous surplus of $16,701,591 there is a profit and loss surplus of $26,463,254.

Ideal Wheel Triples Capital

MASSILLON, OHIO, April 29.—The Ideal Wheel Co., which operates a factory at Massillon, where steel wheels for motorcycles, automobiles and aeroplanes are manufactured, increased its capital stock from $50,000 to $150,000 at a meeting of stockholders at Cincinnati. Ten thousand shares will be issued at $10 par value.

The Ideal Wheel Co. was organized in 1912 and was the owner of the patent and manufacturing rights of the

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	58	.58	.58	.58	.58	.58	...
Antimony	.40	.38½	.37½	.37½	.37½	.36½	— .03½
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.29½	.29½	.29½	.29½	.29½	.29½	...
Copper, Lake, lb.	29½	.29½	.29½	.29½	.29½	.29½	...
Cottonseed Oil, bbl.	10.75	10.75	10.75	10.72	10.70	10.83	+ .08
Fish Oil, Menhaden, Brown	.54	.54	.54	.54	.54	.54	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	.98	.98	.98	1.03	1.03	1.03	+ .05
Lead, 100 lb.	7.50	7.47½	7.42½	7.38	7.38	7.38	— .12
Linseed Oil	.76	.76	.76	.76	.76	.76	...
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kan., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	..
Rubber, Fine Up-River, Para	.73	.72	.71	.71	.71	.71	— .02
Rubber, Ceylon, First Latex	.81½	.81	.79	.79	.79	.79	— .02½
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	2.00	2.00	2.00	...
Tin, 100 lb.	49.50	49.50	49.50	50.25	50.25	51.50	+2.00
Tire Scrap	.06½	.06½	.06½	.06½	.06½	.06½	...

Ideal Steel Wheel Co., which had a plant at Winton Place. The latter company moved its plant to Elkhart, Ind., in 1914, and in 1915 went into the hands of a receiver. The Ideal Wheel Co. bought out the receiver, E. C. Crow, Elkhart, and moved the plant to Massillon.

The following are the directors of the company: L. E. Levassor, L. L. Dolle, W. B. Hall, D. T. Mount, Anthony Schemel, Charles Ayres and F. H. Goosman. Mr. Ayres is from Wilmington, Ohio. The other men are Cincinnatians.

Dividends Declared

Milwaukee Motor Co., Milwaukee, Wis., second dividend of 10 per cent, amounting to $25,420.55, in favor of creditors of that defunct company.

Prest-O-Lite Co., $1.50 a share, payable May 1, to holders of record April 24.

B. F. Goodrich Co., quarterly of 1 per cent on common, payable Aug. 15 to stock of record Aug. 4.

Yale & Towne Mfg. Co., extra dividend of 5 per cent out of past earnings, payable May 8 to stock of May 1.

Lee Rubber Co., initial quarterly of 50 cents a share and an extra dividend of 25 cents a share, payable June 1 to stock of record May 15.

Briscoe Motor Corp., initial quarterly of 1¾ per cent on preferred to holders of record April 27.

Studebaker Declares 1 Per Cent Extra

Studebaker Corp., quarterly of 1¾ per cent on preferred, 1½ per cent on common and extra of 1 per cent on common, all payable June 1 to stock of record May 30.

Good Crops Predicted for Texas

Farmers Optimistic and Are Investing in Automobiles—Large Sales Promised

AUSTIN, TEX., May 1—Favorable prospects for another splendid crop season all over Texas are serving to stimulate the automobile trade very considerably. Inquiry of dealers in different sections of the State bring the unanimous answer that the demand and sale of automobiles, motor trucks and delivery vehicles are larger than ever before known. Many farmers who had deterred placing order for cars on account of the drouth that prevailed during most of the winter have had their optimistic feeling as to the crop prospects revived by the heavy and seasonable rains and they are investing money in automobiles instead of holding on to it as a means of tiding them over what promised a few weeks ago to be a dry season.

110,000 Cars in Texas

It is claimed by men who are in close touch with the automobile trade in the State and who have gathered more or less complete statistics on the subject that there are now not less than 110,000 automobiles in use in Texas. This late estimate is considerably in excess of the figures that were given in some reports that were issued a few months ago which placed the number of cars at 80,000 to 85,000.

It is the opinion of many dealers that there will be many more cars sold in Texas this year than in any one year before. The average farmer of the State has now reached the point that he regards the automobile as one of the prime necessities of his business. The introduction of these vehicles to the farming class has opened a new world to that element of citizenship. They are not only able to obtain practical and profitable benefit from the use of the cars, but they are able to enjoy pleasures that were never open to them before.

Truck Sales Large

The increasing prices of mules and horses are having a tendency to enlarge the demand for motor trucks and motor delivery vehicles, it is stated. Nearly every industrial plant of any magnitude in Texas now does its hauling by means of the motor truck. This is true not only of the cities and towns, but of the country districts as well.

Ford to Fight California Tax in United States Supreme Court

SAN FRANCISCO, CAL., April 29—The Ford Motor Co. will carry its fight against the payment of a State franchise tax of $24,000 to the United States Supreme Court. Governor Johnson several weeks ago ordered the company's license to do business in California revoked, following its refusal to pay the tax.

Detroit Drivers Responsible for All Accidents to Pedestrians

DETROIT, MICH., May 1—Police Commissioner John Gillespie, who has figured prominently in many of the traffic re-

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	65	66	—1
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	81	87	85	89	—1
Chalmers Motor Co. com	90	95	154	160	+4
Chalmers Motor Co. pfd	95	97	98½	99¼	+1½
Chevrolet Motor Co	..	..	196	199	+18
Electric Storage Battery Co	51	52	58½	59½	—3½
Firestone Tire & Rubber Co. com	465	..	800	..	..
Firestone Tire & Rubber Co. pfd	110	112½	114	117	..
General Motors Co. com	143	145	426	446	+26
General Motors Co. pfd	101	103	113½	114½	+2
B. F. Goodrich Company com	50	52	76¼	76¾	+2¼
B. F. Goodrich Company pfd	102	102½	114	115	..
Goodyear Tire & Rubber Co. com	262	..	405	440	..
Goodyear Tire & Rubber Co. pfd	104½	105	117	119	+1
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	13½	14½	10	14	..
International Motor Co. pfd	29	32	22	30	+2
Kelly-Springfield Tire Co. com	135	137	71¼	71¾	+ ¾
Kelly-Springfield Tire Co. 1st pfd	83	86	96½	97½	+1½
Kelly-Springfield Tire Co. 2nd pfd	130	140	..	..	..
Maxwell Motor Co. com	52	53	77	78	+7½
Maxwell Motor Co. 1st pfd	84	86	85	86	+8
Maxwell Motor Co. 2nd pfd	40	42	57	58	+7
Miller Rubber Co. com	180	189	265	..	..
Miller Rubber Co. pfd	104	106	113½	115½	..
New Departure Mfg. Co. com	..	..	190	195	..
New Departure Mfg. Co. pfd	..	..	112	..	..
Packard Motor Car Co. com	105	115	165	175	..
Packard Motor Car Co. pfd	99	..	100	104	..
Paige-Detroit Motor Car	..	..	750	850	..
Peerless Motor & Truck Corp	..	..	22	24	+2
Portage Rubber Co. com	35	38	75	77	..
Portage Rubber Co. pfd	85	88	108	109	..
Regal Motor Co. pfd	..	..	15	22	—5
*Reo Motor Truck Co	14½	15½	27	29	—1¼
*Reo Motor Car Co	32	33	38½	39	+ ½
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	69½	71½	84	86	— ¾
Stewart-Warner Speed. Corp. pfd	103	105	109	110	..
Studebaker Corp. com	76	78	131	132	+11
Studebaker Corp. pfd	101	103	108	111	..
Swinehart Tire & Rubber Co	81	90	84	86	..
Texas Co.	129	131	187	189	+8
U. S. Rubber Co. com	70	71	75	76	+24½
U. S. Rubber Co. pfd	108	109	106½	109½	+ ½
Vacuum Oil Co	213	215	239	243	+9
White Motor Co (new)	..	..	48	49	+1½
Willys-Overland Co. com	116	118	228	230	+18
Willys-Overland Co. pfd	100	102	103	104	+ ½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	30	..	..
Chalmers Motor Co. com	93	94½	..	161	+6
Chalmers Motor Co. pfd	95	97	96½	..	..
Continental Motor Co. com	..	185	36	37	+2
Continental Motor Co. pfd	82	85½	..	10¼	..
Ford Motor Co. of Canada	700	..	..	400	+5
General Motors Co. com	143	144½	400	450	+10
General Motors Co. pfd	100	102	111	113¼	+ ¼
Maxwell Motor Co. com	52½	54½	72	75	+3
Maxwell Motor Co. 1st pfd	84	86	83	85	+1
Maxwell Motor Co. 2nd pfd	40½	42½	54	57	+2½
Packard Motor Car Co. com	..	..	..	172	+2
Packard Motor Car Co. pfd	95	..	..	104	..
Paige-Detroit Motor Car Co	..	..	800	850	..
*Reo Motor Car Co	..	32¼	38⅜	39⅝	+ ⅜
*Reo Motor Truck Co	14⅞	15½	28	29	+ ½
Studebaker Corp. pfd	101	103	108	..	..
Studebaker Corp. com	77½	79½	127½	131	+5

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	195	..	320	365	..
*W. K. Prudden Co	19¼	19½	30	32½	..
Regal Motor Car Co. pfd	14	20	15	22	..

*Par value $10.

forms that have gained such wide adoption throughout the country, and who is responsible for the tennis court traffic lines and the Stop and Go semaphores at street intersections, has come out with another edict that is new to the regulation of traffic in this country. Due to the great number of traffic accidents in this city in which pedestrians have figured, the Commissioner holds that hereafter the driver of a car is responsible for accidents to foot traffic under any conditions. That is, even though a pedestrian carelessly backs into the street and gets run down, or if someone drops apparently from nowhere in the path of the car and gets hurt, or for any other similar circumstances, which heretofore has been regarded as no fault of the car driver, the latter henceforth will be held responsible and will have to go to jail.

One Drink Makes Car Driver Guilty of Negligence

Louisville, Ky., April 29—Persons operating automobiles while under the influence of liquor or even after partaking of strong drink, no effort being made to define the number of drinks required to cause intoxication, are guilty of negligence per se, according to a ruling made by Judge W. H. Field in instructing a jury in the case of E. G. Heartick against W. C. Semple, and acting on the instruction the jury returned a verdict awarding Heartick a judgment of $400 against Semple.

The case is the first on record in local courts in which an instruction was given covering intoxication in which the court held that to operate an automobile after indulging in drink was an act of contributory negligence on the part of the driver.

Slater Bill a N. Y. Law

Albany, N. Y., April 27.—Governor Whitman has signed a bill introduced by Senator Slater, making it a misdemeanor to wilfully place on a highway any glass, tacks, nails or other substance which might injure an animal or person or puncture an automobile tire.

Driver Responsible for Violation of Law

Madison, Wis., April 29—The Attorney General of Wisconsin holds, an an opinion handed down recently, that only the driver, and not the owner, should he be seated in the motor vehicle, is responsible when the law is violated. Richland County officials brought up the point and were instructed to prosecute only the chauffeur in a case where the car was not stopped for a frightened horse, as required by law. The owner of the car was in it at the time.

$4,500 for Master Drivers

Bosch Co. To Present $1,000 Trophy and $3,500 Cash to Winners

New York City, April 29—By arrangement with the contest board of the American Automobile Assn. the Bosch Magneto Co. will present the Master Driver selected by the board with the silver Bosch trophy valued at over $1,000 and $2,000 in cash. The trophy will also bear the secondary title of Champion Motor Car Driver Trophy. To the driver rated second in the number of points awarded in the Master Driver contest the Bosch company will give $1,000 in cash and to the third driver, $500 in cash. All these prizes will be won outright.

It is planned to hold a banquet in Chicargo during the 1917 show week for the awarding of the trophy and cash prizes. In the past six years the Bosch company has donated over $25,000 in cash prizes for various events.

O'Donnell in Duesenberg Wins Raisin-Day Race

Fresno, Cal., April 29—Eddie O'Donnell, driving a Duesenberg won the 300-mile Raisin-Day Race from the field of seventeen starters making his third win this month. His time was 4:54.13 and his average speed 61.01 m.p.h. Jim Parsons was second and Frank Elliott third. Earl Cooper was ruled out at the end of the 25th lap for failure to report a change of mechanicians. O'Donnell receives a cash prize of $3,000 and a silver cup. O'Donnell has used Oilzum in all his races this year.

Bert Dingley Back Again

Los Angeles, Cal., April 25—Bert Dingley, who was injured in the Tacoma Speedway, July 4, 1914, has recovered from his injuries sufficiently to enable him to return to the motor car industry. Dingley was recently appointed manager of the William R. Ruess Co., and will devote his energies to the selling of Mitchell cars.

Gardena Race Meet May 6

Gardena, Cal., April 25—The speed event for semi-professionals that will be staged at Gardena on May 6, will be the first road race ever held in Southern California minus an admission fee. This race will be a part of the Strawberry Day celebration, another feature of which will be a great floral pageant.

Entries will be restricted to cars having a piston displacement of 231 cu. in. or under. The event will be classed as a class "C" division 5 race, and will be the first of its kind ever sanctioned by the A. A. A. in Southern California. In addition to the prize money, a valuable trophy will be offered, and it is expected that a large field of small cars will be entered.

23 Sheepshead Entries to Date

New York City, May 2—The entries of an Adams Special and another Sunbeam for the Sheepshead Bay Speedway race on May 13 brings the total entry list up to twenty-three. The Adams Special is entered by George Adams, a wealthy sportsman. The Sunbeam is entered by Joseph Christiaens and is a duplicate of the six-cylinder car which he will drive in that race. No driver as yet has been named for the car. The latest Sunbeam entry is now on its way here from London.

24-Hr. Sheepshead Race Postponed

New York City, April 26.—The 24-hr. race scheduled for the Sheepshead Bay Speedway on June 16 and 17 by the Trade Racing Assn., this city, has been postponed. Several of the automobile makers who are contemplating entering the event pointed out to the association the advisability of postponing the race until such time as their new models appeared.

Luverne Adds Combination Fire Apparatus to Its Line

Luverne, Minn., April 29—The Luverne Automobile Co., manufacturer of a touring car, has added to its line a combination motor fire apparatus, to meet the needs of small and medium size cities and to give fire protection in country tributary to the cities in which the trucks are operated.

The motor has six cylinders, 4 by 5 in. Tires are cushion type, dual at the rear. Wheelbase is 150 in. The motor has self-starter, and there are electric lights and double ignition.

Fire equipment is chemical tank, chemical hose with reel, hand extinguishers, ladders, axes, etc. The steel hose body has space for 1200 ft. of 2½-in. hose and standing room for eight men. Price of the outfit is $3,500.

The Luverne company has also placed on the market a hearse which it has listed at $3,000. The chassis carries a 60-hp. six-cylinder engine electrically equipped. Wheelbase is 150 in. and tires 36 by 4½ in.

Riley Goes with Jordon

Cleveland, Ohio, May 1—W. B. Riley, formerly assistant sales manager of the Thomas B. Jeffery Co., has become assistant to E. S. Jordon in the direction of sales of the Jordon Motor Car Co.

Twenty Entries for Indianapolis

List Includes 4 Peugeots, 1 Sunbeam and a Delage—One Unnamed Car

INDIANAPOLIS, IND., April 28—Twenty entries have been made to date for Sixth International Sweepstakes Race on the Indianapolis Speedway May 30. The latest entrants are Ralph Mulford, Resta, Aitken and Merz in Peugeots; Oldfield in a Delage; Rooney and Anderson in Premiers; Osteweg in a Osteweg Special, and DuChesneau in a DuChesneau.

Oldfield on Delage

Merz and Aitken will drive cars owned by the Indianapolis Speedway Team Racing Co.; Oldfield will drive one of the Delages built for the Grand Prix in Europe in 1914. This car has a block type motor, with valve in the head, with a bore and stroke of 3.70 by 6.3, and a cu. in. piston displacement of 271.8. He finished third with this car at Elgin last year in the C. A. C. cup race. He also entered it at the Sheepshead Bay Speedway race last year, but was forced out at the end of the 16th mile with a broken piston and connecting rod.

Rooney on Premier

Rooney will be at the wheel of the new Premier that was designed for the late Bob Burman. The Osteweg Special entry is from Lee, Ill., is entered by Apperson & Osteweg, who have built a special car. The car weighs about 2400 lb., has four cylinders, 4 11/32 by 5 in., and a piston displacement of 296 4/10 cu. in. O. Bloomberg or J. Booth will act as relief driver and mechanician to Osteweg.

The entries to date are:

Car	Driver
Sunbeam	Christiaens
Peugeot	Aitken
Peugeot	Merz
Frontenac	L. Chevrolet
Frontenac	A. Chevrolet
Frontenac	G. Chevrolet
Peugeot	Mulford
Premier	Anderson
Premier	Rooney
Premier	Stillman
Du Chesneau	Du Chesneau
Peugeot	Resta
Maxwell	Rickenbacher
Maxwell	Henderson
Duesenberg	O'Donnell
Duesenberg	D'Alene
Duesenberg	Unnamed
Delage	Oldfield
Osteweg	S. Osteweg
Unnamed	Unnamed

INDIANAPOLIS, IND., April 26.—Howard C. Marmon, chief engineer of the Nordyke-Marmon Co., has been named referee for the 300-mile race at the local speedway on May 30. G. M. Dickson, general manager of the National Motor Vehicle Co., this city, has been appointed starter. Chester S. Ricker has been appointed the head of the timing, scoring and technical committees for the local speedway race May 30. He will be in charge of the three departments. G. A. Weidely will be the first assistant head of the technical committee; O. A. Porter will be the first lieutenant of the timers, and D. G. Ong will be chief clerk to Ricker in the scoring booth.

Five Entries for Chicago Race

CHICAGO, ILL., May 2—Five entries for the Chicago speedway 300-mile race on June 10 at Speedway Park, have been made to date, including a Sunbeam, driven by Christiaens; Sunbeam, unnamed driver; and three Duesenbergs with O'Donnell and D'Alene driving. The third driver has not as yet been selected.

Electricians Plan Show

NEW YORK CITY, April 29—Representatives of electrical interests of the United States with capital investments of more than $4,000,000,000 met recently and decided upon a countrywide celebration of the electrical resources of the United States from Dec. 2 to 9 next.

27,220 Miles by Ajax Winner

New Haven Man Wins $500 in Tire Mileage Contest—Drove Cadillac

NEW YORK CITY, May 1.—The Ajax Rubber Co., this city, has announced the winners in its third annual tire mileage contest. The winner of the first prize of $500 was G. C. Mathis of New Haven, Conn., who drove a Cadillac for Mrs. J. D. Jackson. He made a record of 27,220 miles, or 5,200 miles better than last year's winner.

The first thirty capital prize winners averaged 19,411 miles. The average of the 208 prize winning chauffeurs was 8076 miles, as against 7722 miles last year.

Other winners were: Second, C. V. Finfrock, Pierce-Arrow, 25,648 miles, $300; third, L. E. Pederson, Rambler, 25,337 miles, $200; Jos. Rozek, Pierce-Arrow, 24,896 miles; A. D. Silvia, Simplex, 24,002 miles; W. S. Bliss, White, 22,870 miles; John Laffy, Alco, 22,687 miles, and Fred Weitzmann, Ford, 21,200 miles. The last five received $100 each.

The accompanying tabulation gives the first thirty winners:

Westinghouse Equipment for Murray

EAST PITTSBURGH, PA., April 29—A contract was recently signed by the Murray Motor Car Co. of Pittsburgh, Pa., for Westinghouse starting and lighting equipment for the new Murray eight.

Olds Establishes Permanent Service School

LANSING, MICH., April 29—The Olds Motor Works have established a permanent school for Oldsmobile service men

First Thirty Prize Winners in Ajax Rubber Co.'s Annual Mileage Contest

Prize	Miles	Driver	City	Owner	Car
$500	27,220	Geo. C. Mathis	New Haven, Conn	Mrs. J. D. Jackson	Cadillac
300	25,648	Charles V. Finfrock	Dayton, Ohio	Maurice Costello	Pierce-Arrow
200	25,337	Lars C. Pederson	Chicago, Ill	Mrs. G. B. VanNorman	Rambler
100	24,896	Jos. Rozek	Cedar Rapids, Iowa	M. Ford	Pierce-Arrow
100	24,002	Anthony D. Silvia	Haverhill, Mass	Chas. W. Eaton	Simplex
100	22,870	William S. Bliss	Brooklyn, N. Y	Sylvan Levy	White
100	22,687	John Laffy	Chicago, Ill	Thos. McInerney	Alco
100	21,200	Fred Weitzman	Brooklyn, N. Y	Mrs. G. K. Jack	Ford
50	21,056	Geo. I. Lesser	New York City	I. S. Sanger	Lozier
50	20,942	William F. Trueman	St. Louis, Mo	W. F. Koken	Pierce-Arrow
50	20,016	Barney Roth	New York City	Harlem Taxi Co	Renault
50	19,908	Abraham Schwartz	New York City	S. W. Moscowitz	Locomobile
50	19,455	Harry Burrell	Cleveland, Ohio	Michael Gallagher	Peerless
50	19,176	W. H. Bodine	New York City	Bryant Motor Service	Peerless
50	18,920	R. E. McMorris	Jacksonville, Fla	E. P. Fleming	Cadillac
50	18,780	H. B. Weeks	Richmond, Me	R. E. Dunning	Winton
50	18,250	J. O. White	New York City	Baker-Vawter Co	Ford
50	17,988	Anthony Dirori	New York City	Henry Kelly, Jr	Columbia
25	17,938	Alex W. Thorne	Chicago, Ill	J. D. Purcell	Premier
25	17,684	Charles D. Osterhout	Albany, N. Y	W. B. Philips	Moyer
25	17,628	Charles Carter	New York City	J. Barrone	Chalmers
25	17,622	Jos. Pentz	New York City	Harlem Taxi Co	Packard
25	17,570	Peter Eckman	Grand Rapids, Mich	Chas. Trankla Co	Reo
25	16,728	Joseph Goddard	Scranton, Pa	P. P. Jordan	Ford
25	16,273	Tony Ross	New York City	H. G. Heming	Simplex
25	16,000	Geo. E. White	Pike, N. H	Chas. P. Glover	Hudson
25	15,231	William A. Oldenburg	Detroit, Mich	B. Schroeter	Overland
25	14,000	W. A. Stevens	New Bedford, Mass	G. S. Taber	[illegible]
25	13,360	Fred H. Goldhart	Union Hill, N. J	Mrs. J. Asmus	[illegible]
25	13,201	P. E. Tinkham	Denver, Col	Hallack & Howard Lbr. Co	[illegible]

at their plant here. The first meeting recently was attended by over 200 service men connected with Oldsmobile dealers in all parts of the United States, and much good is expected to come of the move. Meetings are to be held regularly, and the idea is to make every Oldsmobile man an expert diagnostician so as to save time in making repairs and giving service. The school will also establish a standard method of doing various work on cars, such being the result of accurate time studies of different operations made by the factory experimental department.

Thousands of American Cars Arrive in London

LONDON, ENGLAND, April 13—American automobiles lately have been arriving by the hundreds on nearly every ship from New York City, and there are several 10-acre yards along the upper Thames where these cars, in boxes, may be seen stacked ten boxes high. The majority are trucks for the army, and they are allowed to accumulate till wanted.

Jersey City Jitney Charge 5½ Cents

JERSEY CITY, April 29—Five and one-half cents a ride will be charged by local jitney bus owners hereafter because of the additional expense they will be under when the Kates law goes into effect on May 15.

Hupmobile Men Report Prosperity

Branch and District Managers Find Car Sales Booming in All Sections

DETROIT, MICH., April 28—Hupmobile branch and district managers held their semi-annual meeting here last week, and the keynote of the meeting was the exceedingly prosperous condition of the general market for motor vehicles in all parts of the country. Representatives from the four distributing branches and the twelve selling districts of the country reported business more thriving than it has been in several seasons, and every indication is that the demand will exceed the supply. In fact, if the reports from the Hupp men are a good indication of the business for this season, the manufacturers will not be able to meet the demand by about 50 per cent. This is the first season that no cars have been stored by the big factories and very few dealers have machines on hand, so that by the middle of May it looks very much as if the old condition will prevail in the business, when it was necessary to order a car four to six weeks in advance in order to secure it at all.

The meeting brought out the fact that during the nine months of the present selling season, Hupp is far ahead of the entire twelve months of the previous selling year. Every section of the United States is ordering large quantities of cars, and the prosperity is not confined to any one section.

Auto Parts Co. Has Co-operative Plan

PROVIDENCE, R. I., April 29—A dealers' co-operative plan has been launched by the Auto Parts Co., this city, which will enable the dealer in parts and accessories for the Ford car to compete with the mail-order and cut-price houses. It includes the listing and describing of the products of reputable concerns that guarantee their products in a special catalog which is to bear the name and address of the dealer. The products of the United Specialties will be nationally advertised and the dealer will be co-operated with in local advertising. There will also be store and window displays and a bulletin service, the latter to include practical selling suggestions for the salesmen.

149,500 Registered in Ohio

COLUMBUS, OHIO, April 29—W. H. Walker, head of the Ohio State automobile department, announces 149,500 registrations up to April 20, as follows: Gasoline cars, 143,000; electrics, 4000; dealers' and manufacturers', 2560.

24-Hour Record Gained by Hudson

(*Continued from page* 799)

termine whether or not he was in condition to continue the drive. Mulford went ahead.

Tenth stop, 688th lap, 12 gal. gas, 1 gal. oil, 2 qt. water. Time, 4 min.

Eleventh stop, 760th lap, 14 gal. gas, 1 gal. oil, 1 qt. water. Changed left rear tire, as it was looking worn. This was the only tire change made. Time, 6 min. 0.8 sec.

Twelfth stop, 780th lap. This was the first engine stop. Pivot pins for the carbureter float weights had worn out and were replaced. Time, 4 min. 8 sec.

Thirteenth stop, 798th lap. This stop was caused by dirt in the carbureter. The screen was removed and the gaspipe sucked out. Time, 4 min.

Fourteenth stop, 799th lap, changed No. 3 spark plug. Time, 2 min. 13 sec.

Fifteenth stop, 802d lap. Changed remainder of spark plugs. Time, 3 min. 40 sec.

Sixteenth stop, 877th lap, 13 gal. gas, ½ gal. oil, 1 qt. water. Tightened grease cups, etc. Time, 6 min.

For the whole run the average gas consumption works out at 11.4 miles per gallon, which is an excellent showing when the very high speed is considered. Oil consumption was fairly high, being at the rate of 1 gal. per 150 miles, this being about 50 per cent better than the consumption of the average racing car.

Before the engine was stopped 1460 miles had been covered. Throughout the run Mulford drove with marked consistency, as is shown by the speed figures for the various stages. The average speed for the first half of the run was 76.9 m.p.h., only about 1 m.p.h. faster than the average for the whole distance. The following figures show the speeds at various distances above 500 miles:

Miles	M.P.H.	Miles	M.P.H.
500	77.1	1200	77.33
900	77.2	1400	76.8
1000	76.4	1700	76.66
1100	77.04	1800	75.82

The Hudson car used in the run was a stock Super Six with the ordinary body removed and a taper tail fitted. The gear ratio was 2 11/18 to 1. The oil used was Veedol and the grease, Whitmore compound. The car traveled with head-lamps and side lamps lit.

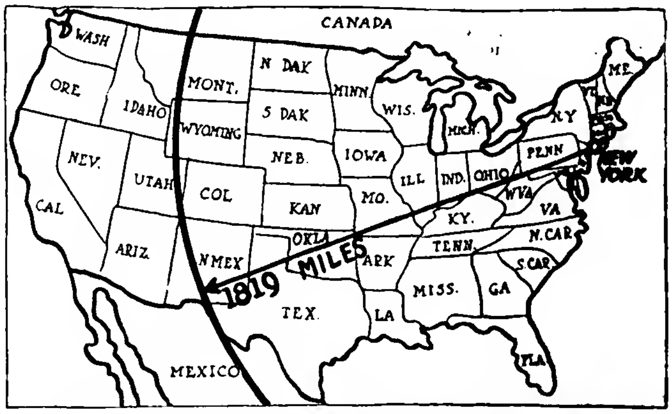

Diagram map, showing what Mulford's run of 1819 miles in twenty-four hours in the Hudson Super Six would mean in cross-country travel

Factory Miscellany

Mid-Continent Tire to Build—The Mid-Continent Tire Mfg. Co., Wichita, Kan., has obtained plans for a one-story plant, 280 by 450 ft., at an estimated cost of $250,000.

Berlin Fabric Erecting New Plant—The Berlin Fabric Co., Berlin, Wis., manufacturing advertising novelties, seat covers, pennants and similar goods, is erecting a new plant, 60 by 70 ft., two stories and basement, costing $15,000.

To Make Wooden Parts — Wooden parts for automobiles will be made in the factory which is to start operation in Ionia, Mich., within a few days, and in which H. B. and George W. Webber are the principal stockholders.

Makes a Gasoline Regulator—The Duplex Vitalizer Mfg. Co., Elmira, N. Y., has been formed with a capital of $10,000 and is manufacturing a device to regulate the consumption of gasoline in automobiles. S. A. Pulford, 401 Realty building, Elmira, is president; J. T. Hawley, vice-president, and Clayton Hulslander, secretary and treasurer.

To Make Motors—The Keystone Motor Co., East Greenville, Pa., has been formed to manufacture motors. It will erect a plant in the near future. Arthur Yocum is president; A. L. Miller, vice-president; J. L. Dimnig, secretary, and F. M. Moll, treasurer.

Signalite Co. to Build—The Signalite Mfg. Co., Kansas City, Mo., recently formed with a capital of $50,000 by W. M. Farr, L. F. Jones and L. R. Fraker, will equip a plant to manufacture automatic automobile signaling devices. O. R. Williams is vice-president and general manager; J. R. Clark is treasurer, and Barry Shannon, secretary.

Michigan Stamping's New Plant—The Michigan Stamping Co., manufacturer of auto parts and metal specialties, now located at 759 Bellevue Avenue, Detroit, has contracted for a new plant to be located on Mack Avenue, adjacent to the Lozier plant. It will be partly a one- and partly a two-story structure, 400 by 600 ft.

To Make Electric Horns—The United Electrical Mfg. Co., Adrian, Mich., has been incorporated to make electric horns and other electrical goods. The concern starts with a capital of $50,000. B. D. Hayes is president; K. F. Wagner, secretary; Walter Haly, treasurer. These officers and E. J. Wagner are directors, the fifth one to be elected in a few days.

Work Started on Gillette Plant—The Gillette Safety Tire Co., 316 Barstow Street, Eau Claire, Wis., has awarded all contracts, and work is now under way on the superstructure of its new plant, foundations for which were laid last fall. The building will be fireproof, 60 by 250 ft. one story high, and is to be ready for operations some time in June. The equipment was purchased during the winter. The investment in buildings is to be $30,000 to $35,000, and the equipment complete cost $45,000.

Lefever to Add—The Lefever Arms Co., Syracuse, N. Y., has just placed a contract for an addition to its plant to take care of additional production. The building will be a two-story building, 41 by 144 ft. It will be devoted entirely to manufacturing purposes in producing transmissions and transmission gears. At the same time, another building has already been started, which is one story, 60 by 75 ft. These additions will take care of their present large volume of business and also provide somewhat for the future.

The Automobile Calendar

May 6	Sioux City, Iowa, Speedway Race, Sioux City Speedway Assn.
May 9-12	Hot Springs, Va., N. A. A. A. J. Meeting.
May 13	New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 14-20	Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.
May 18	S.A.E. New York Section, May Meeting.
May 20	Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 22-26	Chicago, Ill., N. E. L. A. Convention, Electric Veh. Section, Congress Hotel.
May 25	Pennsylvania's Second Good Roads Day.
May 26-27	Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
May 30	Des Moines, Iowa, Iowa Derby, 20 miles; Des Moines Special, 10 miles.
May 30	Tacoma, Wash., 10, 20 and 30-Mile Races, Tacoma Speedway Assn.
May 30	Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn.
May 30	Indianapolis Speedway 300-Mile Race.
May 30	Minneapolis, Minn., Speedway Race.
June 4	Sheepshead Bay Speedway, 30-mile Race, American Liberty Day Committee.
June 8	New York City, Orphans' Day Outing at Donnelly's Grove. College Point, L. I. Orphan's Automobile Day Outing Assn.
June 10	Chicago Speedway Race. International 300 - mile Race, Speedway Park, Speedway Park Assn.
June 12-16	S. A. E. Summer Trip on Great Lakes.
June 16-17	Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.
June 20	Galesburg, Ill., Track Race, 100 miles.
June 28	Des Moines, Iowa, Speedway Free-for-all, 300-mile race.
July	LaGrande, Ore., Track Race, LaGrande Motor Club.
July 2-6	Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
July 4	Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4	Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4	Minneapolis 300-mile Speedway Race.
July 4	Sioux City Speedway Race.
July 15	Omaha, Neb., Speedway Race.
July 15	North Yakima, Wash., Track Race, Hiller-Riegel Co.
July 17-21	Dallas, Tex., Tractor Demonstration.
July 24-28	Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4	St. Louis, Mo., Tractor Demonstration.
Aug. 5	Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 7-11	Fremont, Neb., Tractor Demonstration.
Aug. 11-12	Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12	Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 14-18	Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 18-19	Elgin Road Race, Chicago Auto Club.
Aug. 21-25	Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1	Indiana Tractor Demonstration.
Sept. 2-9	Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 4	Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4	Indianapolis Speedway Race.
Sept. 4-5	Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 4-8	Madison, Wis., Tractor Demonstration.
Sept. 6-7	St. Paul, Minn., Good Roads Congress, Auditorium.
Sept. 11-16	Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.
Sept. 16	Providence Speedway Race.
Sept. 29	Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30	New York City, Sheepshead Bay Speedway Race.
Oct. 7	Philadelphia Speedway Race.
Oct. 7	Omaha Speedway Race.
Oct. 14	Chicago Speedway Race.
Oct. 19	Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Nov.	Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

The Week in the Industry

Goodyear to Establish Canadian Branches—The Goodyear Tire & Rubber Co., Akron, Ohio, will establish branches in Canada. A plant will be located in New Toronto, Ont., where the company expects to spend $1,000,000 on it. The company will employ 1,500 hands.

Canadian Trade Items—The Ford Motor Car Co. of Canada, Ltd., Ford, Ont., has taken out a charter to do business in the Province of Saskatchewan. Its capital is $10,000,000.

McLaren Bros., 1470 Saint Lawrence Blvd., Montreal, Que., are handling the U. S. L. battery, Dann spring insert and the Outlook windshield cleaner for the Province of Quebec.

A company is being organized in St. Catharines, Ont., for the purpose of acquiring the rights to manufacture and sell Globe tires in Canada. The concern will be called the Globe Tire Co. of Canada, and will manufacture automobile and truck tires.

Connecticut Trade Items.—R. H. Smith, formerly of the Stanley Works, New Britain, Conn., has joined the sales force of the A. C. Hine Co., 314 Pearl Street, Hartford, Conn., state Oakland distributor. Alfred Nordstrom of New Britain has also joined the Hines forces and will look after the New Britain retail sales.

R. R. Ashwell, 341 Trumbull Street, Hartford, Conn., has taken on the service representation of the Bijur electric system.

Minneapolis Stewart-Warner Moves—On May 1 the Minneapolis branch office of the Stewart-Warner Speedometer Corp. will move into its new quarters at 1309 Hennepin Avenue.

Northwest News—Rothweiler & Co., Seattle, manufacturers of a 1-ton truck, have recently opened a branch in Spokane, Wash., at 224 Washington Street. The Spokane office will serve all of Montana, eastern Washington and northern Idaho. The branch is in charge of Al Sharp.

Two new automobile connections were opened in Portland, Ore., during the past week. D. C. Warren, formerly connected with the Oregon Motor Car Co., has taken the State agency for the Velie car. The new agency is known as the Warren Motor Car Co.

A. H. Knaus has resigned his position with the Braly Auto Co. to accept the managership of the Portland branch of the Gerlinger Motor Car Co., Pathfinder, Hollier and Federal dealers.

Trade Happenings

Curl Continental Purchasing Agent—L. C. Curl has been appointed purchasing agent for the Continental Motors Co. plant, Muskegon, Mich. He was formerly purchasing agent for the Buda Company of Harvey, Ill.

Hood Maxwell Purchasing Agent—R. M. Hood, former assistant purchasing agent of the Maxwell Motor Co., Detroit, has been appointed purchasing agent of the company.

Munsell, Delco-Light Agent—J. J. Munsell of Dayton, Ohio, soon is to assume the duties of general agent in the Columbus district for the new Delco product, Delco-light, which is made by the Domestic Engineering Co. of Dayton. The Domestic Engineering Co. was incorporated recently. The management is the same as that of the Delco.

Blackley Boulden's Assistant — B. E. Blackley, formerly New England division sales manager of the Chase Motor Truck Co., Syracuse, N. Y., on May 1 assumed the duties as assistant to H. T. Boulden, general sales manager of the company. He will have direct charge of the dealer's aid department and motor truck research work, succeeding W. A. Clare, who resigned as Mr. Boulden's assistant on April 1 to become sales manager of the Atterbury Motor Truck Co., Buffalo, N. Y.

Barker Hupp District Supervisor—A. E. Barker, Cleveland district representative for Dodge Bros, Detroit, Mich., has been promoted to the position of supervisor of the district. A. T. Stanton, formerly the Dodge Bros. representative for the British Isles, making his headquarters at London, has been transferred to Cleveland to succeed Barker.

Dodge with Dayton Rubber—G. A. Dodge, who has spent a number of years in the manufacturing and engineering departments of several of the largest tire companies in the country has become chief engineer and factory manager for the Dayton Rubber Mfg. Co., Dayton, Ohio.

Gramm Opens N. Y. Office—The Gramm-Bernstein Co., Lima, Ohio, has opened an Eastern office of the Gramm Co., Inc., at 1457 Broadway, at Forty-second Street, New York City, for the sale of Gramm worm-drive trucks from 1 to 6 tons' capacity.

Goodrich Station in Harrisburg—The B. F. Goodrich Tire Co., Akron, has opened a service station at 1412 North Third Street, Harrisburg. The Harrisburg depot is in charge of W. F. Mower, who has had a number of years of experience in the service department of the Goodrich company. J. R. Sauter, the sales representative in the Harrisburg district, has been connected with the Goodrich company for the past twelve years.

New England Trade Notes—An agency for the KisselKar has been placed at Portland, Me., with the Forest City garage.

The Chevrolet Motors Co., of New York, has opened a direct factory branch at Providence, R. I., and with R. B. Keyser of Boston, Mass., as manager. The temporary salesrooms are on Broad Street.

W. E. Whitten has taken the agency for Empire cars at Providence, R. I.

Illinois News Items—The Rock Falls Casket Co., Sterling, which has been engaged for many years in the manufacture of caskets and other mortuary supplies, but which recently added the construction of automobile hearses, has decided to discontinue the casket manufacture and devote the plant exclusively to motor hearses. All of the machinery and supplies used in casket construction were sold this week to the Central Mfg. Co. of Dixon.

D. U. Smith, Springfield, has resigned as manager of the Cadillac agency in that city to become sales manager for the Cadillac company, with headquarters at Evansville, Ind., and with a territory consisting of thirty-two counties. H. D. Fulmer, Peoria, Ill., has been appointed sales manager at Springfield to succeed Mr. Smith.

C. F. Ball and J. E. Ball, Springfield, have opened a garage at 327-329 North Sixth Street, and will specialize in electric and battery work. They will do a repair business exclusively, carrying a line of supplies and accessories.

Farle & Miller, 978 South Michigan Avenue, Chicago, have been issued articles of incorporation with capital stock of $25,000, to manufacture, buy, and sell automobiles and accessories. The incorporators are: J. H. Farle, R. A. Miller and A. A. Miller.

The Williamson Motor Co., Freeport, Ill., has removed from the Wilcoxson Building to a new location on Galena Street, due to the necessity of securing larger quarters. A complete line of automobile accessories will hereafter be carried.

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The Automobile

Improving Splash Oiling

Dipper Lubrication Systems Could Be Much Improved—Some Conventional Designs Highly Inefficient—Effect of Load and Gradient Analyzed

By L. V. Spencer

VERY many of the splash lubrication systems found in present-day automobile engines are capable of much improvement. They work well on the level, as a rule, but let the car get on a grade, even as low as 10 per cent, and most of them are so constructed that less than the required amount of oil is splashed as it should be. This refers particularly to the splash system, but some of the pressure type and the combined pressure and splash systems can also be criticised in this respect.

It almost seems that engine and car designers have been so deeply concerned in the development of good-looking, silent-running and generally efficient cars that they have had very little time or inclination to attack the engine oiling, since in the average case it is sufficiently good. Yet surely the lubrication of the motor is one of the first things that should be worked out satisfactorily. So much of the efficient operation and general satisfaction that is derived from a car depends upon the oiling system that it would seem the engineering fraternity has sidetracked a very important step in car development in its haste to attack those things that are more evident on the surface.

The foregoing applies most strongly to the low or medium priced car; the higher priced types are generally better because of more careful designing for a more exacting clientele. The really absurd part of it is that the cost of such improvements as would make the average engine greatly better, so far as lubrication under general operation conditions is concerned, is small indeed, and the wonder is that these designers persist in the use of systems that are fundamentally wrong when the cost of alteration is so greatly out of proportion to the benefits to be derived from simply rectifying these conditions.

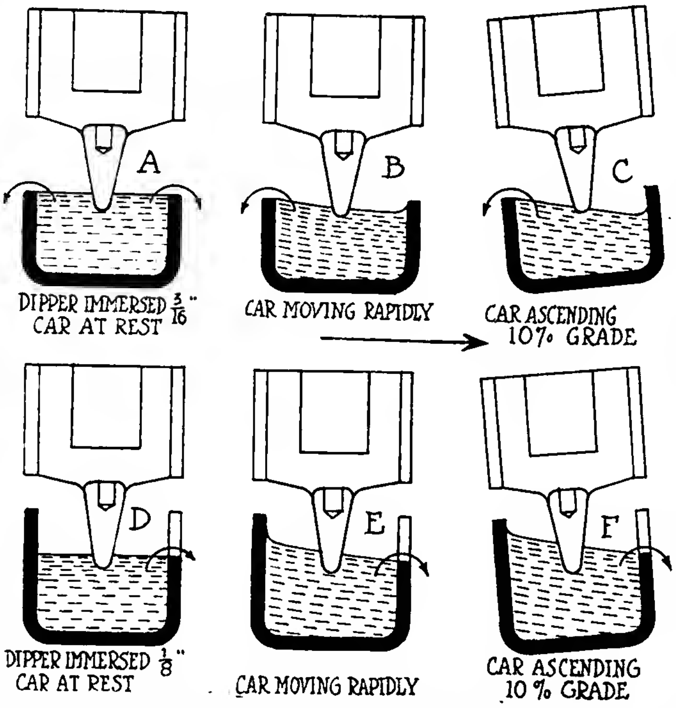


Fig. 1—A, B, C—Action with equal sided trough. D, E, F—Action with overflow trough. A—Dipper immersed 3/16 in., car at rest. B—Car accelerating. C—Car ascending 10 per cent grade. D—Dipper immersed 1/8 in., car at rest. E—Car accelerating. F—Car ascending 10 per cent grade

Probably a great many engineers will not agree with the stand that has been taken and will maintain that the normal schemes for getting an equal amount of oil to each cylinder and bearing are practically sound. It is not with the intention of attacking any system specifically, but with the thought of showing the faults in many of the well-known arrangements that this article has been prepared. Often a very small modification will make a wonderful difference in the working of a system, and it is hoped that such criticism as follows will be productive of some good results generally. The diagrams have been taken from the actual drawings of certain representative designs.

Our attention will first be directed to some of the flagrant violations of good practice that are to be found in certain widely used types of splash systems. The full

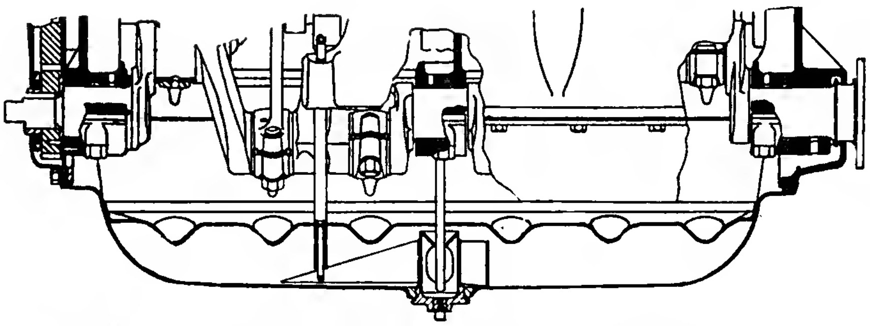


Fig. 2—Section of oil trough construction in common use. There is no provision for retaining sufficient oil in the splash troughs for hill work. The front troughs are starved on up-hill going and get too much oil on down grade

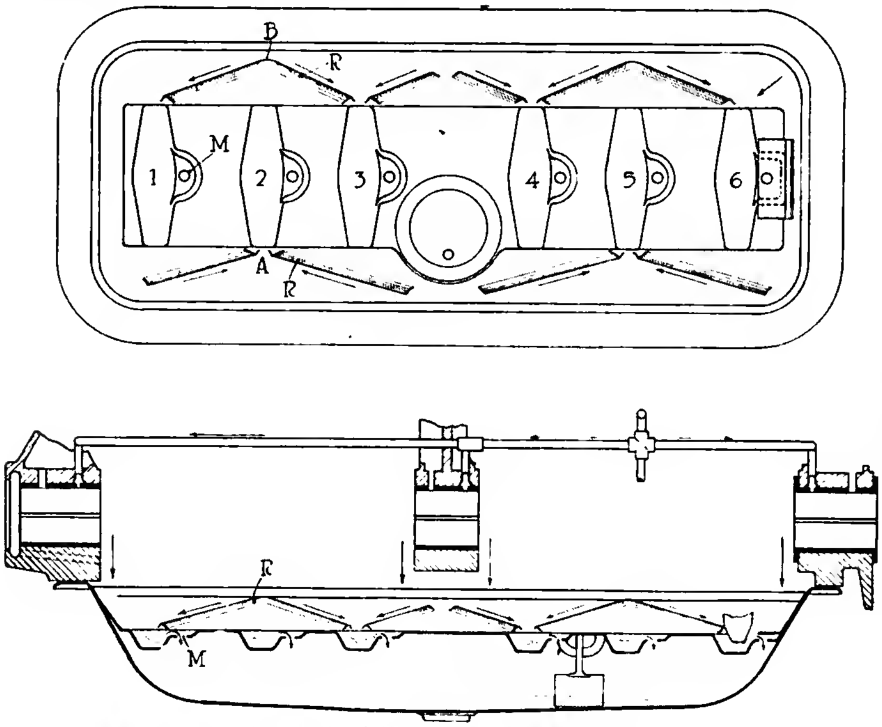


Fig. 3—Showing an adaptation of return ridges pressed into the trough to redistribute the splashed oil evenly

advantage of the fact that gravity is the big factor in the handling of the oil in such systems is very evidently often overlooked. Take for example the conventional form of splash trough that you will find in at least two-thirds of the engines using splash. This is shown in Fig. 1, and it will be noticed that the two sides are on the same level, with overflow either way. Now suppose the engine with this trough to be inclined as in ascending a 10 per cent grade, as at *C*. The oil backs away from the front side of the trough and flows out at the rear, thus lowering the working level, and reducing the possible dip of the splasher on the end of the connecting-rod. Obviously, as the grade increases, less and less oil can be dipped by the splasher. Yet on steep grades it is especially desirable that more oil be sent to the cylinder walls and bearing surfaces. Thus the action is exactly the opposite from what it should be.

Several Simple Remedies

There are several simple remedies for this defective trough construction. Would it not be possible to raise the rear side of the trough about ¼ to ⅜ in. to prevent the oil from flowing out this way when on a grade, and of such a height that the dipper would get a maximum at about 20 per cent grade? Such a suggested construction is shown at *D*. As the grade increases, the more the liquid is backed up on the rear side, and hence the greater the depth the dipper enters, and the more oil is splashed, which is as it should be. Obviously if both sides were made of this greater height without some provision for lowering the level when on flat ground, the dipper would dip too deeply and an excess of the requirements would be supplied. But to prevent this, and to bring the level to just what is needed for flat ground, an overflow can be cut in the front side of the trough to reduce the level to the minimum. The action is clearly brought out in the diagrams which compare this simple modification with the conventional trough. A similar trough arrangement has been noted in several motors.

This is but one illustration of the point that it is hoped to bring out—that a little ingenuity will do great things for motor oiling, and with a minimum of expense.

Take another instance of an inefficient arrangement that could be very readily improved so as to work most advantageously under practically all operative conditions. This is the typical splash trough and connecting oil pan of a well-known motor.

When Going Up Hill

Referring to Fig. 2, it will be noted that the troughs under the connecting-rods are pressed into the sub-base and there is no special provision to compensate for running on hills. Suppose the car to be going up a hill. Then the front end of the oil pan is elevated, and there is a tendency for the oil to run out of the front troughs, starving the forward cylinders and giving too much to the rear ones. If the grade is not steep enough for much of the oil to run out of the troughs, it will at least act as already shown by the diagrams in Fig. 1. On descending a hill the result is the opposite and the front cylinders get more than their share of the oil.

The writer believes that some sort of overflow device would greatly relieve this undesirable condition without very materially affecting the cost of construction. If a slot were cut in the forward side of each of these troughs at the proper height and the rear side were pressed out a little higher than it is normally in Fig. 2, this would have the effect of drawing off the oil through the overflow slots when the car is on a down grade, preventing excess from working its way back to the rear cylinders. While it is true that such lowering of the level in the troughs would prevent a normal amount from being splashed, it must be remembered that it is not necessary to have as large a supply when going down grade. On ascending, the higher rear sides of the troughs would also prevent the oil from overflowing back to the rear cylinders, and the greater dip would result in more oil being splashed to the bearing surfaces—a desirable feature for up-grade work. There are, doubtless, many variations of this idea and, while a number of cases have been observed where some such principle is involved, the number of splash installations in which the troughs make no provision for any angular positions of the engine is surprising.

It is doubtful if this modification of the simple trough would alone effect the most satisfactory results, although there is no question of its value. It could very cheaply be made in conjunction with little ridges or channels that might be pressed into the sub-base to direct the oil running down from the cylinders or other points, on which this oil had landed after being thrown up by the rod ends. Such ridges would serve to distribute the returning oil, and prevent one trough from getting an over-abundance.

Recently a very neat adaptation of this idea was observed in a certain design, somewhat similar to the diagram reproduced in Fig. 3. Diagonal ridges *R* were raised in the pan as indicated, and led to the different troughs in such a way that each was calculated to be cared for properly. By this arrangement, oil that finds its way to point *B* for instance, would be directed either to trough No. 1 or to No. 3, whereas directly opposite to point *B*. Such distribution is quite autoany that arrived at *A* flows into trough No. 2, although directly opposite to point *B*.

Incidentally the diagrams in Fig. 3 also show a scheme for taking care of the trough level by means of overflow ducts *M*, with the idea of compensating for variations of motor angle. Such a combination involves patents held by E. M. White, Detroit, Mich.

Fig. 4 shows another arrangement of this kind that is entirely of the splash type, and is somewhat of a variation from the scheme of Fig. 3, although the principles are exactly the same so far as the dividing of the splashed lubricant and its return to the troughs is concerned. In addition, this indicates a good method of insuring clean oil getting to the main bearing through the lead *N* which is arranged so as to catch some of the splash and direct it to the bearing through a standpipe brought a slight amount above the level of the pocket in the bearing support. Any particles of metal or grit will settle in the pocket and only the clear oil flows through the pipe to the bearing. This is a refinement, which, though seemingly small in itself, has much to do with the efficient lubrication of these important points. It is a thing small in cost but, when added to other little refinements, aids materially in securing the most from the lubrication system.

Insuring Distribution

There are other methods of insuring distribution of the lubricant in splash systems, utilizing gulleys or ridges pressed into or cast in the side of the crankcase or stamping that forms the holder for the troughs. One patented way of doing this which indicates the possibilities of efficient lubrication with great simplicity is shown by the diagram in Fig. 5. In this case all the oil is introduced at the front, going either first to the timing gears and then to No. 1 trough, or to this trough direct. Excess over the amount required for this trough overflows through the hole at *D*, and on being splashed from this No. 1 reservoir, the lubricant is caught in the diagonal ridge *C* and led to the next trough. From this it is carried by the next diagonal to the next successive splash reservoir and on back until it eventually enters the end trough, the excess then overflowing through hole *E* into the reservoir.

The action is obviously one in which the minimum amount of oil is splashed when the engine is idling or the car is running very slowly, and increases with the speed of engine and car, for the speed of the car serves to back the oil away from the overflow holes somewhat, making a greater level for the rod ends to dip in the master troughs, thus increasing the splash to the others as well. As the engine speeds up the pump delivers an increasing quantity, which is reflected in the added amount the intermediate troughs get as well as the controlling ones at the ends.

The shape of dippers has a great deal to do with the splashing of the oil. If a narrow face meets the oil then the dip is not nearly so efficient as in the case where a wider dipper is used, which serves to scoop the oil, the effectiveness of the splash of course depending upon the needs, and the shape made accordingly. Some designs of engines are to be found in which no special dippers are fitted, but the ends of the cap bolts are relied upon to do the work, similar to Fig. 8. This is probably satisfactory when the engine occupies a level position, but if on a grade of even moderate steepness, the trough level is apt to slant so that such a narrow dipping surface barely touches the oil. To overcome this, some form of wider dipper is advisable—one that will get into the oil no matter what the angle. Fig. 6 will illustrate this point. The round dipper here shown, in connection with the round-bottomed trough, works equally well in getting into the oil on even very steep grades. The wider the dipper face, the less deeply it has to enter the trough, hence generally speaking, the dipper shape has a bearing upon the form and depth of the trough section. Simplicity of manufacture would seem to dictate a wide shallow trough with a wide-faced dipper. It looks like putting the cart before the horse to design the rod dipper and then think about a trough to fit it, but the dipper design should not be considered as an afterthought—anything that will be easiest to fit. It is

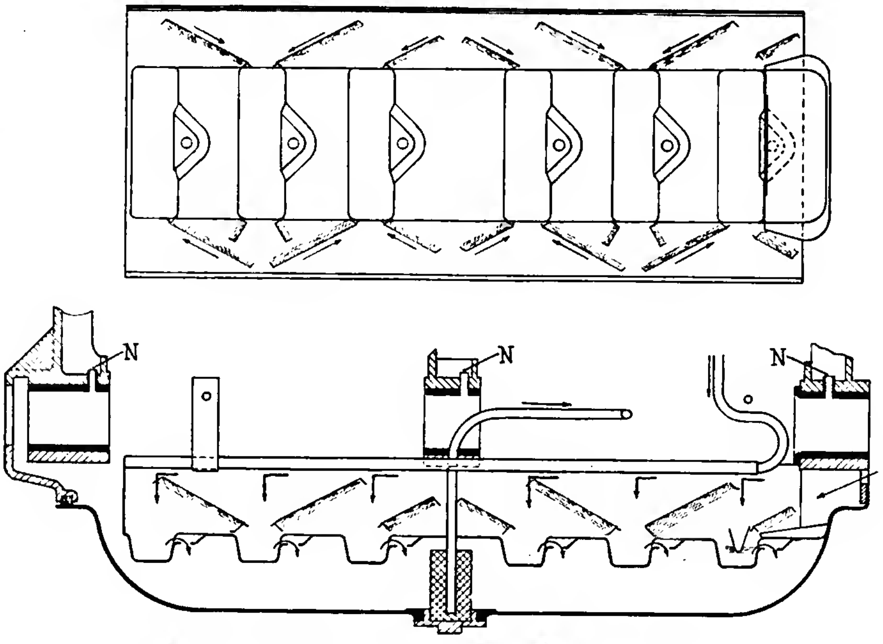


Fig. 4—Return splash trough and pan arrangement for a six

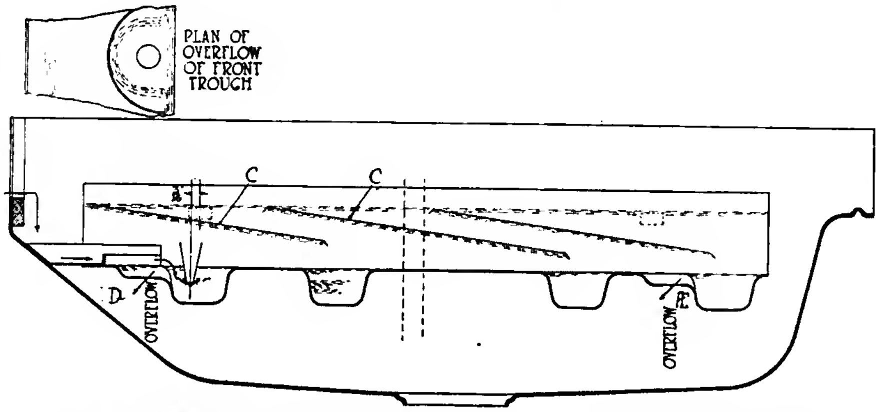


Fig. 5—A circulating splash arrangement which introduces all the oil at the front trough and eventually allows it to overflow at the rear trough

as important to general results as any other feature. A deep trough is not required provided the circulation of the oil is in conformity with the rapidity with which the oil in the trough is depleted, and there is provision for maintenance of level for various motor angles.

In some splash systems, the troughs do not follow the circumference of the crank circles far enough to maintain oil in the troughs at the various angles to which the engine is sometimes tipped sideways. While this is not so important a consideration as that of proper care for uphill and down-grade operation, nevertheless there are times when the road slopes to one side to cause even as much as a 15 deg. angle from the horizontal, and this should be taken into account in designing a system that will be adequate for any conditions that might be met in service. It is not much trouble to curve the troughs up at the sides so as to retain oil under such conditions, and no trough that is nearly straight can hope to act efficiently when the engine is tipped sideways to any extent. Fig. 7 illustrates a trough designed to take care of this condition. Note that the trough follows the crank circle sufficiently on either side to hold plenty of oil at even extreme side angular positions of the crankcase.

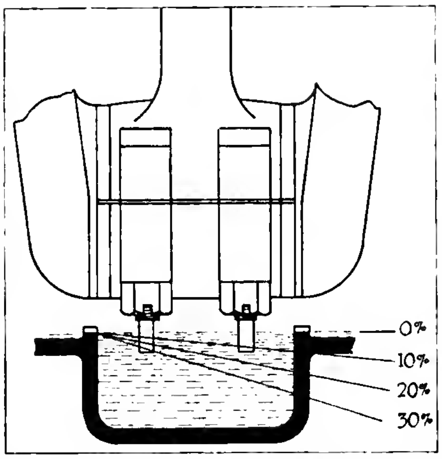


Fig. 8—Illustrating the ineffectiveness of dippers of the form shown when on grades of carrying amount

Two Important Factors

In one respect the engineer's task is very hard, for there are two things to keep in mind: the bearings need all the oil that can be supplied to them, and the details of dipper and trough design so far considered have been regarded from this viewpoint. On the other hand, the pistons must not receive too much, or else the oil will get to the combustion space in quantities, producing smoke and rapid carbonization. The reason that such extremely narrow dippers are used on some high-speed engines with splash lubrication is that any increase in width floods the cylinders at once.

Must Not Impair Bearing Supply

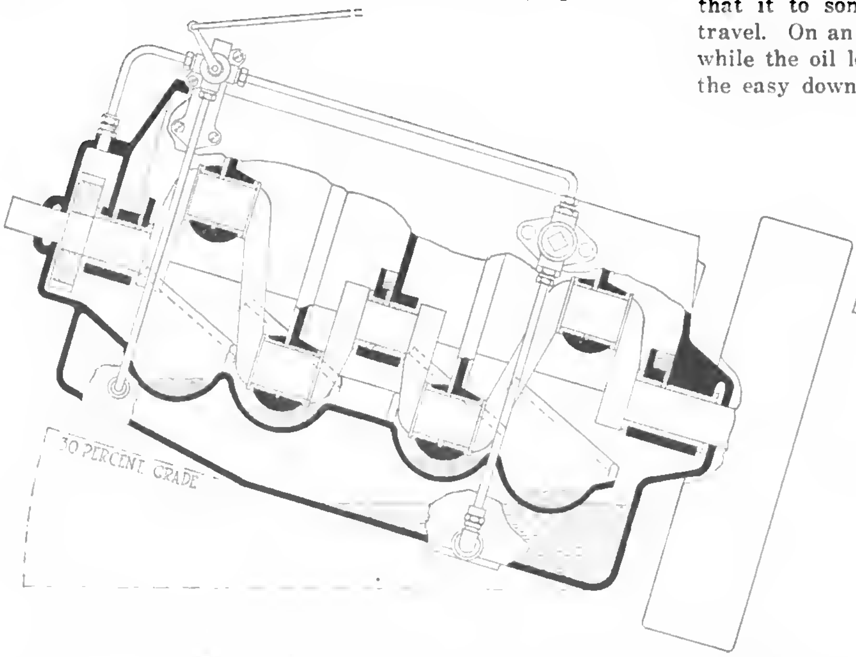
It seems, however, that it is fundamentally wrong to cut down the bearing supply in order to prevent too much reaching the cylinder walls. It is not difficult to design pistons to resist the passage of the tremendous whirl of oil thrown out from the bearings of a full force lubricated motor, baffles to deflect the spray and a proper piston design being able to cope with almost any oiling conditions.

First, a long piston is a great help, and luckily aluminum alloy has made long pistons possible without substantial increase in the reciprocating weight. Grooves in the piston with small holes leading to the inside of the skirt are another effective method. A few large holes drilled in the skirt is another solution, much favored in European high-speed engine design, while there are all sorts of alternative designs for scraper rings.

Another point in lubrication which has been much neglected, is means for varying the oil supply to suit the amount of work the engine is doing rather than to suit its speed. Examples of this idea are seen in the Marmon and the Rolls-Royce designs, where the oil is throttled by a cock in connection with the carbureter throttle. Both these systems are full pressure ones, but the idea has been applied to splash oiling, notably by Chas. Y. Knight, the neatest example being seen in the Minerva-Knight engine.

In this design each trough is a separate piece. Seen from the front of the motor the edges of the trough are curved as in Fig. 7, to maintain the level when the trough is tilted, but instead of being fixed to the crankcase base, each trough is hinged at one end to the crankcase side. On the opposite side of the crankcase there is a rod running from end to end having a series of small arms projecting inward and links from the ends of these arms support the free ends of the troughs. The extreme end of the rod passes through the crankcase and a final lever is here linked to the throttle control. On opening the throttle the rod is turned so as to lift the troughs, so increasing the depth of dip of the connecting-rod splashers. As the throttle is closed the troughs are lowered again so that the dippers only just lick the surface at idling speed, this arrangement giving sufficient distribution under these conditions.

This device, though complicated, has a double advantage in that it to some extent compensates for up and down hill travel. On an up grade the throttle is open and the dip deep, while the oil level drops with the closing of the throttle for the easy down hill run.



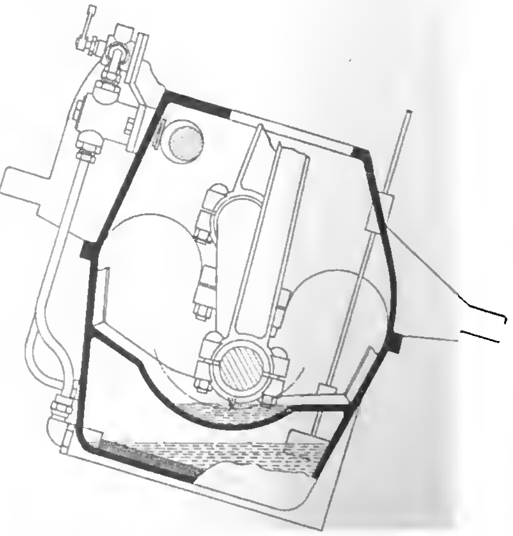


Fig. 6—Left—How a round flat dipper gets into the oil equally well at all angles up to the limitations of the engine. Fig. 7—Right—Trough rounded to care for condition when engine is tipped considerably to one side

Extraordinary Transmission System

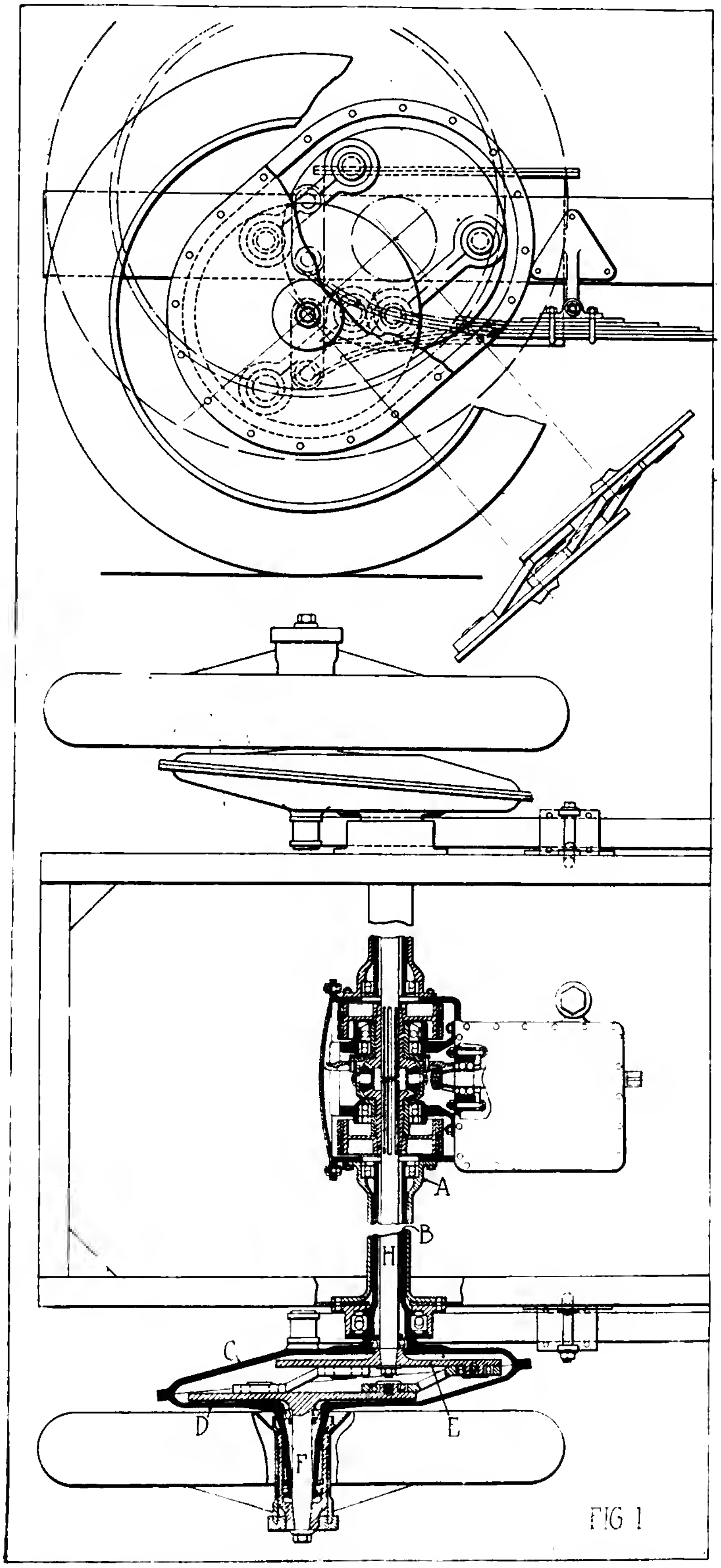


FIG 1

Fig. 1—Jacobson transmission in part section showing the method for supporting the wheels without an axle, and the connecting rod drive. Observe the location of the two brakes on either side of the differential

Danish Design Eliminates Rear Axle—Rear Wheels Can Move Independently

By A. Ludlow Clayden

IT is but rarely that a practicable automobile invention appears that is utterly new and has little reference to anything that has gone before. The idea illustrated on this page, the invention of P. Jacobson, Jyderup, Denmark, appears to possess this sort of novelty and is highly interesting, even though it must remain for trial to demonstrate the validity of the claims.

The inventor states as his chief aim the reduction of unsprung weight, and his design provides for very little more of this than the weight of the wheel itself. There is no rear axle in the accepted sense of the word, and the two rear wheels are quite independent of each other. With an axle connecting two wheels the passage of one wheel over a high spot causes compression of the spring on one side and so tilts the axle and both wheels relatively to the body of the car. The Jacobson transmission, on the other hand, arrests all tilting and allows either rear wheel to lift in a truly vertical plane.

No Rear Axle

The device is shown in section in Fig. 1. Attached rigidly to the frame of the chassis is a differential housing which may easily be combined with the gearset. The differential is driven by bevel gear in the usual way and operates two ordinary driveshafts, the casing being supported by the outer tubes *A*. Leaving the question of drive for a moment, the method for supporting the wheels may be explained. Between the casing *A* and the drive shaft is a tube *B* mounted in ball bearings at either end and free to revolve without affecting either the casing *A* or the driveshaft. To the outer end of this is fixed a steel forging *C*, which is shaped to a kind of oval, something like a short chain case, and there is a cover plate of steel *D* which has a tubular projection on which the road wheel bearings are mounted. On the back of the case *C* there is a pin, in line with the wheel center, and to this pin the end of the cantilever spring is fitted. Thus the effect is the same as if the wheel were attached directly, and individually, to the end of the spring, lateral stability being given by the case *C* and the tube *B*. The three parts, *B*, *C* and *D* together form a piece which may be likened to one-half of a floating axle with a crank in it near the outer end.

By these means the inventor has provided a system for supporting the two wheels independently so that a rise or fall of one wheel has no effect whatever upon the other. The next step is to provide means for driving both wheels through the medium of the centrally placed differential.

To do this a circular plate *E* is attached to the end of each driveshaft and an exactly similar plate

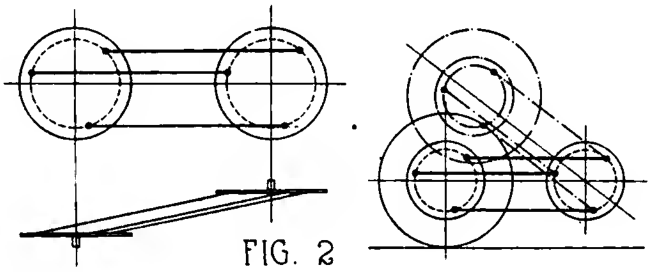


FIG. 2

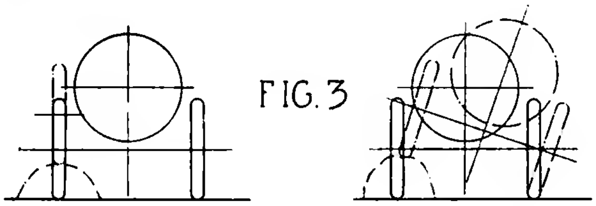


FIG. 3

Fig. 2—Diagram showing that the velocity ratio of the driveshafts is unaffected by spring action

Fig. 3—Contrasting the tilting action of a road shock on the ordinary axle, and the vertical movement of the wheel in the Jacobson design

is forged with a short driveshaft *F* connected to the road wheel just like the driveshaft of a floating axle. To transmit the drive from *E* to *F* there are three short connecting rods, arranged as shown in diagrammatic form in Fig. 2. These rods are mounted on ball bearings at either end and are quite short, about 8 in. between centers being the inventor's suggestion.

This brings us to an important stage in the idea, namely that the drive velocity ratio is unaffected by movement of the spring. Let us suppose that a gear drive had been used instead of the connecting rods. Had this been so, then moving the wheel up and down would cause relative rotative motion between the main driveshaft *H* and the final driveshaft *F*. In other words, passing over a bump would cause the speed of rotation of the road wheel to vary as the spring was compressed by reason of the movement of the center of *F* around the center of *H*. Imagine a gear on the end of *H* held stationary meshing with a pinion on *F*, and it is obvious that *F* could not be lifted upward without causing the pinion to turn.

With the connecting rods this does not happen because each rod is free at each end. The simplest explanation is that given in the diagram, Fig. 3, which shows that the driveshafts are not affected by spring action.

The inventor sums up his claims as follows:

"No small advantages are claimed for the mechanism described compared with orthodox design. No rear axle is needed which has to be strong enough to carry the weight of the car under shocks. All parts may be of light weight; the heaviest, the steel-cover, has but small dimensions. The remaining parts of the transmission may be inclosed in light covers, as they are not influenced by very strong forces and can be braced by rigid girder constructions.

"Springing will be much improved, the wheels move in an ideal manner, causing the car to be light on tires and sideway rolling is absent, making for better stability on the road. The lubrication may be easily made perfectly automatic, as all the transmission forms a unit. By two lengths of tubing the lubrication of the transmission system may be connected to the lubricating system of the engine.

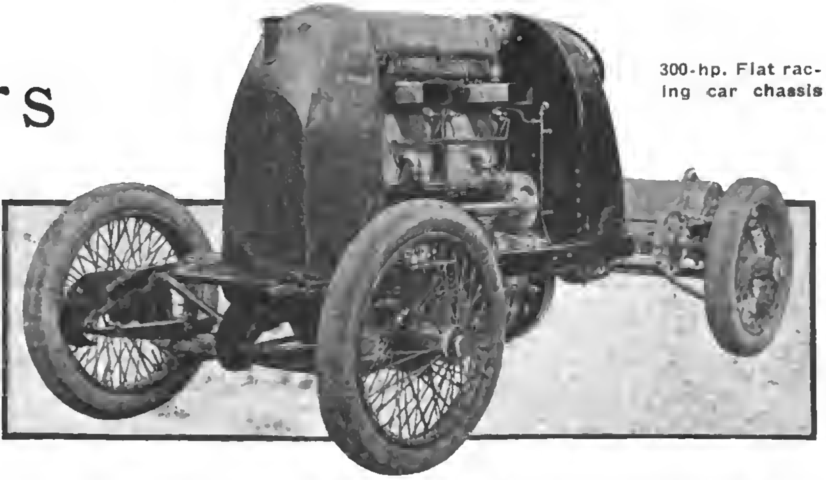
"Yet this novel proposition gets its greatest importance from its perfectly even transmission of power from the engine to the wheels, unaffected by the condition of the road. Combined with the perfect springing this provides a comfort hitherto undreamed of."

Mulford's Driving a Factor in Hudson 24-Hour Record

LAST week THE AUTOMOBILE published in conjunction with its account of the 24-hr. record made by the Hudson Super Six at the Sheepshead Bay Motor Speedway an illustration showing Ralph Mulford at the wheel of the car ready to start on his round-the-clock run. This week our readers may get an idea of the conditions under which part of the trial was made from the accompanying illustrations, that at the top of the group showing the car during one of its brief stops for supplies some time in the watches of the night. Below at the left, is Mulford as he appeared before starting his trial for the world's record and at the right his somewhat tired but still cheerful countenance after the task was accomplished. In spite of the nerve-racking grind at racing speed, however, Mulford's stamina and recuperative powers are shown by the fact that at eight o'clock the following morning he was tearing around the speedway again in the Peugeot he will drive in the May 13 races.

Hudson Super Six stopping for supplies on its world's record 24-hr. run. Below, left, Mulford at the start; right, after the run was finished

Monster Cars Hold Few Records



300-hp. Fiat racing car chassis

THE world's biggest and fastest automobile will always be attractive to the motorist, no matter what his personal views may be on practicability and economy. Fiat holds the record for both size and speed with a 300-hp. car which was driven by Duray at Ostend, Belgium, at a speed of 142.9 m.p.h. This racing freak has a four-cylinder motor of 7.48 by 10.4 in. bore and stroke, giving a piston displacement of 1828 cu. in. The car was built to the order of a Russian prince, and was first driven by Nazzaro. The ambition of the prince was to break the world's straightaway record, and with this object in view he sent Arthur Duray and the car to Ostend in November, 1913. The Italian car was officially timed on several occasions to cover the kilometer at a fraction more than 142 m.p.h. But in order to satisfy the European regulations the run had to be made out and home within a quarter of an hour. Owing to variable weather conditions—wind from the sea, sand blowing in from the shore, rain, etc.—Duray could never make the two trips within the time allowance. Thus, although his speed was never doubted, it was never officially recognized.

Valves in the Head

This giant Fiat has its four cylinders cast in one block, with valves mounted in the head and driven by an overhead camshaft concealed under an aluminum housing, this arrangement tending to increase the height of the motor, which stands more than 5 ft. from the ground. The vertical shaft driving the overhead camshaft is at the rear of the group of cylinders, while the water pump and magneto are respectively to left and right of the casting and driven off a cross shaft. Despite its size, the motor is a remarkably clean design; its hood fits around it as closely as a suit of clothes made to measure. The drive is taken through a three-speed gearbox, jackshaft and side chains to the rear wheels. This car has seen little road service. When it was submitted to the French authorities it was refused the technical license without which no car can be driven over French roads. At the present time it is in cold storage at the Fiat factory.

Exhaust side of 300-hp. Fiat chassis. This view gives an idea of the height of the motor in proportion to the wheelbase

Although the 300 hp. Fiat has been the most spectacular of big cars, it has to take second place in matter of size to a 350-hp. Fiat with which Nazzaro made some demonstrations on Brooklands track three or four years ago. The engine in this case had a bore and stroke of 9.4 by 12.6 in., giving a cylinder capacity of 3498 cu. in. It was estimated that this car would show a speed of 155 m.p.h., but as events proved, it was practically impossible for any single man to hold it on the road. It was not well proportioned and many thought it should have had a wheelbase of 16 ft. or so and, perhaps a 72-in. tread. After the trials on Brooklands track the car was returned to the factory, the motor eventually serving aboard a racing boat.

Some Big Benz Motors

Benz has been responsible for some very big racing motors, the most successful of which was a machine of 7.87 by 9.8 in. bore and stroke, giving 1913 cu. in. piston displacement. This car climbed Gaillon hill, near Paris, one kilometer in length, with an average gradient of 8 per cent, at an average of 101.5 m.p.h., thus creating a record which remains unbeaten.

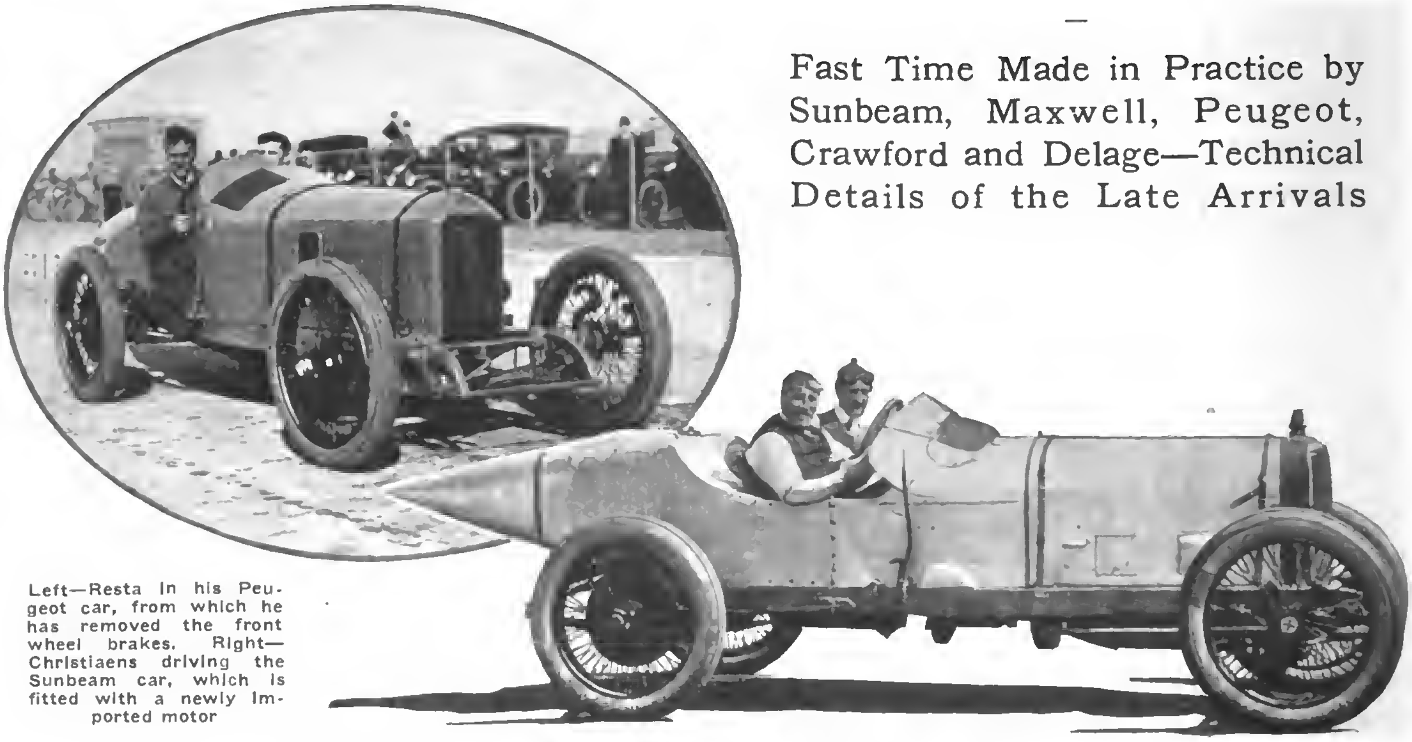
The biggest Fiat long-distance road racers ever built were the machines with which the late David Bruce-Brown took part in the French Grand Prix at Dieppe, in 1912. These cars had four-cylinder motors of 6.1 by 7.87 in. bore and stroke, giving 920 cu. in. piston displacement. They were defeated by the Peugeots of only 447 cu. in., this being the biggest racing car ever built by the French firm. It was this same Peugeot car which won the 1913 race at Indianapolis.

Tendency Toward Smaller Engines

There are indications that for record-breaking stunts, and for the publicity which they secure, the building of big freak cars will be continued. Nevertheless, for competition work on road and track the whole tendency is toward smaller and smaller engines. An example of this is shown in the case of Peugeot, whose biggest racing engine had only 447 cu. in., and was barely capable of 100 m.p.h. A smaller car of 275 cu. in. piston displacement, showed a speed of 110 m.p.h.; the smallest car, built just before the outbreak of war, and not yet seen in public, had 152 cu. in. and showed a speed of 95 m.p.h. average over the measured kilometer. Had it been possible to put this little machine in the 1913 Indianapolis race it would doubtless have defeated Goux's 447-cu. in. Peugeot, which covered the 500 miles at an average speed of 75.94 m.p.h., beating Wishart's Mercer by 13 min. and 8 sec.

1916 Racing Cars at Sheepshead

Fast Time Made in Practice by Sunbeam, Maxwell, Peugeot, Crawford and Delage—Technical Details of the Late Arrivals



Left—Resta in his Peugeot car, from which he has removed the front wheel brakes. Right—Christiaens driving the Sunbeam car, which is fitted with a newly imported motor

NEW YORK CITY, May 9—Day by day the activity on the Sheepshead Bay track is increasing, and about the line of garages beneath the curved sides of the great 2-mile bowl there is a hum of excitement and preparation for the opening of the racing season of 1916. On the track Christiaens in his Sunbeam, Billy Chandler in his Crawford, Ralph Mulford in the Peugeot, Rickenbacker and Henderson in Maxwells, and Miller in the Mulford Special are already trying out their mounts in preparation for the event of May 13.

Considerable interest attaches to Christiaens' Sunbeam, as it is a brand new motor, built with the special intention of bringing racing honors back to the Old World. The chassis of this car is the same that appeared in races in this country in previous years, but the motor has never been used until its arrival in this country, except for a few short trial spins at Brooklands. It is said that a sustained speed of 115 m.p.h. is not beyond the possibilities of this engine, and the car is looked upon as one which is sure to make itself heard from in this year's events. The motor is a six-cylinder design with a bore of 81 mm. and a stroke of 150, or approximately 3 3/16 by 5⅞ in.

One set of spark plugs is used, these being placed in a single line along the center at the top of the cylinders. The current source for ignition is a single Bosch magneto driven at three-quarters engine speed. There are two oil pumps, one which provides lubricant for the ball bearings supporting the crankshaft and the other for the two camshafts. A feature of the motor is the individual breather pipe for each cylinder.

Four Valves per Cylinder

Twenty-four valves, four to a cylinder, are employed. The camshafts driving these are mounted overhead, and the valves are set at an angle in the top of the cylinder head. Camshafts are driven by a vertical shaft and gears from the front of the engine. Christiaens' old specialty of two carbureters is again in evidence on this car, which is fitted with two neat intake manifolds, providing an interesting layout for gas distribution.

The gearset has four speeds with a final reduction on direct of 2.7 to 1. The car is equipped with a revolution counter, and the exhaust manifold is carried outside of the hood with a pointed entrance line.

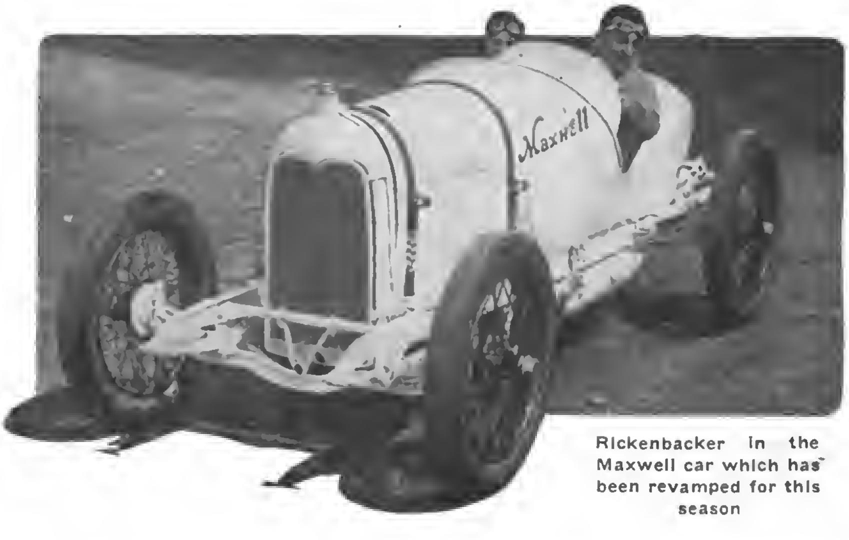
The sixteen-valve Duesenberg motor used in the Crawford cars should also be of great interest in the coming race and in other events on the national circuit. This motor is the one which was experimented with last year but which was completed too late to be used in any of the events. It is built very much along the same line as the eight-valve Duesenberg, having the valves operated by long rocker arms on the side. These rocker arms extend up the side of the motor and act directly on horizontally-placed valves located above the cylinder.

The Duesenberg motor stood up well in last year's races. At Indianapolis the car driven by Alley suffered no trouble of a mechanical nature beyond a loosened exhaust pipe. O'Donnell stopped only three times at Indianapolis, and his mechanical adjustments consisted of the replacement of a nut, which had jarred off the brake bracket, and a quick adjustment of the shock absorber. On the whole, these cars performed very consistently throughout the entire season and, while they were not so fast as some of the other entries, were generally in the money on account of their steady performance.

With the new sixteen-valve motors the same reliability should be acquired with an increased amount of speed, due to the greater gas passages, and a creditable performance is generally expected.

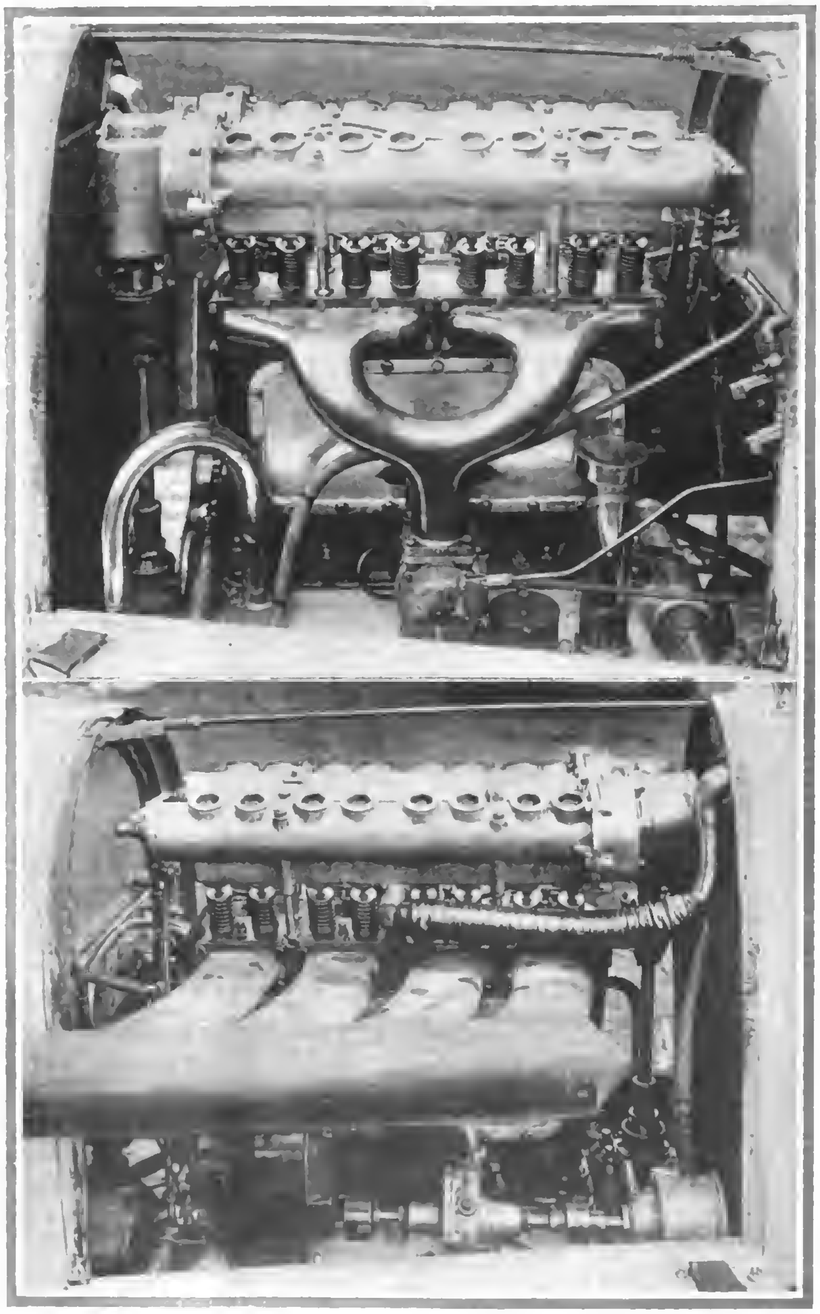
The Maxwell Racers

Every once in a while a flash of white around the 2-mile saucer betokens the presence of the Maxwell racing cars of the Indianapolis team. These cars are faster than the Max-



Rickenbacker in the Maxwell car which has been revamped for this season

Stern view of the Maxwell car showing the new pointed tail piece



Intake and exhaust sides of the new engines now fitted in the Maxwell chassis

wells of a year ago, due to the incorporation of a number of detail changes calculated to reduce the wind resistance and to increase the motor efficiency.

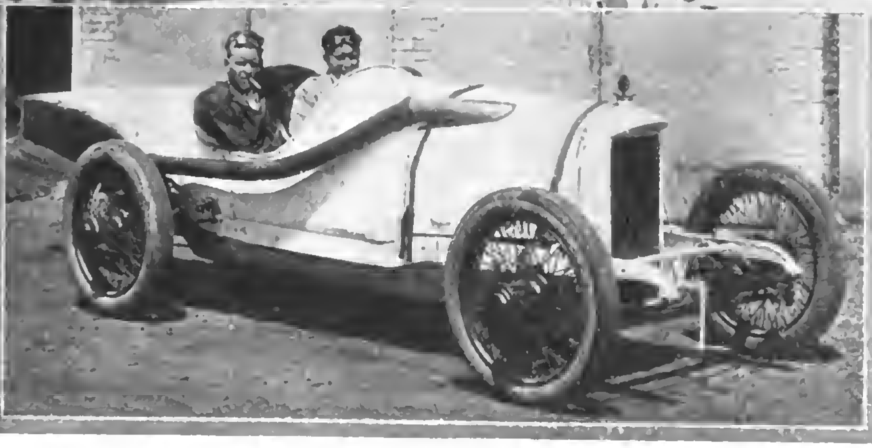
Instead of the stub-ended rear portion of the earlier cars, a long tail has been fitted, designed to a true streamline form, and thus cuts wind resistance to the minimum. Within it is carried the fuel tank of very large capacity with an exceptionally large opening, by which gasoline can be dumped into it in record time. This is the main fuel supply, and is by pressure. In addition there is an auxiliary fuel supply of less capacity, carried in the cowl, and which feeds by gravity, so that if the main supply becomes exhausted the driver can run in on the auxiliary by throwing a valve underneath the steering wheel.

The motors incorporate the only other changes from last year's practice. In most respects they are identical with the 300-in. sixteen-valve motors of the Maxwell team of 1915. Like those motors, they have a bore of 3¾ and a stroke of 6¾. These dimensions bring the displacement to just within the limit. To be exact, it is 298.2 cu. in.

The valve sizes have been changed slightly, the intakes being increased to 2 in. This is ¼ in. greater diameter than in the 1915 racers. The exhaust valves have not been changed, but the lift of all valves has been increased ⅛ in., the cams opening now 7/16 in.

The divided intake manifold of the 1915 cars has given way to a more direct and probably more efficient intake, in which the whole side of the cylinder head casting above the intake valves is opened up to the gas, thus giving a blanket of fresh gas over the entire intake valve area. Incidentally, the new manifold has been copper-plated and rounded off.

The original practice of having a large carbureter intake air horn outside the hood has been discarded, and the new cars have the whole within the bonnet.



Top, Left—View of the intake side of the eight-valve Duesenberg motor showing the arrangement of the intake manifold and the double set of spark plugs

Top, Right—Exhaust side of the Duesenberg eight-valve motor, showing the location of the magneto and the oil filler opening

Lower—View of the exterior of the Duesenberg car, illustrating the narrow front and the long tapered tail to reduce wind resistance

The oiling system has been changed somewhat, chiefly through the use of a triple-gear pump instead of a double one employed earlier. The system is a force-feed circulating type, in which fresh oil is drawn continually from a torpedo-shaped oil tank under the frame and returned to the tank after use. This keeps the oil cooler than would be possible otherwise. The details of the method of forcing the oil through the hollow crankshaft and camshaft to the connecting-rods and main bearings have been dwelt on before.

Uses Unique Crankshaft

The real feature of the Harroun motor as exemplified in these Maxwells of the Prest-O-Lite team, is the unique counterbalanced crankshaft construction, which eliminates the flywheel. This has not undergone any change for the past season.

Connecting-rods still are made of chrome-vanadium steel, and have been subjected to accurate machining over all. The I-beam section is further strengthened by forging webs on either end of the section, making a very sturdy rod.

The use of magnalium pistons is continued. The piston heads are domed to give them strength, and each has five rings. There are two diagonally split rings in each of the upper grooves and one wider ring below, which is used for a retainer for the wristpin. The use of magnalium reduces the piston weight from over 2 lb., the weight of a similar cast-iron piston, to about 15 oz.

In explanation of the counterbalanced crankshaft, it might be explained that the flywheel function is distributed along the entire length of the crankshaft, and is productive of fine engine balance. The counterbalance weight opposite each rod bearing is equal to the weight of the lower part of the rod and its bearing; thus the active forces are balanced with respect to the center of gravity, and the centers of masses revolve in the same or parallel planes. Vibration is materially reduced thereby.

The cylinders are cast in a block, and the head, carrying the valves, their rockers and the camshaft, is detachable. Intake and exhaust passages are on opposite sides of the casting, and they are large and free, so that the least possible interference with the passage of the gases to the manifolds is obtained.

Billy Chandler in the Crawford car which is equipped with a Duesenberg motor

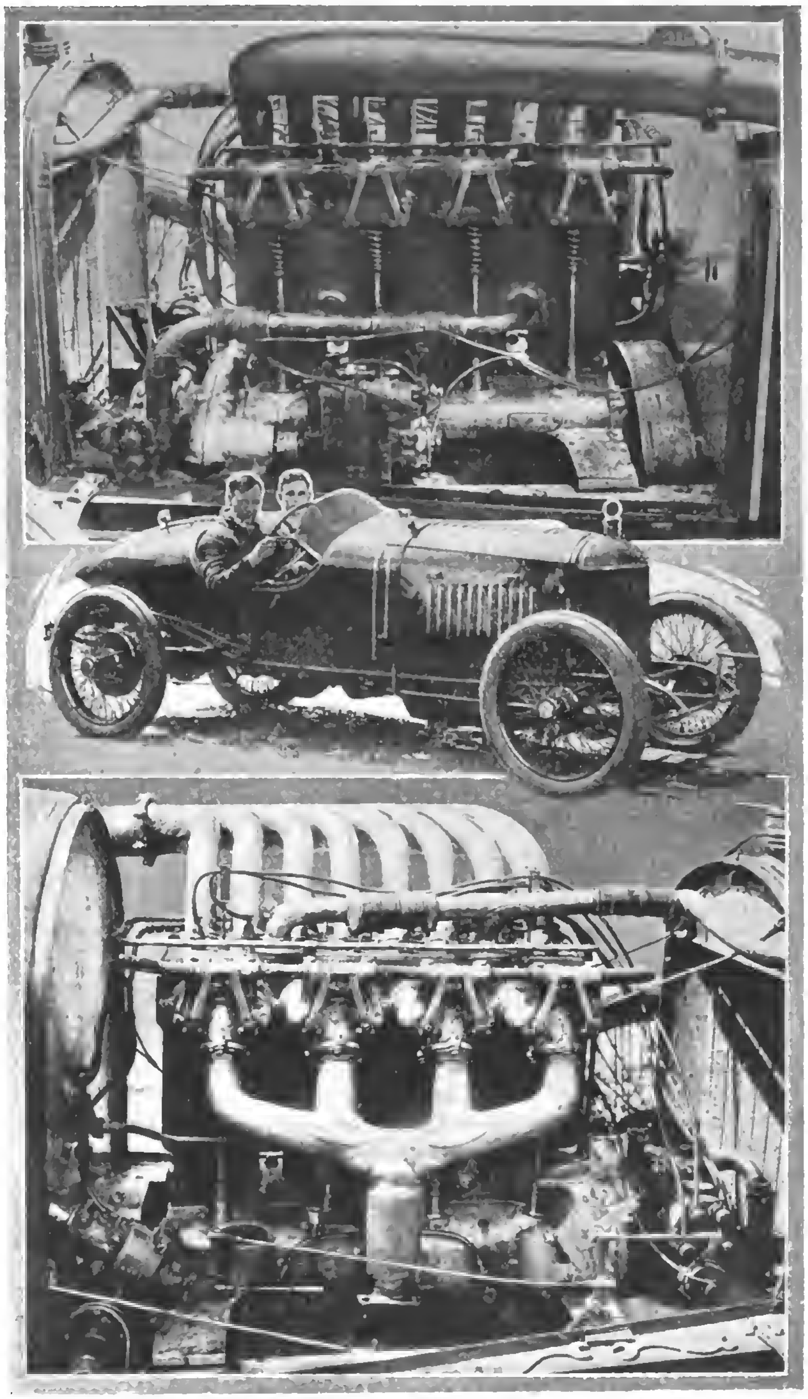
Although there are four complete cars, all in shape to make fast time, it is the intention to use only two of them in any race, holding the other two back for emergencies. In addition to the two completed cars held in reserve there is a very complete supply of spare parts and a thorough system of shipping and storing of parts so that they will be on hand when needed. One of the features of this preparedness program includes a combination motor stand and shipping crate; another, a parts bench, which becomes the parts locker for transportation. Altogether Rickenbacher, the team manager, has made very thorough plans for a successful campaign.

Mulford Special Withdraws

The Mulford Special was out on the track without its complete body, but is now withdrawn due to motor trouble. The motor in this car disclosed little from an exterior view. It is a square block in appearance, having four cylinders 3.98 by 6, giving a piston displacement of 299 cu. in. The valves are operated by vertical rocker arms. Everything is being done at the present time to make this car faster. In the last Sheepshead Bay race the Mulford Special was flagged at the 274th mile.

The Erwin Special has been out on the track for a few short trial spins but has had a little trouble with the engine, probably due to the fact that the bearings have been set up too tight. The engine is the same as the Erwin of last year, while the chasis is new although of similar design to the former one. The car is made by the Erwin Motor Machine Co., Philadelphia, Pa., and has a bore of 4 and a stroke of 5 15/16 in. The cylinders are L-head, cast in pairs, with the intake valves in the head and the exhaust valves on the left. All the valves, however, are operated from one camshaft. Rudge-Whitworth wheels with 33 by 5-in. tires are being used in practice. The wheelbase of the car is 108 in.

Harry Harkness's team of Delage cars which were described in THE AUTOMOBILE fully on March 23 have been showing excellent speed on the track and if they have the stamina of the other old Delage whose motor is illustrated on this page they should be well to the front. The new tails that have been fitted make them suitable for speedway work and they have created a good impression.



Intake and exhaust sides of the older type of Delage motor with the Delage car in the center

The engine of the new cars are considerably different from the older motors as the horizontal valves have been abandoned. There are now four valves per cylinder arranged in the head in the usual way at an angle of about 45 deg. The two camshafts are driven by a single vertical shaft with a nest of bevel gears at the upper end, the spark plugs being in the center of the cylinder heads. A small peculiarity is that the cylinders are bolted on from beneath the studs fitting in the cast iron foot with the nuts inside the aluminum crankcase. The valves are operated positively in both directions by a stirrup which passes right around the cam, only a cushion spring being interposed, so there can be no possible lag in closing.

There are two Claudel carbureters on each engine, operating simultaneously with throttles interconnected.

The engines are well within the 300 cu. in. limitation being 94 by 160 mm. or 3.7 by 6.3 in. This gives a piston displacement of almost exactly 270 cu. in. The wheelbase is 106 in., and the tires 34 in. diameter on Rudge Whitworth wheels.

Just back of the seats there is an immense tank for gasoline and oil, the latter being fed by hand pump when desired, and circulated in the engine by a centrifugal system.

The National Road

A book which should help give to the noted highways of America the prestige they deserve by awakening a greater appreciation of them among motor tourists has been written by Robert Bruce under the title "The National Road." It is descriptive of that historic thoroughfare, the old National pike, running from Baltimore, Md., and Washington, D. C., via Frederick, Md., and Cumberland, Md., through southern Pennsylvania, to Wheeling, W. Va., and so to the banks of the Ohio River.

Paragraphs on Current Topics

By MARIUS C. KRARUP

Many are thinking worm gear. Worm drive for trucks. Worm drive for electrics. Why not worm drive for light cars? Nay, even two worm drives in tandem might be arranged and the gearbox dispensed with. Or perhaps three would be easier to manage, with two of them to be cut out to give direct drive. What delightfully silent little cars that would make. But halt. "Never pick up a snap" is a safe rule, which translated into mechanics means that the obvious is usually not so. Trouble lurks somewhere. Have you thought of coasting efficiency? Well, the light car needs a lot of coasting efficiency, and the worm drive, even of 45 deg. pitch, has not any to spare. We would like to know just how great the coasting efficiency of a worm gear can be made, and we know of others to whom it would be useful to know it. Coasting efficiency is the winged word of conservatism in worm gear speculations at present and has to be considered, though it need not be accepted as an insuperable bar to hopeful planning.

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May we say it is the employment of a suction which is beyond direct control that has made carbureter construction difficult, still makes carbureter adjustment ticklish and necessitates many sizes? To be sure, a 900 r.p.m. suction can be managed so as to pull itself up to a 2000 r.p.m. suction in a few seconds, giving as rapid acceleration as is usually wanted. This is marvelous, but a better action could have been accomplished much more simply with compressed air on tap. The Decupli system of forced induction demonstrated so much, at least, several years ago. To remind us, it is illustrated on another page.

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Citified automobilism is well along, but here—at the movies—we see an armored motor car stalled in Van Cortlandt Park because one of the front wheels has sunk into the soft ground and not more than halfway to the axle. Volunteer soldiers are digging it out. The scene is filmed to exemplify Preparedness work. But a wheel that would roll out of the hole would seem fully as patriotic to some of us, so much more as the design—in the case of a front wheel or a trailer wheel—is almost obvious.

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When publicity ceases, stagnation and worse sets in; competition is corrupted. Without the searchlight of public comment constantly playing on every detail in automobile and motor truck construction, furnishing the facts and nomenclature for thousands of interested discussions and conversations all over the land, can anybody imagine just how much the zest for improvements would have lagged and how much smaller the pressure would have been for combining high quality with economical construction? Where publicity has met the greatest obstacles and has been farthest behind—as in all matters relating to durability and in all details and refinements of motor trucks and delivery wagons—there too the accomplishments of the industry have been least worthy of admiration. Why these remarks, trite and self-evident? They are for the express benefit of truck salesmen who unexpectedly and suddenly lose promising prospects without knowing why. They have run against the axolotl. An axolotl is a blind newt having its habitat in subterranean waters, but it is also a motor truck made to be sold through the influence of interlocking directorates. No ray of light is shed upon its construction from outside of the charmed circle. Its parts yield profits to several sets of directors. Its assembling and sale to other directors and bankers. In the corporations which purchase the axolotl trucks to do their transportation work there are directors who make three profits on the deal. If there are shortcomings in the construction, the common shareholder in the purchasing concern will pay for them. It is his lookout. And he sits in a subterranean cave with no ray of publicity to help him see, no disinterested comment to make him hear. Truck construction is not yet quite far enough advanced and, especially, the public appreciation of the requirements is not yet so ripe and deliberate as to make this sort of development a welcome feature. It courts abuse of confidence and discourages fair play. But there is no remedy, it may be said, if those who are to pay the bills are not bright enough to look out for themselves. How about contests? Such contests, for example, as the army departments of foreign governments have held to determine what makes of trucks should be entitled to subsidy or what price should be paid for them.

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Truck contests in the past have been uninteresting and inconclusive because everybody knew that durabilty, the main factor in serviceability, was not tested.

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In a tight place in the traffic we press the accelerator hard to jump out of the squeeze. But there is a little time gap between the actuating of the pedal and the desired movement. This important little gap varies for different cars, and in acceleration charts, by the Wimperis accelerometer, it does not seem to be recorded. In comparing acceleration by test for different types of motors, it might be interesting to plot a separate curve for the gap, beginning with the intention to accelerate and ending one to two seconds later. Most of the luxury in prompt acceleration is concentrated in this period.

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Differentials always do what they are designed to do. They are forgotten when weather and roads are fine. If there is trouble it is because the road or one of the wheels fails to do its part in operating the differential. Every improvement, so far, consists in making it differentiate less perfectly; making the axle operate more nearly as a unit when one of the tractor wheels fails to tract. The next step in this direction is the solid axle, which is now proposed for trucks. Probably it is a question of average road conditions which method will involve the greater expense for wear of tires and extra demands upon the motor power. There are some other possibilities. The free wheel in conjunction with a reverse gear whose operation automatically locks the wheel has not been fully tried. But the radical remedy relates to the wheel. With caterpillar traction the differential has only its cost against it. Eventually there must be developed a real "automobile wheel" whose traction will be reliable enough to relieve the differential from unmerited blame. We see it coming by way of army trucks, agricultural tractors and light steel castings or sheet steel construction.

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Specifications for army trucks have been framed, on request of Major-General Leonard Wood, by Robert McAllister Lloyd, W. P. Kennedy and Joseph A. Anglada, all of the S. A. E. metropolitan section, in consultation with Captain Gordon Johnston and Major C. S. Lawton. The specifications are in three classes, representing first, second and third choice. The object is the double one of guiding the army authorities in purchases and the truck manufacturers in construction, as well as to have a large percentage of commercial trucks eligible for army work. It would be a remarkable vindication of this method if the new specifications were locked up for a while and the work done over again with three other engineers—say from the Detroit section—and substantial correspondence was found to exist in the results in both instances. Should divergencies appear, a most excellent debating material, for both army men and truck builders, would have been created, much for the advancement of the cause.

* * *

It would be interesting, in addition, to stage carefully all those army requirements which are special and indispensable, have them visualized in a few hundred photographs with explanatory captions, have all of these published or distributed in full sets and invite all S. A. E. members to specify means for meeting the needs. Division into as many classes of vehicles as the army men think should be allowed would simplify the designers' work.

Forced Fuel Feed vs. Automatic

VARIOUS means for operating a motor at will with a charge higher than its normal maximum and with the compression correspondingly increased have engaged attention, with a view to getting high power and speed from a small motor and an economical power development over a much wider range than would be at disposal by using a larger motor. In the ordinary high-speed motor a similar object is accomplished mainly by large overhead valves, narrow valve faces, increased valve lift, internally polished induction pipes with a minimum of abrupt bends, suitable valve timing and a number of refinements necessary for taking care of the inertia forces. In comparison with these means, or in conjunction with them, the system of forcing the intake of the gas and air charge has the advantage that it may be used for increasing the force of explosions at slow motor speed, when the motor is handling an overload, and that the surcharge at any speed can be made much greater; in fact so large as to involve the risk of burning out exhaust valves and plugs and injuring the motor generally. Additional interest attaches to the whole idea of forced intake now, because it gives promise of assisting greatly in reaching complete success in the use of other fuels than gasoline, especially kerosene and alcohol. This prospective advantage depends upon being able to apply the forced intake at any desired point in the cycle, rather than being limited to the suction stroke.

The most practical example of forced charging was the Decupli arrangement, which was described and illustrated in THE AUTOMOBILE in 1912, when it was fitted in a car and submitted for trial to the French Automobile Club. Eric Walford draws attention to this construction again in a recent issue of *The Autocar*, giving the illustrations which are reproduced herewith. Fig. 1 shows diagrammatically the general arrangement in fitting the system to the test car.

Alongside the gearbox there is mounted a short shaft driven by a belt from the clutchshaft and carrying a clutch, so that the pumpshaft can be rotated or not, at will. At the rear end of the shaft is the compressor supplying compressed air to the carbureter, which is of the construction shown in Fig. 2.

With modern provisions for motor-starting and electric lighting, these cumbersome arrangements can evidently be much simplified, and the facilities now existing in this respect are among the factors causing renewed interest in the subject.

In the carbureter there are two jet nozzles, *A* and *B*, the former operating in the usual manner when no forced charging is desired. At such times extra air for the carbureter enters by the valve *C*, which is interconnected with the throttle. When compressed air is supplied, on the other hand, the plunger *D* over jet *B* rises, uncovering this second jet. Supplementary air and safety valves are provided, as shown in the cut, and the float chamber is in communication with the spraying chamber, so as to balance the pressures.

At the trial this system was fitted to a 12-hp. Mors car and the records show that the car climbed a hill at an average speed of 24 m.p.h. without making use of forced charges, and that it was possible to raise this speed to 33.6 m.p.h. by admitting the compressed air, such admission producing at once a forward leap of the car, the weight of which was 3360 lb. It was figured that the charge forced into the cylinders with the Decupli device was double the normal maximum, which would also nearly double the compression and probably set up stresses so high as to call for special design in many details of the motor.

The situation looks different in many ways when it is contemplated to have the cylinders draw their normal charges in the usual manner and to employ the compressed air only for introducing the surcharge at a later moment; or else to draw in air alone by suction and shoot in the fuel with a little additional air later, as should be especially suitable for fuels whose vapor, as that of kerosene, is liable to cracking while exposed to a temperature which is not quite sufficient for ignition.

In Diesel motors with high compression the air-compression plant is said to absorb an average of about 6 per cent of the power output, and it may be doubtful if any smaller allow-

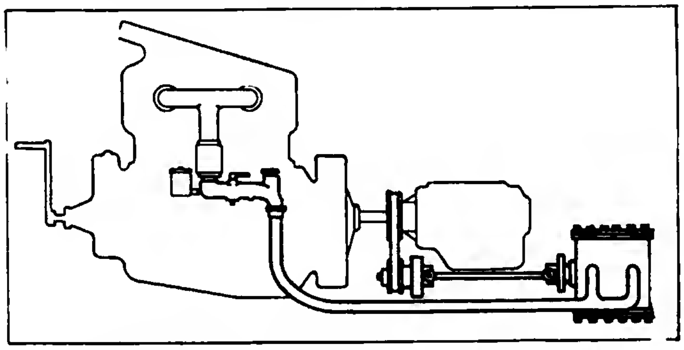


Fig. 1—Arrangement of drive, compressor and carbureter in Decupli system of 1912

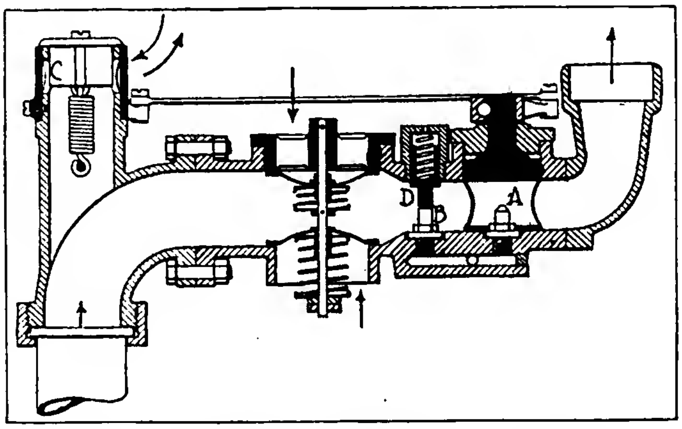


Fig. 2—Construction of Decupli carbureter for increasing fuel charges by compressed air

ance should be estimated for automobile motors whose small dimensions would make for lesser efficiency in this detail.

The Blower System

Mr. Walford, in his above-mentioned review of the attempts made to materialize forced induction as an adjunct to motors not originally designed for it, mentions those made by Alexander in 1907, by Kessler in 1909 and by Lewis a year or two later, as well as a patent by Gore which does not seem to have been tried in practice. In a general way it is found that neither the use of air compressed in the crankchamber nor that of force blowers is fully acceptable.

R. M. Alexander used a blower in the inlet pipe between the carbureter and the engine and obtained a decided increase of power. The fan used was about 6 in. in diameter and was run half as fast as the engine by means of a friction disk actuated by the flywheel.

If a blower were placed so as to force air through the carbureter it would interfere with the carbureter action, so long as this depends upon producing an atmospheric depression around the fuel jet in order to draw the fuel out. This objection may be overcome, however, as in the Decupli device, by putting the float chamber and the fuel tank into communication with the inlet side of the carbureter.

The blower device fitted by E. W. Lewis was coupled direct to the induction pipe and drew gas from the carbureter without the use of any reservoir between the engine and the blower. Its dimensions were large and cumbersome and no tests were made to determine approximately what gas pressures or horsepower were produced.

The Kessler system was applied to a two-cycle motor fitted to an American Kessler car which was taken to England in 1909 and tried out on the Brooklands track. The principle was that of utilizing the piston stroke for compression of air in the crankchamber and sending this air into the other cylinder in addition to an almost full charge introduced by suction. The four-cylinder motor developed great power at all of the three gear speeds, but was very noisy.

In another instance a four-cylinder, four-cycle motor of the horizontal type with two opposed air-cooled cylinders was operated with forced charges on a principle similar to that used in the Kessler two-cycle motor, and in this as in the other cases there was no doubt about the increase of power; but the attending drawbacks, both in construction and operation, pointed to larger size of the motor or the usual expedients of high-speed design as being preferable for attaining the desired power and acceleration.

Summarizing the Impression

The data on forced fuel feed to the cylinders are vague so far. One feels that the experiments which have been made were partly on the wrong track. The idea of forcing power and speed by cramming the cylinders overfull with explosive charge does not appeal strongly to mechanical sense; not at this date. But there is a larger view. The methods used for cramming the cylinders point to better ones which may be used similarly but for a more moderate purpose: For improving carburetion, cylinder-charging, combustion, lubrication, acceleration; for introducing an improvement over the automatic cylinder-charging now universal; an improvement likely to prove more important than the change, of old, from automatic to mechanically operated inlet valves, which was the beginning of higher-speed motors and decisive for efficiency and motor control.

It is known that the practical limits for high motor speed can be reached and exceeded without more than full charges in the cylinders. The difficulties which set these limits must operate even more strongly against additional forcing of the charges. But if, for example, the extreme valve timing which is resorted to in racing motors could be avoided, as seems more than likely, by positive cylinder-charging—supplementing a partial charge with air by suction—the useful range of motor speeds would be largely increased, and the high-speed motor would become flexible as well as powerful and economical.

This and the relation to other fuels than gasoline lends the subject an interest which must continue to grow and must result in many experiments in the industry.—M. C. K.

Rule for Obtaining Correct Tension for Silent Chains

THERE is nothing that is so destructive to a silent type chain as is running it slack. If the tension is incorrect the slack side "thrashes" and this quickly beats the life out of the chain. Probably a large percentage of chains used for electric generator or starter drives give much less service than they ought to do because they are allowed to get slack. The automobile owner and even the repairman is often at a loss to decide how tight a chain ought to be, hence the opinion of an expert is of great value. F. L. Morse, maker of the Morse rocker joint chain, gives the following simple rule for obtaining correct chain tension. It is:

"Tighten the chain by the adjustment till it growls when running; then slack it off by slow degrees till the growl just ceases. The chain is then at the right tension."

Mistakes Impossible

Mr. Morse also says the adjustment is so easy that to make a mistake is almost impossible. Nearly everyone with any mechanical knowledge knows the way to adjust a cup and cone ball bearing, namely, to tighten it till it runs stiff and then slack back the cone till it just, and only just frees itself. The method for chain adjustment is almost exactly similar. Mr. Morse gives as his opinion that adjustments ought to be made as accessible as possible, since any owner can keep a chain properly tensioned without professional assistance, if he can get at the adjusting nut. He considers inaccessible adjustments militate against the proper maintenance of tension and so against the life of chains.

Dodging British Taxation

THINGS are usually supposed to move slowly in Great Britain but something seems to have been doing since the motor car taxes were raised. The government has just announced a new schedule of horsepower taxation to come into force in June which makes the annual license fee for Ford cars $90.72, three times the old tax. The Ford suffers because it has a large bore and falls in the class between 80 mm. and 102 mm. which has this sum as the annual due.

It is now announced that a company is in course of formation and will commence operations immediately, to supply cylinder liners and new pistons which will fit any Ford motor and reduce its bore to come within the next lower tax schedule of $30.24 per annum.

Our British contemporary *The Autocar* for April 22 is filled with letters bewailing the injustice of the new taxes and pointing out how vicious an effect upon design is exercised by a tax upon bore which takes no regard for stroke or total piston displacement. *The Autocar* in an editorial points out that the money must come from some place and suggests that if the automobile is to be taxed as heavily as this the same total amount could be raised more fairly by charging so much per 100 cu. cm. (about 6 cu. in.) as this volume normally produces about 1 hp. Even this, it is pointed out, falls harshly upon owners of old cars with large, inefficient engines, and this sort of vehicle has been used largely by people of small wealth owing to the low first cost. It will certainly spoil the used car market.

Sun Six Uses Ejector Exhaust

Well Known Parts Used In Assembled Product

A LIGHT six-cylinder car has been put on the market by the Sun Motor Car Co. of Elkhart, Ind., in five-passenger touring, four-passenger roadster, and five-passenger sedan style. The touring car sells for $1,095.

Five-passenger touring car on Sun light six chassis, listing with full equipment at $1,095

Although this is an assembled car, in exterior appearance the lines are characteristic. The wheelbase is 116 in. and this space has been used in a way to give good body room in both the forward and rear compartments.

Has Suction Exhaust Effect

The motor is a six-cylinder L-head 3 by 5 with removable cylinder head and featured by what the Sun company calls a dual ejector exhaust, the idea of this being that the ejector principle is used in having the exhaust from one cylinder create a suction to lessen the back pressure on the next cylinder. Both the intake manifold and the hot air connections for the carbureter are integral with the cylinder casting. The 20-gal. gasoline tank is placed at the rear of the chassis and fuel is fed to the carbureter by the Stewart vacuum system. The carbureter is a Rayfield.

Large diameter valves are used and light pistons. The crankshaft is carried on three main bearings and is balanced by the curved web system in which the crank cheeks are claimed to act largely as their own counter weights.

The valve actuating mechanism is located within the crank case where it is subjected to the spray of oil due to the splash lubrication. Pump circulation is used for the oil which is kept at a constant level in the splash troughs. Circulation of the cooling water is by thermo-syphon. The water circulates entirely around the cylinder wall and the valve seats and both the intake and outlet water pipes are 2⅜ in. in diameter. The radiator is a honeycomb type having a water capacity of 2½ gal.

Single Disk Clutch

From the motor the power is transmitted by a Borg & Beck single plate dry disk clutch to a three-speed selective type of gearset. This is mounted as a unit power plant and the entire unit is supported at three points to avoid distortion. The rear axle is a floating type with the weight of the car carried on a pressed steel housing. Both ball and roller bearings are used to take the drive and weight.

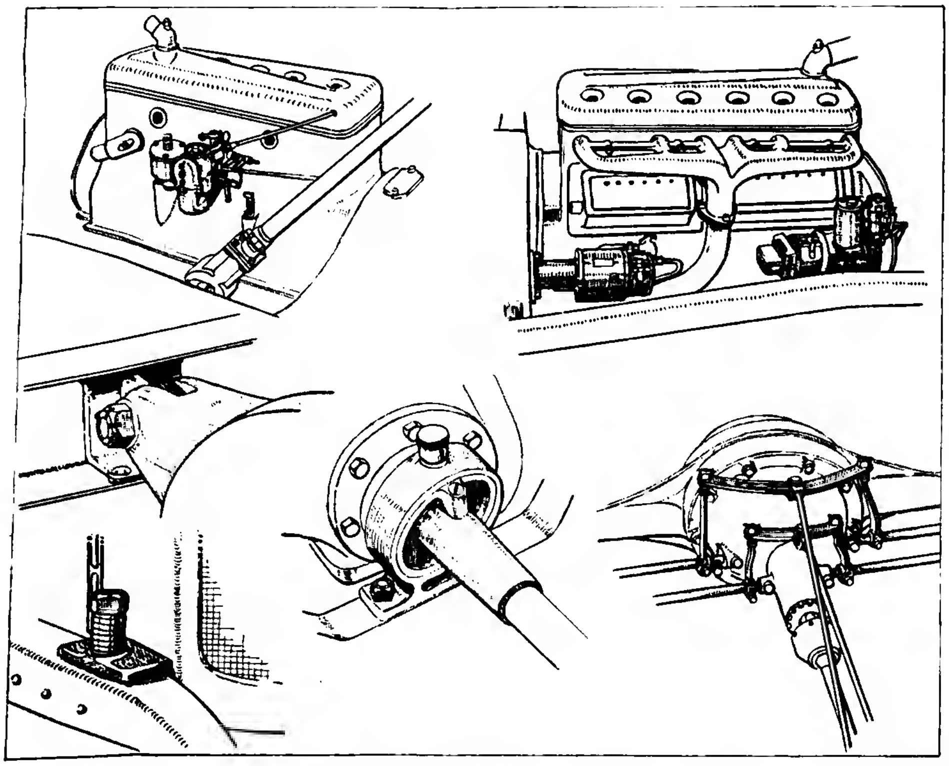
The front axle is an Elliot type with a cup and cone ball bearing. The frame is designed to be rigid, being of channel section 5/32 in. stock, reinforced by six cross members. The frame width in front is 28 in., giving a small turning radius. Semi-elliptic springs are used, front and rear, the latter being 52 in. long by 2¼ in. wide. Cross-rolled vanadium steel is used in their construction and the frame channels are arched over the axle at the rear with the springs swung directly underneath.

Equipment Is Complete

Some of the other features of the car are Remy starting, lighting and ignition, Burd high-compression piston rings, Jacox irreversible steering gear, twelve-spoke wheels, 34 by 4 in. tires with non-skids in rear, one-man top, Jiffy curtains and a full line of equipment.

This includes ventilating rain-vision windshield, electric motor-driven horn, tire carrier at rear of chassis and Firestone demountable rims.

The standard color is Brewster green with hood, fenders and running gear black enamel.



Details of motor and chassis features, illustrating simplicity of design in new Sun chassis

Effect of Compensating Jet

How the Zenith Carbureter Operates and Theories Underlying Its Design

By V. R. Heftler

Manager Zenith Carbureter Co.

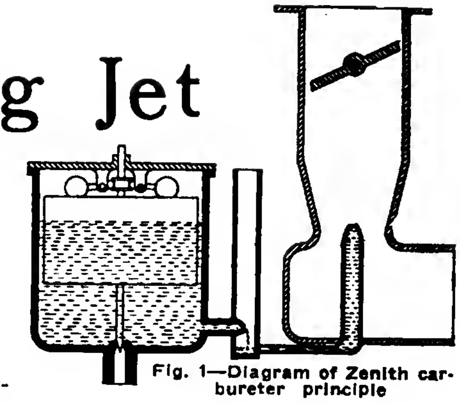


Fig. 1—Diagram of Zenith carbureter principle

THE paper on carburetion read recently before the Cleveland section of the S. A. E. by F. O. and H. O. Ball and published in THE AUTOMOBILE for April 27 provoked considerable discussion, a prominent participator being L. V. Heftler of the Zenith Carbureter Co., who took exception to some of the deductions made by the authors. Mr. Heftler's remarks cover the basic theory of the Zenith design and are thus of considerable interest, and in the following are given practically in full:

Krebs' View of Carburetion

It strikes me that, in the first part of the paper, the theoretical deductions are made under certain assumptions which, as the paper says, are contrary to a more prevalent opinion. This prevalent opinion was presented by Professor Rummell and was contrary to the view of Krebs presented in 1902. Krebs, as all carbureter engineers know, held the view that while the air curve follows a parabolic law the gasoline curve also follows a parabolic law having a slight lag at the start. He attributed this difficulty to the slight difference in level between the constant level and the tip of the nozzle. Krebs determined experimentally this curve lag and he found the corrective term to be equal to 21 mm. when his nozzle was not 21 mm. above the level.

Suggests a Test

It seems to me that, if this law upon which all those curves are based were true, the engineering community would be very much interested in knowing in what manner this new opinion, contrary to the view that we have, has been arrived at. It would be a very easy matter to find out if these considerations are correct; the obvious way to do is to eliminate that disturbing influence caused by the nozzle being too high above the level. We could very easily make, for experimental purposes, a carbureter in which the nozzle should be, say, ⅛ in. below the level. Of course, such a carbureter will be impractical for use in an automobile, because it will spill gasoline while at rest, but while being used to test on the dynamometer, we could find out whether or not that is the cause which prevents the gasoline curve from following the air curve. This would be a simple way of testing that theory. The theory of Krebs, to which Messrs. Ball now revert, was very much opposed by various authors, and the theory that is adopted now by the majority is that the gasoline curve of a fixed orifice is a parabola, but the apex of a parabola is not on the horizontal axis, as in Krebs theory. It is somewhat below.

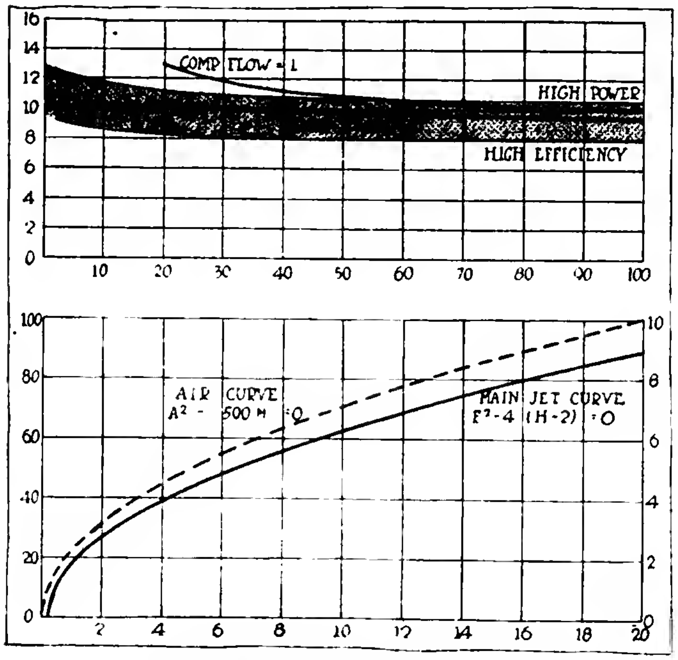


Fig. 2—Curves obtained with Zenith carbureter

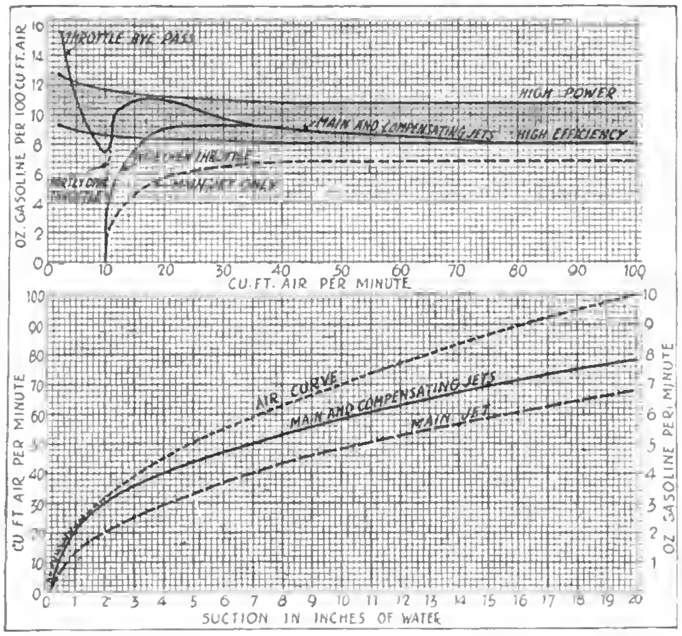
But even taking the premises used in making the theoretical analysis of the various carbureters, I believe that it is possible, at least in one case, to arrive at a different conclusion. I have reference now to Figs. 3 and 4 and to the compensated fixed orifice carbureter. This type of carbureter is described as follows: "A second supply is drawn from a well open to the atmosphere and supplied with a constant quantity of gasoline from the float chamber by gravity." This quotation from the paper reproduces the term of a patent to Baverey, and therefore is referring, and can refer to only one carbureter, with which I am associated. Taking Fig. 4, I have considered the parabolas used in making the curves, and I find that the air curve is very accurately, absolutely accurately represented by the equation $A^2 = 500\ H$ where A is the air flow, and H the suction, and that the fuel curve of the main jet is represented by the equation $F^2 = 2.316\ (H - 0.2)$. These equations can easily be verified.

The Compensating Jet

The compensating jet has been assumed to follow a more complex law. It has been assumed to be constant and give a quantity of fuel equal to 1 oz. per minute provided the suction is greater than 2 in. Before the suction reaches 2, the carbureter jet does not get constant flow. I will see later whether this is justified.

$$C = 1 \text{ provided } H > 2$$

Now, the analysis of this carbureter does not show very well, but the remedy is obvious. If I had a carbureter like that, that does not show very well, I would simply increase some of the jets, and I am assuming exactly the same premises that have been assumed in the paper. The analysis in the paper shows a tendency for the mixture to become too lean at high suctions, while it is about correct at low suction. Let us therefore increase the size of the main jet, that is, change the parameter in the main jet equation. For instance, $F^2 = 4\ (H - 0.2)$. If I were to keep the same compensator, I find that with the quality diagram at 20 cu. ft. per minute, the quality number would be 13, and that at 100 cu. ft. per minute it would be 9.9, but, obviously, all I have to do is to take a smaller compensator. I take for this compensator one



Above—Fig, 3, Below—Fig. 4—From Ball paper curves for carbureter with fixed orifices and compensating device

represented by C = 0.5, the compensator giving only ½ oz. per minute and the quality diagram varies for 20 cu. ft. from 10.5 to 9.4 for 100 cu. ft. What a difference! The accompanying curves show the quality curves with $C = 1$ and with $C = 0.5$. Now, the assumption has been made that the compensating flow obtains constancy only when the suction is 2 in. of water. This might be correct if the carbureter were designed that way. In order to make myself clear, I will make a very rough diagram of what this constant fuel device is like, Fig. 1.

I have very roughly here shown a constant level fuel chamber and I have neglected to show, because it is a complicated drawing, the main jet, the one referred to in the curve as the main jet, so that we have here the constant level fuel, a well open to the atmosphere, a fuel orifice below the level, and a connecting channel terminating in this nozzle. Now, the suction at which the flow of the compensator becomes constant depends on various factors shown here, which are the area of the nozzle, the area of the compensator and the height between the nozzle and the connecting channel. At exceedingly low suctions, the fuel drops in the well, then a suction is soon reached at which the air passes through the channel to the main nozzle, and from that time on the flow through the compensating orifice is practically constant. As I said, the suction at which this constancy is reached depends on the instrument. In the instrument, such as our company makes, this constancy of flow is reached for a much lower suction than 2 in. of water, and the fair average would be 1.1 in. of water, so that we have there one reason why it is legitimate to continue the curve of quality of the main compensated jet nearer toward the origin of co-ordinates.

When Throttle Is Wide Open

There is another reason why it can be continued still further. There is a statement in the paper, which I will read: "When the throttle is wide open and the motor is slowed down by additional load, the decreasing suction of the motor permits the atmospheric well to fill gradually with gasoline, thus decreasing the gravity head in the float chamber and causing the quantity discharged into the well to decrease."

It would seem that way, but it is not correct. This is a peculiar point, which is hardly known outside of our own organization, and I don't wonder that an error can be made. After the suction is reached, we have no gasoline in channel but an emulsion, but it is much lighter than gasoline, and it would take a good deal less suction to hold it up and carry it up, so that if the critical suction is 1.1 of water, going up, it doesn't follow that the well will again fill up when this suction of 1.1 of water is reached, going down; this kind of hysteresis effect causes the flow from the compensating jet to remain constant for suctions much lower than have evidently been assumed.

Summing Up

To sum up, I have taken the premises under which this theoretical analysis has been made, and have shown that, by simply changing parameters, which is equivalent to changing the sizes of the jets, I arrive at results quite different.

There is, therefore, a question in my mind as to whether or not, by following exactly the same course, changing the jets, it would not have been possible, when operating with the actual carbureter, to obtain, likewise, entirely different and much more satisfactory results.

I am not questioning the accuracy of the curves. I am not questioning that at all. I do adopt, for purposes of argument, the theories that were evolved from the facts and from these theories, as well as from the fact, I have deduced what the facts would have been if a larger nozzle had been chosen. This is quite different. I am taking the very premises that are presupposed by both curves. I have taken those premises, and by choosing the parabola, or, in other words, by choosing the size of the opening, and the amount of constant flow, I have obtained this curve. We know by experience that this is what is done in a practical fitting of a carbureter to an engine. When you change those jets, those curves are changed.

Cleveland Gets Cars by Water

Ninety cars worth $65,560 were shipped by water May 6, by the Willys-Overland Co. to Cleveland on the steamer City of Buffalo, establishing a new record for automobile shipments.

The Willys-Overland, Inc., of Cleveland, uncertain as to whether it would receive its spring shipments of cars in proper time, owing to a shortage of freight cars, decided on this procedure to get prompt delivery.

The City of Buffalo left Cleveland Friday evening and reached Toledo Saturday morning at 10 a. m. At 10.30 the City of Buffalo moved forward to the dock and the cars were run on board. Less than two hours later the ship was steaming down the river. The boat reached Cleveland that evening and was met by a hundred drivers.

Automobiling Hard Hit in England

Touring Car Importation Prohibited, Gasoline Taxed 12 Cents Per Gallon and Triple Car Taxes with Strict Driving Regulations—Contrasting Situation in France

By W. F. Bradley

LONDON, ENGLAND, April 20—With the importation of touring cars prohibited, a tax of 12 cents per gallon on gasoline, no benzol supplies, and a proposal which will almost certainly become law to triple present taxes, the position of British motorists is not at all enviable, Further, there is an active campaign against what is termed pleasure motoring, quite an appreciable amount of money having been spent in posters and other printed matter asking motorists not to use cars for purposes of pleasure. As a matter of fact, automobiles have been very little used during the last six months for anything but utilitarian purposes, the high cost of gasoline and the all-around increased cost of living being quite sufficient to eliminate motoring for pleasure. Nevertheless, the effect of the official appeal has been to create an impression in the minds of the public that car owners are squandering money which ought to be kept in the country and used for more useful purposes.

$1,000,000 in Taxes

The new taxation proposals are a very severe blow. It is officially announced that $1,000,000 will be gathered in by means of these taxes, but as owners have the facility of storing their cars and thus avoiding the payment of the taxes, it is quite possible that the taxable material will disappear and that the object of the government will be defeated. This danger is so great that many are inclined to believe the taxes have been levied with a view to suppressing motoring rather than to getting additional revenue.

Up to 16 hp. taxes are doubled; from 16 hp. and upwards they are trebled. The method of calculating horsepower is on cylinder bore only. A four-cylinder car of 2 11/16 in. bore is less than 12 hp. and normally pays an annual tax of $15; up to 3 5/32 in. bore is less than 16 hp. and pays $20 tax. Up to 4-in. bore cars are rated at less than 26 hp. and are normally taxed $30. While in the two lower classes the taxes are doubled, in the third and all higher classes the tax is trebled. This strikes particularly hard at all the cheaper American cars, for with the exception of the Overland model 75 and the small Saxon these come into the third or higher classes and have to bear treble taxes. The Ford, which is in a numerical superiority in England, has to bear a triple tax. The following table shows the original and the new taxation on some of the leading American cars on the British market:

Car	Original Tax	New Tax
Ford	$30	$90
Overland 6-cyl.	40	120
Overland 83	40	120
Overland 75	20	40
Dodge	30	90
Buick D-54, 6	50	150
Buick D-44, 6	30	90
Studebaker, 4-40	30	90
Studebaker, 6-50	50	150
White, G. A. H.	30	90
White, G. E. D.	40	120
Saxon, 14-15	20	40
Saxon S-2	30	90
Saxon 17	30	90
Pierce 66 A-4	100	300
Packard 12-cyl.	100	300

Old type cars of any make, the value of which is now very low, are so highly taxed that it is practically impossible for their owners to run them. There must be hundreds of old-type Panhards, Charrons, Mercedes, De Dion, and other established makes, the value of which is less than $300, but which on account of their big cylinder bore have a high-rated horsepower and are taxed $90 to $150. Under the English law if a car is not in use it does not pay taxes, thus it is quite likely that many owners will prefer to store their cars at the end of June and avoid paying the increased duty. In these cases the State will lose not only the car tax, but also the gasoline and the annual driving tax. In drawing up the budget it appears to have been assumed that cars of 16 hp. and above are all costly vehicles belonging to wealthy persons.

Horsepower Inequalities

The fact has been overlooked that the horsepower rating is quite an arbitrary one, and that many a small bore, long stroke, high-speed European motor has a bigger cylinder capacity and develops greater power than a big bore short stroke American car. As an instance, the 3.1 by 7.08 in. Hispano-Suiza is only rated at 15.9 hp., and will pay a $40 tax, while a 3¾ by 4-in. Ford, which develops less than half the power and costs a third of the price of the French car, is rated at 22.4 hp. and has to pay a $90 tax. Scores of such examples could be quoted to show the illogical nature of the new taxation.

Automobile dealers are very hard hit. There are very few English cars available for the market, and all agents have in consequence been glad to take up agencies for American cars. Now that this source of supply is shut off, nothing remains for dealers but to close their stores. Many of the smaller dealers who were unable to get American business closed months ago, but the larger firms have managed to keep going until the present. Now such big firms as the Fiat company and the Renault branch have decided to close their doors. The value of used cars, particularly small models and modern types, is strengthening; big, old type cars have lost in value.

Few Restrictions in France

Reports, which were prevalent a few weeks ago, of the Government control of gasoline, which would only be given out to those persons who could show a valid reason for motoring, are now receiving little attention. The prohibition of imports, the increased taxation and the high cost of gasoline are doubtless sufficiently restrictive measures. Motorists are still receiving very close attention in the matter of lighting regulations, headlights being forbidden in practically the whole of England and only feeble sidelights being permissible in most of the coastal area.

Motoring conditions in France contrast strangely with those of England. In a country where the war is being decided there are, outside the army zone, practically no restrictions on the use of automobiles. Unlike England, lighting regulations have undergone no change; automobile taxation has not been increased, although a rise is promised for immediately after the war; the gasoline tax remains as before the war, although high freights and other causes have sent the price of fuel up nearly 40 per cent. All motorists must register monthly with the police, but this measure is intended to weed out undesirables and not to restrict the use of cars. The whole of the army zone is rigorously and unconditionally closed to civilian motorists, but in the remainder of French territory it is possible to use a car with as much freedom as in peace times.

Very few factories are producing cars for private consumption, although there are rumors that a few of the leading firms will shortly get a release from army orders permitting them to build for private customers. Too much importance must not be attached to this, for in very many cases the automobile factories are now so efficiently organized for the production of shells and other war material that it is more profitable to continue on the present work than to build cars for private use. During the last twelve months some of the biggest factories have been so completely converted and so thoroughly equipped for shell production that it would be unprofitable to build cars. The only advantage of car orders is that in some cases it enables old stock to be used up which could not be employed in normal and more critical times.

Demand for Cars and Trucks

A certain demand has sprung up during the past few months for both touring cars and trucks of American construction. The touring car demand is almost entirely dependent on military requisitions. If the army authorities visit a certain district and requisition the private cars to be found there, that district immediately becomes a buyer of American cars. There are now very fews cars in France not indispensable to their owners. Thus, if the army steps in and purchases the cars, paying cash for them, the motorist immediately becomes a purchaser of an American car.

Seeing that the net result of the requisitions is to increase the sales of American cars, the agents for these cars have endeavored to sell direct to the army. In this way the army would get American cars instead of the private motorist, and the latter would not be subjected to any loss and inconvenience. While the army is quite willing to examine all offers made, and will cause sample cars to be stripped so that all details can be examined, there does not appear to be a single case of an order having been placed. About 1000 ¾-ton Jeffery trucks were ordered recently for ambulance service, but not a single order appears to have been placed for American touring cars for general army work. It is certain that no orders can be got direct out of Paris, and if any business were done it would go through the buying commission in New York.

American Firms in France

The American firms now doing touring car business in France are Ford, who easily heads the list, Buick, Overland, Dodge, Chevrolet, Maxwell, Mitchell and Saxon. It is understood that H. B. White, who has been Ford European representative for a number of years, will shortly return to America, and that Mr. Perry, the present English manager, will take charge of Europe, with an independent company for France. It is also known that Ford will erect big factories near Southampton, producing there for the whole European market. This would free the cars from any import duties which may be imposed, for it is practically certain that there will be some preferential tariff among the Allies after the war. Another feature of this ever-changing problem is the high taxation which falls on American cars by reason of the European system of determining horsepower by bore alone. If this present system of taxation is continued it is likely to have a serious effect on the sale of American cars.

The Buick is being very vigorously handled by a former Delage sales manager. Overland is in the hands of M. Falconnet, one of the oldest members of the French automobile industry, with very fine quarters in the Avenue Malakoff near the Etoile and Avenue de la Grande Armee. Dodge is placed on the market by Gaston, Williams & Wigmore, the Goode Brothers, formerly in charge of Packard interests, looking after the automobile section of this firm. The other American firms are doing a lesser volume of business; the attempt to put the Chalmers car on the market has not been followed up. Fairly high prices are being asked and obtained for American cars. Ford prices have been increased $200 in order to cover higher freight and increased rate of exchange. The two Buick six-cylinder models are being sold at $2,100 and $3,000 respectively. The Overland models are $1,640 and $1,860 each. The Dodge is sold at $1,600.

Up to the present there has been no increase in the import duties on foreign automobiles, the rate being about 8 per cent of the value of the car. It is well-known, however, that French manufacturers are determined to defend their interests, and that they are working for a higher tariff. Reports are circulated in the trade that there will very shortly be a duty of more than 50 per cent on foreign automobiles, or a total prohibition of imports. The probabilities are that prohibition will be preferred at the present time to an increase in duty; it is certain that a tariff as high as 50 per cent will not be adopted. The arguments in favor of prohibition are the example set by England, the necessity of releasing freight for more necessary articles, and also of getting monetary exchange back to a more favorable rate.

The French Industry

The French automobile industry is a wonderfully organized section of the munitions department. There is not a factory but has increased either its ground area or its plant, or both. In the big factories the increase runs as high as 60 per cent. In the small shops the value has gone up not less than 200 per cent. Among these latter are garages and small repair shops which before the war possessed a lathe and a drilling machine, but which are now very finely equipped machine shops capable of doing the best and most economical work. There is a strong tendency to invest profits in additional plant and factory improvements for the future, rather than show a high profit now.

Not a few manufacturers are asking what they will do with their enlarged and improved factories when the war is over. In practically all cases the original cost of the plant has been wiped off by war contracts, but work must still be found for it. The future is so uncertain that it is a most difficult matter for any manufacturer to decide what set of conditions he will have to meet and to prepare to meet those conditions.

It is evident that Allied automobile manufacturers will make a determined stand against foreign competition. All kinds of schemes are suggested, and while many of them have not and never will get beyond the talking stage, it is evident that common action is in contemplation. According to one well authenticated report a group of Allied manufacturers, small in number but representing powerful interests, will arrange to build in their respective factories a uniform type of cheap popular car on American lines to be sold at home and abroad at a price which will eliminate the American car of the same class. These cars will differ only in the names they bear. There will be a clearing house, so that a shortage of any one make can be met by the other firms, and profits from these sales will be pooled. It is impossible to say what chances, if any, this scheme has of being put into execution. It is certain, however, that at least one powerful European firm has already produced a popular after-the-war-model on American lines with the single exception that the motor dimensions are better adapted to European taxation conditions than are the dimensions of the average American engine.

The History of the Pneumatic Tire—2

Early History of Rubber—First Mentioned in 1525 as Used by Natives in Mexico—Early European Experiments—Early Making of Waterproof Fabrics

The History of the American Automobile Industry—29

By David Beecroft

THE modern automobile tire is so completely a thing of rubber and the automobile is so dependent upon its tire, without which many people think it could not have proved successful, that it seems necessary to begin with a history of rubber itself. Rubber, while largely an American product, is found in all the tropical countries of the world and is the product of a great many plants. The best rubber, however, is from a South American tree, which has, in recent years, been introduced into many of the tropical countries, so that a large amount of our modern rubber comes from rubber plantations of recent growth, a majority of our rubber coming from the plantations of the Straits Settlements in the East.

Rubber First Mentioned in 1525

The first mention of rubber dates back to 1525, when certain Spaniards in Mexico saw the natives playing with balls of a noticeable elasticity. They bounced more than did balls with which the Spaniards were acquainted. In 1536, Orviedo y Valdas, in his history, described articles made from the coagulated latex of the rubber tree by the Amazonian Indians. They not only made balls and flexible jugs, like horn bulbs or syringe bulbs, but also made boots and waterproofed their fabrics with it. The jugs or bulbs were made by dipping a clay form into the juice and letting it coagulate, often assisted by smoking over a fire. When a sufficient thickness was obtained, the clay form was broken so that it could be taken out through the narrow neck. They also fitted tubes to these bulbs and used them for various purposes, the tubes being hollow reeds or bamboos.

Its Use in South America

Two hundred years later, in 1725, the French government sent La Condamine to South America in charge of a scientific expedition, and he sent a small quantity of rubber to Paris and described its uses as he found them in South America at that time. It had been brought to Europe before that time or about the beginning of that century, but neither its origin nor nature seemed to be known. In 1751, Fresneau described the rubber tree and how the natives obtained the material. This is done by cutting into the bark of the tree and catching the juice which exudes or flows therefrom. The name, Caoutchouc, comes from the original native name which implied that the juice exuded. Small pieces of coagulated juice may often be picked from the trees, and frequently cups were cut into the bark which collected the juice, but more commonly, the method is to catch the juice as the sap of the maple is caught for producing maple sugar. Rubber is not, however, a sap, and is not found in the body of the tree, but in the bark. It differs widely from gutta percha.

Early Experiments in Europe

Two French chemists, Herissant and Macquer, communicated to the Paris Academy, in 1768, the results of their experiments, showing that India rubber is soluble in oil of turpentine and in pure ether, but no commercial use seems to have been made of this knowledge in the next twenty years. From 1791 to 1815, several people prepared garments by the use of rubber solutions. In 1820 Nadier cut it into threads and made tissues of these. In 1770 Priestly suggested its use as an eraser for pencil marks, but in those days there were practically no pencils and therefore very little use for erasers. Its common name, however, comes from this use.

Benzine as a Solvent

The first industrial application worthy of the name seems to have been that of Macintosh of Manchester, England, who, in 1823, or possibly a little earlier, found that rubber would dissolve in benzine, a fairly cheap solvent, and who began making waterproof fabrics, to many forms of which his name still attaches. In 1832, the Roxbury India Rubber Co. was formed in Massachusetts to engage in this work and Charles Goodyear was one of its employees. In the same year, both Hayward in England, and Luedersdorf in Germany, independently used sulphur to prevent adhesion of rubber articles to each other. It does not appear that either of them recognized any vulcanizing or curing effect, however, as no mention of their doing so is made in any of the references to their work as recorded at that time. This discovery was reserved until three years later when Goodyear attained the first knowledge of such possibilities. His early work in this direction and its results will be taken up next week.

The FORVM

HABIT IN AUTOMOBILE CONSTRUCTION KILLS PROGRESS OR IMPROVEMENT—THE STEERING FACTOR IN THE DIFFERENTIAL PROBLEM—MORE CYLINDERS AND COMPLICATION—TWO ENGINES

Two Engines as Solution of Differential Problem

By W. J. P. Moore

YOUR article in THE AUTOMOBILE for April 13 on the suggested Abandonment of the Differential, like your article of Sept. 2, 1915, on Improving the Steering is a most important one, and should attract considerable attention, and discussion in regard to this rather complicated and expensive, and apparently useless, mechanism of automobile construction. It seems to point the way to important improvements, that are possible and is quite in line with the advanced ideas you have put forward, and advocated with a number of your articles that have appeared from time to time.

Some of these articles, however, do not appear to have attracted the attention their importance justified, at least so far as discussion of them in your journal indicates, although they may have taken deeper root than thus appears and set many thinking and scheming.

There is a saying, "Force of habit beats competition," and it would almost seem that, so far as many things that go into the construction of the present day automobile are concerned, this might be modified to, "Force of habit in the construction of automobiles kills progress or improvement."

Your illustration of the motor truck axle without a differential may show one way that it can be done, but is not this way of doing it a step in the wrong direction and accomplished at a great sacrifice of power and efficiency?

This seems like going right back to the old car axle type mentioned in the beginning of your article, which appears to be the most inefficient form of axle known, and in which there has been no improvement or progress made since the early ages and it does not seem probable that we will get anywhere by following such obsolete and out of date practice.

Railroad Car Axles Crude

There is nothing in the history of development of railroading to show that any serious attention has ever been given to increase efficiency or reduce the power required to handle a given trainload, but that all their attention has been given to increasing size of load to be handled by merely increasing the power of locomotives, size of cars and weight of rails necessary for these increased loads.

Some day, and it does not seem to be very far off, they will reach their limit of power for their locomotives, and the strength of rail required to carry them, and will be compelled to give consideration to efficiency and abandon their crude axles, for a more efficient form and then the locomotive of the future to draw equal size loads will compare with the locomotive of the present day about as a Ford compares with a Packard twelve, and with these improvements will come cheap transportation. Also they will be compelled to see the "self tracking tractor train" of the motor truck and take a lesson from this and learn how to pull their trains in the direction of least resistance. How long a tractor train would a motor truck haul (even on rails with flanged wheels) when pulled by the body of tractors and the wheels unguided except by grinding on the flanges as guides? Now with the one-wheel-drive motor truck without differential that you illustrate, you are driving always in one direction, straight ahead, and steering in many directions and never are these forces in unison except when moving in a straight line, hence loss of power and efficiency. This is admitted by your article, for you say that this motor omnibus required more throttle opening and was sluggish in making turns.

Further with a motor truck all these turns would be made at a much more moderate speed than with an automobile, and the amount of throttle opening would correspondingly increase as well as the sluggishness. Moreover, on slightly greasy or wet pavements the skidding of the front wheels would be greatly increased and danger of accidents be much greater.

You do not say how much harder it was for the driver to steer, but this must have been considerable on a heavy motor omnibus, and certainly would perhaps be even a greater factor in lighter and higher speed automobiles.

Decreasing the Spinning

As regards the apparently lesser tire wear mentioned, this improvement undoubtedly is accounted for by the "spinning" being decreased, which of course is the cause of the greatest wear in all tires. If spinning were practically eliminated probably the wear on the tire would be halved or say its life doubled. In this respect at least the differentialless axle marks an improvement and undoubtedly should tend to equalize the life of the front and rear tires and increase their life.

Is not your assumption as stated in the concluding paragraph of 99 per cent normal (straight) running rather high? Straight roads are few and far between, bends and corners very numerous, not to mention turnouts to be made and holes and obstructions to be avoided. It would be interesting to have, say, a day's record of the motor bus you mention showing the various turns and the degrees of each movement of the wheel, and probably this ratio would be nearer 3 to 1 than 99 to 1, for no matter how small the angle, the increased power factor and decreased efficiency would enter into it. However, that there are many advantages to be gained by a differentialless axle cannot be denied, and these are pointed out very thoroughly in your article, and the real question is how is the best way of accomplishing this.

Two Differential Drives

At the present time there are only two forms of drive axles with differential in extensive use, either for automobiles or motor trucks.

A—Single axle drive with differential.

B—Two axle drive with differential.

or the so-called "four-wheel-drive," and both having the same inherent defects due solely to the differential, namely:

Axle A—If either wheel lacks traction you are at a standstill and down and out.

Axle B—If either wheel on the front axle lacks traction you have, of course, still the other axle to drive the same as in A. This is not a four-wheel drive in reality, but rather a double two-wheel-drive and it is impossible to get a real four-wheel-drive and have a differential, as your driving wheels go out of commission by twos instead of singly. Of course the advantages of the two-axle-drives are not questioned, neither must the complications of this form of construction be overlooked. Probably the latter type of axle will never come into use in automobile construction and how long its use will be justified in truck construction is perhaps problematic.

Other Forms of Drive

Now your article on a differentialless axle shows how this can be done in the type of motor truck axle indicated, namely:

Axle C—A *single* two-wheel-drive without differential, but beyond this there is still another form of drive which you do not mention and which it seems should not be lost sight of, namely:

Axle D—A *double* two-wheel-drive having two bevel gears and pinions without differential, or a real two-wheel-drive, each wheel driven independently by separate dual or twin motors.

This latter form of axle seems to combine all the desirable features of the differential axle, without its disadvantages; and also to be free from the defects of the differentialless axle C, you mention.

The points of superiority of Axle D seem to be:

1. Unless *both* driven wheels are tractionless you are not at a standstill.

2. It gives you all the advantages of the so called four-wheel-drive without any of its complications for two wheels must be tractionless before you are at a standstill.

3. Your power and efficiency is maintained under all conditions of turning, for you can drive in the direction you are turning.

The Steering Problem

4. Steering is easier and almost a negligible factor as you drive around a corner or bend, the steering and driving practically timing together.

5. With a castor type of three-wheel truck like the Knox tractor, all steering could be eliminated and the machine be entirely manipulated by driving only provided that suitable means are adopted for driving one of the drive wheels faster than the other by proper controls. The same thing would be possible with any four-wheel machine having the steering knuckle in the center of the rotation plane of the wheel and of the castor type as advocated in your article of Sept. 2, 1915, referred to above.

6. With either of the forms referred to in 5 above, the steering gear could either be done away with entirely or used only as an auxiliary or secondary, and the irreversibility of the steering gear now so necessary, dispensed with and therefore much cheapened.

7. The power exerted to drive each wheel would be in proportion to the power required and the maximum of efficiency be maintained under all conditions of service and especially on curves.

Complications Are Increasing

8. The above results can undoubtedly be accomplished with less complication and fewer parts than with the present forms of twelve-cylinder engines (not to mention the sixteen or more cylinders we hear talked of) with their gearboxes, change speed gears, differentials, etc. Some of these machines have enormous power as for instance the Packard twelve which by published reports admits to 122 hp. under test and probably is equalled also under maximum working conditions on the roads or in speed tests as at Sheepshead Bay speedway. Probably also other of twelve-cylinder cars are equally powerful although no authentic published reports have appeared.

In fact an examination into what is being done by some of the important makers tends to show that size, complication and weight are continually increasing and there appears to be no limit they are prepared to go to in order that certain results may be obtained.

Such being the case, there has probably never been a time in the history of automobile construction that any modification or improvement that may be advocated would receive the attention that it would at this time.

Why Not Use Two Engines?

9. Assuming the driving power to be gasoline engines, twin fours or twin sixes would replace the V eights and twelves, the complication in the engines themselves would not vary materially and would be more than offset by the fact that it would be possible to do away entirely with gearbox and change speeds provided the size of the power units was anything like those now so extensively advocated and used in the present forms of construction or even with smaller units for that matter. All that is required is a type of clutch that can be slipped in starting and under other adverse conditions and it would appear to be an easy trick to arrange to water-cool the clutch if found necessary.

10. As it might be difficult to reverse the gasoline engines, that could be easily accomplished in the rear axle, this providing for forward motion and reverse as well as a neutral.

11. The various speeds of the gasoline engines could be controlled by a single throttle lever located on the steering wheel in the usual manner and so adjusted that when the steering wheel is in its central position and the car going straight ahead, each carbureter valve is opened and closed in unison, but when the wheel in steering is turned in either direction, the outside carbureter be automatically given a slightly greater opening and the inside one slightly closed, thus driving the outer driving wheel at an increased speed and reducing the speed of the inner driving wheel.

It seems as though this would make an ideal racing car for circular speedways, and give the maximum of power and efficiency on the curves and be able to beat out any car of its inches or displacement ever designed; for on a track like the Sheepshead Bay speedway, as one half the distance is on a curve, therefore the racing car as now constructed it is inefficient at least half the time.

Perhaps this also may account in part for the Sunbeam car mentioned in your article reverting to a differential as it would seem that with the increase of speedway racing the differential type as compared with the differentialless car as ordinarily constructed would have an advantage.

Undoubtedly there are other forms of differentialless axles that will be suggested to others by your article.

Comfort and Body Weight—Cylinders and Economy

By Chas. E. Duryea,
Consulting Engineer

PERMIT me to protest against Mr. Watts' paragraph in THE AUTOMOBILE for April 27, in which he classes cars as those of toleration weighing below 1800, those of comfort weighing from 1800 to 3000 lb. and those of luxury weighing above that. True, he qualifies this statement by saying that "there are notable exceptions," but does not say how they are obtained and leaves the matter based on the idea that his preceding paragraph covers it. That the ratio of sprung to unsprung weight and the ratio of sprung weight to passenger weight are the controlling factors in determining passenger comfort, although he has "never seen any mathematical proof," is, it seems to me, wholly unwarranted.

Any farmer boy who has jolted to town with a basket of eggs nestling in a small pile of straw on the floor of a springless farm wagon weighing nearly a ton has ideas different from these, and farmers are buying many cars these days. That same farmer boy finds the light spring seat he uses made with four hickory sticks for springs and no cushion at all fairly comfortable, although both he and the seat may not together weigh 100 lb., and although the floor of the wagon is bouncing so badly that his feet are actually suffering. This is no fanciful picture. I was that boy. Further, most of my automobiles have been well below the 1800-lb. figure and a number of them—some as light as 500-lb. total—have carried the power plant complete on a frame which rested at one end on the rear axle. Some of this construction have used solid tires. So if experience is worth anything, and most people prefer it to theory, I can assure Mr. Watts and your readers that light cars exist which are more comfortable than many cars of two to four times their weight. Comfort is secured by using springs proportionate to the load; by avoiding synchronous vibrations; by proper hanging of the body so as to permit the wheels to toss from side to side without greatly affecting the body and by again cushioning the riders so that body movements of short amplitude do not largely reach them. I do not believe that light passengers find a heavy-bodied car easier riding than do heavy passengers, but rather the reverse. For comfort passengers should be carried between the wheels and not over them and should be carried low so as to avoid the sidewise rocking. One's body does not well resist sidewise rocking. There are many factors affecting comfort and users should not assume that they cannot have comfort in a light car. The glass bead on the tip of the feather on milady's hat may do much moving about, but it is comfortable and runs no risk of being broken.

The Cylinder Question

Mr. Watts very properly sets forth the falsity of the idea that many engine cylinders are necessary for comfort when he says the engine impulses are absorbed in the flywheel. But even if the car is run at such low speeds that engine impulses are felt it is possible to kill them by introducing an elastic propeller shaft. Or if there is no slack between the engine and the wheels, and therefore no chance for the car to overrun the engine and then get a jerk when the impulse speeds up the flywheel, the engine impulses disappear. In fact, it is hard to imagine a sweeter application of power than the pressure of gases against a piston.

Since, however, most drive mechanisms are far from perfect, the number of cylinders must be considered. The single-cylinder need not be considered, because it cannot be mechanically and explosively balanced as can two or more. Most people judge the number of cylinders by the frequency of the exhaust and with muffled ears cannot tell whether the car has two or twelve cylinders. It is certainly folly to waste fuel that others need on inefficient many-cylindered motors when such is the case. Try it yourself. But do not compare an 1896 two-cylinder motor with a high-priced twelve-cylinder of 1916. Motors of all kinds have improved in twenty years. In fact, this is the answer. Automobiles are better to-day than last year in many respects and the difference in cylinder numbers is not the great factor it is credited with being.

Mr. Stratford's able article in THE AUTOMOBILE for April 20 very properly shows the necessity for filtering the air the motor breathes and he also points out the temperature losses which are a most potent factor in gasoline consumption. Why people complain of fuel costs and buy smaller and smaller water-cooled cylinders I cannot understand.

Mr. Laycock's no-differential argument should be read by everyone, although I cannot favor rigidly-connected rear wheels. The well known form of differential cannot leave us too quickly.

Mr. LeGare seems to think that a magneto jumps more than one plug gap at a time. I know of no warrant for this. The magneto spark is of much lower voltage and burns the points more rapidly, so several are provided that the gap may not burn too wide for the low voltage to jump. The battery and coil system does not use such a metal carrying current and so does not need to provide protection from wide gaps.

Your remarks on the constant pressure cycle are interesting. Professor Lucke has claimed that the Brayton cycle is as economical as the Rochas if properly built, but it certainly is not so easy to secure this theoretic economy. It seems to me that the gas turbine holds much promise for the near future and could easily be developed to the low efficiencies of the modern water-cooled multi-cylinder automobile engine. Your readers would appreciate information on this motor.

Thinks M. & S. Differential Near Ideal

By G. W. Smith

Chief Engineer Thos. B. Jeffery Co.

REGARDING the article dealing with the elimination of differentials, we have not conducted any direct experiments in this matter other than those having to do with the elimination of the differential from the transmission of the quad. I have no doubt that somewhat the same conditions are obtained here as in the conventional rear axle. It is certain, however, that the effects are much smaller and we have experienced no difficulty whatever although the differential has appeared in but one of our quad trucks.

I am inclined to think that the elimination of the differential from the touring car is not feasible on account of the short turning radius and the comparatively short wheelbase of most touring cars. The greatest difficulty to be met with would be the tendency of the rear axle shaft to twist and it is quite certain that these shafts would have to be approximately twice the strength of the present shaft to resist this continued action.

On the other hand I believe the differential could be dispensed with on cars having comparatively long turning radius and operated so as to favor the device to some extent. In other words the operator would be expected to make long turns at corners and other places, thus avoiding the great difference of tire travel in the outer and inner tires in a short length of travel.

It is my opinion that we have by far the best solution of this matter in the M. & S. differential and I feel that ultimately such a differential will be used on a majority of touring cars, thus avoiding any of the disagreeable features I have named above.

The Light Car Handbook

The publishing house of Iliffe & Sons, Ltd., 20 Tudor Street, London, E.C., England, in addition to producing *The Autocar* and several other British trade papers, is also responsible for a number of books on automobile subjects. The latest edition to its library is the Light Car Handbook, which has been produced for the instruction of owners of small cars. Although written with particular regard to a class of machine practically unknown in America, the book contains very clear explanations or a great many things applying to cars of every size.

It is profusely illustrated, contains very good instructions concerning care for the various parts of a car. It is a book which the earnest student of automobiles would be interested to possess. The price is 36 cents, or 48 cents prepaid.

The Rostrum

Unsprung Weight and Tire Wear

EDITOR THE AUTOMOBILE:—In various articles in THE AUTOMOBILE appearing from time to time, mention has been made of the subject of unsprung weight in connection with rear axle construction. I have failed to note any general discussion of the subject, however, and would like to learn more about the evil effects of much weight as applying particularly to the rear axle assembly. Is this effect confined to the matter of strength of rear axle housing or does it also cut quite a figure in wear and tear on rear tires?

How does it work out in the case of the electric vehicles having the driving motor actually inclosed in the rear axle housing?

Cincinnati, Ohio. H. G. C.

—It is generally conceded that the ratio of unsprung to sprung weight is of great importance in its effect on tire wear. The entire matter is one of common sense. It is quite apparent that if a car weighs a given amount the best results and the longest life of working parts will be secured if the greatest possible portion of this weight is cushioned by suitable spring action. On the other hand, it is necessary to increase the unsprung weight to hold the car on the ground and to take care of other features of design. Therefore, the best ratio of sprung to unsprung weight is always a compromise. It may be generally said, however, that in ordinary passenger car practice the efforts are on the side of reduction rather than increasing the relative unsprung weight.

Ideas on Body Design

Editor THE AUTOMOBILE:—I have read with great interest and also studied the body articles as appearing in THE AUTOMOBILE, especially so the one you published in the Feb. 3, issue entitled, Driver's Lot 99 Per Cent Discomfort. I wish to make a few remarks and will start at the diagram showing a section through a touring body on page 217. The steering wheel is fixed by *A*, *B* and *E*, as in Fig. 1. The rim of a wheel being 1 in. will determine the angle α of the wheel for different diameters of wheel; viz., 16 in., 17 in. and 18 in. as in Fig. 1.

$$\text{rim } (90\text{ deg.} - \alpha) = \frac{3.5\text{ in.}}{8} = 0.437 \text{ for 16 in.}$$

$$\frac{3.5\text{ in.}}{8.5} = 0.412 \text{ for 17 in.}$$

$$\frac{3.5\text{ in.}}{9} = 0.388 \text{ for 18 in. wheel.}$$

angle (90 deg. — α) for 16 in. diameter wheel is 25 deg. — 55;
$\alpha_{16} = 64$ deg. — 5
17 in. diameter wheel is 24 deg. — 20;
$\alpha_{17} = 65$ deg. — 40
18 in. diameter wheel is 22 deg. — 50;
$\alpha_{18} = 67$ deg. — 10

I just want to call attention to these angles as compared with what actually exist to-day on cars made. By checking up the same way over the table you have compiled from nineteen makes of cars you will soon see the fact that the angle α is between 45 deg. and 30 deg. and not as recommended in your article, 64 deg. to 67 deg., according to wheel diameter. I think the angle α should be included in the tables instead of the dimension E.

An important thing left off is the height of the sides and the height of the seat back. Also the distance from dash to front seat. Dimension *S* is given in such a way that it is difficult to say what is meant. Is it measured down at the floor, at the narrowest point between rear seat top and front seat back, or how high up from the floor, Fig. 1.

Many dimensions may be arrived at and as you suggest 1 in. either way is important. The position of the front door is not given properly—neither depth of front seat nor how much the underside of steering wheel rim projects into seat.

I would suggest that a standard diagram of a body be prepared so that the dimensions are absolutely fixed and that this diagram be submitted to the different manufacturers for fitting out. The way you have set this thing going is very admirable from the viewpoint of an engineer and there is no doubt you deserve the highest credit for your timely arrangement and opening up of discussion along the lines of body detail. I understand your viewpoint fully when you in starting this do not go further into details than already done, and presume you have laid the dimensions out as shown in order to get criticism started.

Chicago, Ill. A. S.

Steam vs. Gas Engine Power

Editor THE AUTOMOBILE:—Kindly point out the fallacies in the argument of some people that an internal combustion

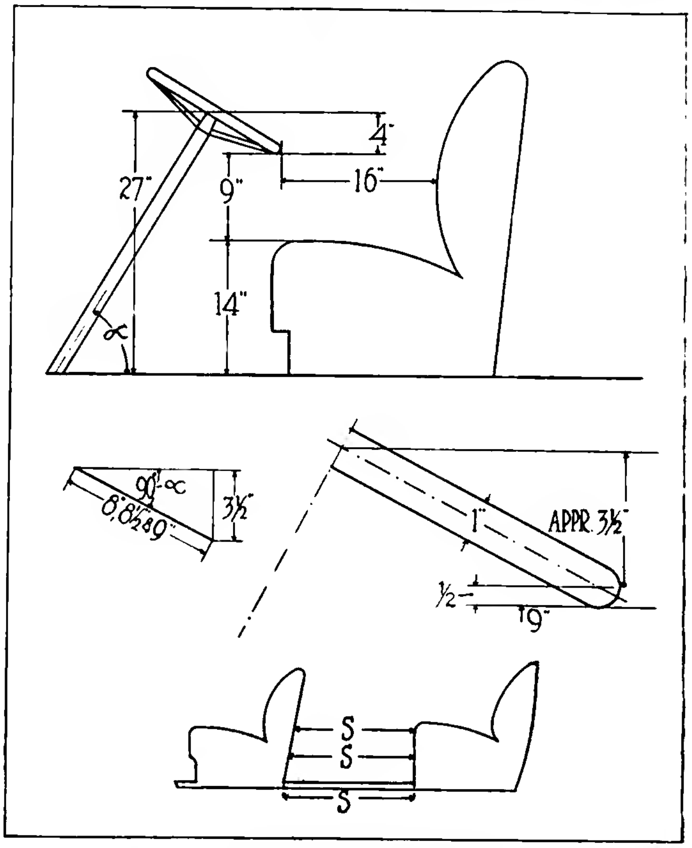


Fig. 1—Diagram of seating layout and arrangement of the steering wheel angle

motor of a given rated power has less real power than a steam engine of the same rated power.

2—Are not most of the high-grade stock motor cars of this country and Europe equipped with T or L-head motors?

3—With what type and location of valve has the highest efficiency on record been obtained in an automobile motor?

4—Has any change of much importance been made in motor or chassis design of the Pierce and Locomobile cars during the last six or seven years?

5—Has hydrogen gas ever been used as a fuel for internal combustion engines? If so, with what result?

Ithaca, N. Y. F. P. D.

—There are no fallacies in their arguments as they are correct. With a steam engine the steam can be admitted at much higher pressure, for instance, thereby giving much greater power than the normal rating.

2—L-head motors are in the majority.

3—We have no knowledge of any authentic efficiency record comparison.

4—No.

5—Yes, but owing to the fact that hydrogen gas is so expensive to make it is too costly for commercial use.

Wants To Enter Amateur Event

Editor THE AUTOMOBILE:—Herewith photograph of racing car which I am anxious to enter in some sort of a race. I am going to take this opportunity to ask if you will kindly advise us of any amateur races which are to be run this summer.

Kane, Pa. A. G. A.

—The only amateur drivers' race scheduled under A. A. A. sanction is for the Chicago speedway on May 20.

Changing Gear Ratio in Oakland

Editor THE AUTOMOBILE:—I have a 1912 Oakland 40. I have always used a 15-53 gear ratio in my rear construction. This ran with very little vibration to the car. I had plenty of power for what I needed, 90 per cent of my work being right in the city and flat country of Long Island. In making a change in my gears lately I was compelled to use a 13-53 ratio as there were no other gears in stock. On running the car I immediately noticed a great increase in vibration when running between 15 and 25 m.p.h. In fact, too much vibration for comfort. Now I am again contemplating a change in the gears and I want to know whether to leave the 13-53 and have the comfort of increased power plus vibration or to put in a 15-53 or even a 3 to 1 ratio.

2—I have a Bosch DU4 model 5 on the same car. While having new platinum points on the magneto we noticed that it gave a much hotter, fatter and yellower spark with the spark retarded and a thinner spark with it advanced. The repairman advised that I change the shoes on the magneto and reverse the spark conditions. He claimed untold increase in power would result after doing this.

Brooklyn, N. Y. B. G. G.

—You have changed your model 40, 1912 Oakland car from practically a 3½ to 1 gear ratio to a 4 to 1 gear ratio for the purpose of obtaining more power. Necessarily, in obtaining this additional power in a four-cylinder motor you got more vibration and there is no possible way to overcome this vibration, especially when running at a medium speed of from 15 to 25 m.p.h. If you desire to decrease vibration you can do so by going back to the old 3½ to 1 gear ratio or even to a 3 to 1 ratio, which would still further decrease the vibration, but if you leave the gear ratio at 4 to 1 you must expect this increased vibration unless your car is running at top speed.

2—The Bosch DU4 model 5 magneto is that model in which the overlap pole shoes are used. This construction provides a very efficient spark in the retarded position so that those engines having improper gas conditions can be started readily directly on the magneto. This construction does not provide a spark of equal intensity at low speed when the magneto is fully advanced, but the spark provided is more than sufficient for all-around efficiency. THE AUTOMOBILE would not advise experimenting with the pole shoes, as suggested, since it is advisable to take into consideration the individual characteristics of the motor. You will no doubt find that your motor will give satisfactory results with the magneto in its present condition. Undoubtedly you have had no difficulty in the past and we would advise no change.

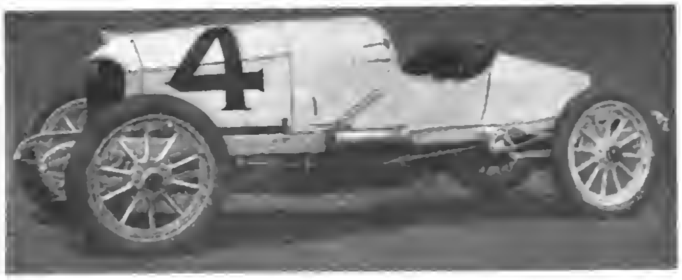


Fig. 2—Racing car reader wants to enter in amateur race

Kerosene as a Carbon Remover

Editor THE AUTOMOBILE:—Will water remove carbon? If so would you advise running it through the carbureter? My car is equipped with a Stromberg. How much would you advise using? I have been told that it was a good idea to use 2 gal. of very hot water followed by a gallon of kerosene put through the carbureter in the same manner. What is your advice?

2—My car has force feed lubrication. Would it injure it to run the motor, say, for one minute, with kerosene in the crankcase instead of lubricating oil? This, of course, is with the idea of running out all the foul deposits.

Bessemer, Ala. L. M.

—There are a great many who believe very strongly in the use of water for carbon removing, and there is no doubt but that it assists in this respect to some extent. It would be better, however, not to introduce it into the carbureter but into the intake manifold between the carbureter and the cylinder. It should be allowed to enter in very minute quantities. The action which probably takes place is this: When the water enters the cylinder it is probably transformed into steam which cuts away the carbon binding substances in the cylinder.

2—It would probably do no harm to run the engine very slowly for only a minute. It would be inadvisable, however, to extend the period beyond this.

How Speedometers Operate

Editor THE AUTOMOBILE:—What makes the hand or dial of a speedometer move? Is it a governor or is it through a spring?

New York City. O. K.

—In fundamental principle there are four methods of operating the needle or dial on a speedometer. These are by magnetism, by centrifugal force, by air or by hydraulic drive.

The magnetic principle as indicated in Stewart-Warner and American Ever-Ready instruments, utilizes a revolving magnet positively driven from the car wheel or other part. The magnet exerts its influence on a metal part which is separated from it by an air gap and which in turn is connected with the indicating mechanism. The metal part is generally aluminum as the inertia of the part must be kept as low as possible to make the speedometer quickly sensible to speed changes. A feature of the magnetic design is that the travel of the dial bears a direct ratio to the speed of travel of the magnet, and in order to compensate for changes in the drag due to temperature differences, a compensating unit is fitted.

Centrifugal control as utilized in speedometers is very much the same as that on a fly-ball engine governor. Standard, Johns-Manville, Sears-Cross, Corbin-Brown, Hoffeker and Garford use this principle. Weights are mounted on the revolving shaft by bell crank levers which allow them to travel further from the axis of the shaft as the speed of the drive increases. The centrifugal force of the weights increases as the square of the velocity of the shaft.

Weights Actuate Needle

This tendency of the weights to fly from the axial center of the shaft under the influence of centrifugal force furnishes the basis of the indicating needle movement. An ingenious feature in centrifugal design is that although the movement of the weights would naturally vary as the square of the speed, the levers or cams governing the movement are so calculated that calibrations on the dial are uniform or nearly so. Another feature which is carefully watched is the balance of the weights. The governors are made very sensitive so that even at low speeds the correct rate of travel may be indicated. Improvements in this direction have been made within a year by at least one of the centrifugal speedometer manufacturers.

The air principle is used only on one make, the Van Sicklen, in which a blast of air from a pump within the speedometer forms the source of operation of the indicator needle. As the speed of the drive increases the volume of air flow becomes greater, thereby increasing the travel of a pivoted dial, calibration of which is effected by governing the size of the passages through which the air flows.

One instrument, the Veeder, which employs the hydraulic system, uses a centrifugal pump which is connected with the drive and which lifts a liquid to a height proportional with the speed of the drive. The tube in which the colored liquid is lifted is calibrated to register speed.

Setting Camshaft On 1909 Rambler

Editor THE AUTOMOBILE:—What is the proper way of setting camshaft and is a model R Remy magneto suitable for a Rambler model 44 serial 20277 1909 car? If so how would you time same?

Sewalls Point, Va. G. S.

—In setting the camshaft proceed in the following manner: Set the number 4 piston on dead center and so place the camshaft that the cam that operates the exhaust valve on number 4 cylinder, which is the front cylinder on this car, is just leaving the roller. Then turn the motor with the crank until cam on number 4 cylinder is just coming onto the roller. At this point the mark on the flywheel should be on top even with the indicator. This mark should be the one which is about 7 in. ahead of the center mark on the flywheel. If this does not come even the remedy is obvious. Turn the camshaft one tooth at a time until you get the result as described above.

Not a Locked Differential

Editor THE AUTOMOBILE:—Kindly give sketch and description of the locked differential which I have seen so much about in your journal recently.

Dumbarton, Va. A. R. JOHNSON.

—If you will refer to THE AUTOMOBILE for April 13 on page 672, you will note that the matter which is being discussed is not some form of differential lock, but the abandonment of the differential altogether.

On that page appeared a drawing of the Sheldon worm-driven axle with a solid driveshaft replacing the differential. A number of tests on this type of axle have been made in this country lately and the Fifth Avenue Coach Co. has some buses running in New York City which are equipped with them. So far tests seem to show that, contrary to general expectations, tire wear has been decreased.

Must Decrease Compression Space

Editor THE AUTOMOBILE:—I have a motor 5½ by 6, T-head, 2¼ valves, 60 lb. compression. How much thickness will have to be added to piston heads to raise compression to 85 lb.?

West Milford, West Va. B. BROS.

—You will have to decrease the compression space to about three-quarters of its present volume.

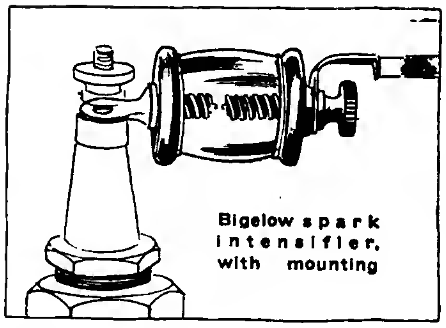
Mitchell-Lewis Stock Rooms Are Overflowing

Chassis assembling department of the Mitchell-Lewis Motor Co., Racine, Wis., giving an excellent idea of the abundant supplies of material laid in by the company to insure delivery of cars on schedule. Steering gears, engines and rear axles for which there is no room in the stock department, are stored here. Other departments are similarly situated

ACCESSORIES

Bigelow Spark Intensifier

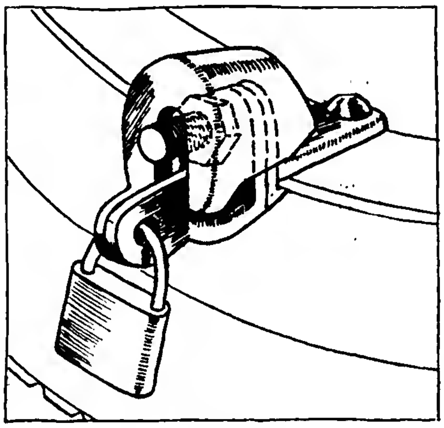
THIS little spark plug attachment, illustrated herewith, is attached by simply screwing on the spark plug binding post and to the wire terminal. By merely looking at this device the spark can be seen jumping the gap, so that spark plug trouble is readily detected. The barrel is made of magnifying glass, and this feature shows up the spark clearly, at night giving a glow like that of an electric light. The intensifier is claimed to overcome all spark plug troubles, making a plug fouled with grease, carbon or soot, or with a broken porcelain, fire perfectly. It is also claimed to intensify the current so that a hotter spark is given, increasing the engine power by 20 per cent and doing away with clouds of black smoke. It is claimed to increase the engine power by 20 per cent and to obviate the necessity for the removal of carbon. Price 75 cents.—Bigelow Co., Chicago, Ill.



Bigelow spark intensifier, with mounting

Haco Tire Lock

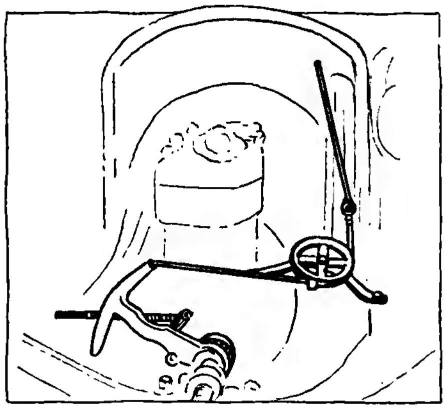
This lock fits 1916 Buicks, Maxwells, Chevrolets, Saxons and other cars using the same type of tire carrier. It is applied to the tire carrying rim and prevents the tire from being taken off until the padlock is unlocked and the stop removed. A Yale lock is fitted to the device. Price, $2.—Howard Automobile Co., San Francisco, Cal.



Haco tire lock

Brinnon Starter for Fords

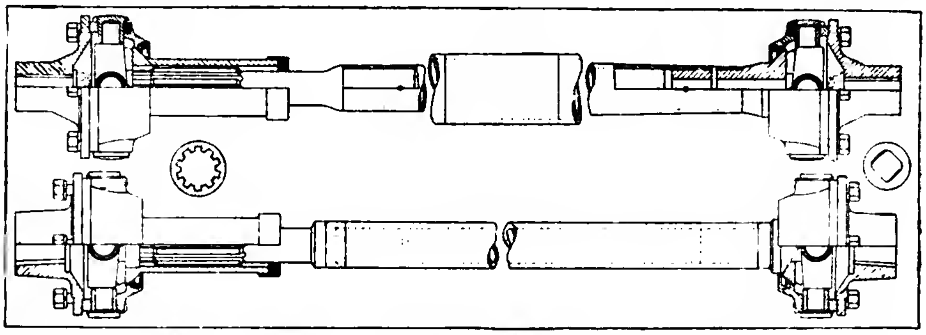
Starting the motor by hand from the dash is accomplished by this device which consists of an arm which is connected to the front of the crankshaft by a ratchet, and from whence a cable runs to the handle mounted on the dash. Price, $10. —Peters Sales Co., Columbus, Ohio.



Brinnon hand starter for Fords

Arvac Universal Joint

As shown in the accompanying illustration of the Arvac propeller shaft assembly, the universal joints are fully inclosed so as to be dust, dirt and fool proof, the design being very compact, simple and accessible. The joint consists of a ball yoke in a socket fitted with cross block and pin, the housing being of forged steel and the entire joint easily disassembled. Bearing surfaces are as large as is consistent with maximum strength and minimum friction. The piece parts being standardized, the few wearing parts may be renewed promptly at minimum expense. The housing is oil-tight and is packed with lubricant, the yoke of the slip joint being made proof against grease leakage by a threaded steel cap containing a soft felt washer. The ample bearing surfaces are hardened and ground to size, thereby guaranteeing long life, minimum friction and uniform accuracy. The Arvac joint is made in one size only—5 in. diameter of flange. This is suitable for all types of passenger cars and trucks requiring a standard joint of this size. The propeller shaft assemblies are made with flanges bored to meet the customer's requirements and with suitable solid steel or hollow shafts. They may be obtained with or without companion flange and with square or 1½ in. ten spline S. A. E. slip fitting.—American Rotary Valve Co., Anderson, Ind.



Arvac propeller shaft assemblies, showing compact, self-lubricating and fully inclosed universal joints

Frame Extension for Fords

The object of the extension is to lengthen the Ford wheelbase enough to permit the carrying of larger loads of bulky stuff. It is not intended that the normal carrying capacity, in pounds, should be exceeded.

The frame is extended at the rear by bolting on a new rear frame section, the forward end of which fits the curved cross-member, which takes the spring. The rear end of the extension is made exactly as the regular Ford frame rear end, and the spring is attached to it in the regular way, by the regular Ford clips. All the fastenings used are already provided for in the Ford frame and it is not necessary to do any cutting or drilling.

The propeller shaft is shifted backward when the rear axle is moved back to the rear end of the extension and leaves a gap between its forward end and the gearbox at the rear end of the power plant. This space is filled by inserting a tubular housing containing a short shaft with universal joint connections at each end, fitting the corresponding joint sections on the propeller shaft forward and on the driving shaft at the rear end of the gearbox. The casing bolts rigidly in place, the bolt holes already existing being used. The shaft and joints are packed in grease.

Material is furnished for lengthening the brake rods, and new running boards are supplied, of pressed steel. Everything required to do the work is furnished; it is not necessary to purchase anything extra.

The outfits are furnished in two sizes; one increases the wheelbase 15 in., making it 115, and the other 30 in., making it 130. The weight of the car is increased about 50 lb.

Apart from enabling the car to carry a longer body, in which light but bulky loads can be carried—hats, bakery products, millinery, etc.—the appearance of the machine is greatly improved and its riding qualities as well. Extended tests have indicated that the added length is not sufficient to cause weakness of the frame even under the maximum normal load conditions and on rough going. This is due to the sturdiness of the Ford frame and also to the easier riding resulting from the longer distance between the axles. Prices, 15-in. extension, $45; 30-in., $50.—Hays Diefenderfer Co., New York City.

Weco Vaporizer

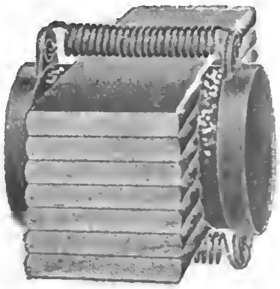
For the purpose of supplying a small quantity of water vapor, or steam, to the motor with the fuel mixture, a copper tank is mounted on the exhaust pipe, where the heat from the exhaust heats the water. A small tube leads the steam to the intake manifold above the carbureter. The tank holds 2½ qt. of water. Better vaporization, lower consumption of fuel and absence of carbon deposits are claimed to result from the use of the device.—Weco Mfg. Co., Boston, Mass.

Temoc Specialties

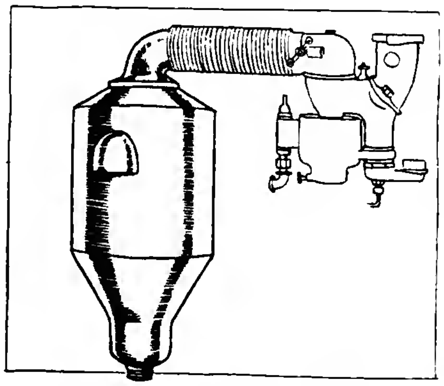
A brush for washing the car may be attached to a hose and with it a car may be washed in 10 to 15 min. without wetting the hands or soiling the clothes. The brush is made of polished aluminum with Chinese bristles and is equipped with a mud scraper for removing chunks of mud from fenders, etc.

A spark plug brush is made of steel wire and is designed to remove carbon from plug points. It also embodies a screwdriver for adjusting the points, and an alligator wrench.

Weco water vaporizer which supplies steam with the fuel mixture



Sterling oiler applied to spring. Note the pads of oil-retaining fabric



Bennett carbureter air cleaner

A wire wheel washer is attached to the hose also. It is made of stiff bristles on flexible, rust-proof wire. Prices are: Washing brush, $3.50; spark plug brush, 40 cents; wire wheel cleaner, 75 cents.—Temoc Mfg. Co., Inc., Chicago, Ill.

Sterling Spring Oiler

This device consists of two shallow cups held one on each side of the leaf spring by means of spiral springs extending crosswise; in the cups, on the side next to the spring leaves, are pads of oil-retaining fabric. These distribute oil to the leaves and carry a sufficient supply for about a month's running. The pads are replenished without removing the oilers. Price, 40 cents.—Sterling Mfg. Co., Cleveland, Ohio.

Bennett Air Cleaner

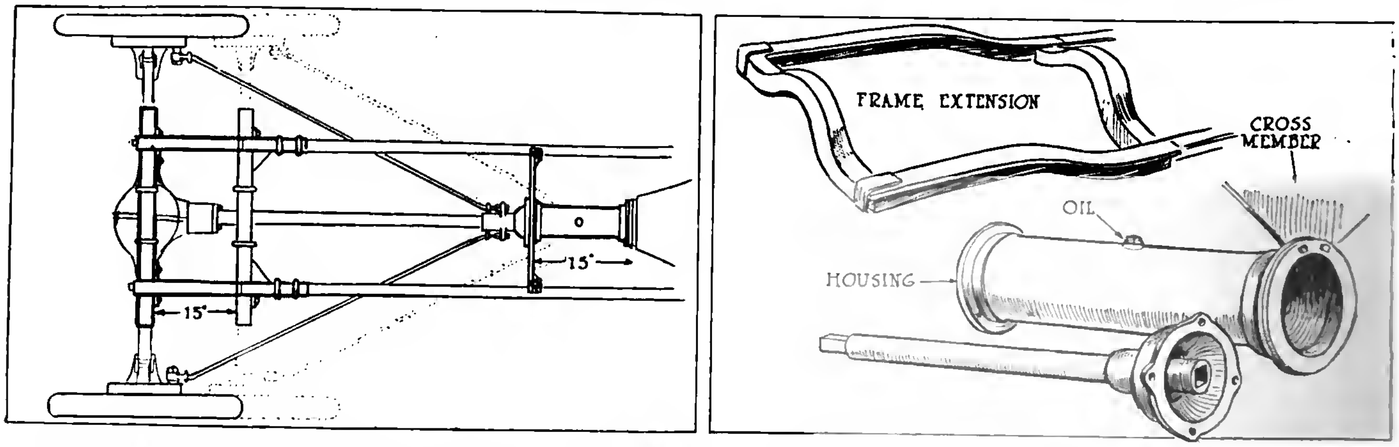
The object of this device is to remove from the air going to the carbureter all dust and other solid matter in suspension. Much of this matter is of an abrasive nature and has a deteriorating effect on bearing surfaces, and all of it is clogging to the oil used for lubrication. There are no moving parts and no cloths to clean, no screens and no adjustments. A cap is removed to empty out dust; otherwise the cleaner requires no attention. Prices, 1-1¼ in., $10; 1½-1¾ in., $11; 2-2½ in., $12.—Wilcox-Bennett Carbureter Co., Minneapolis, Minn.

Tenox Liquid Gasket

This liquid gasket is a new preparation designed to take the place of copper, asbestos, fiber, or other gasket materials. It is said to be suitable for all purposes and is not affected by heat, oil, water or gasoline. It is applied the same as paint, an ordinary brush being used.—Stone Mfg. Co., New York City.

Culver-Stearns Searchlight

In the description of the windshield type searchlight made by the Culver-Stearns Mfg. Co., Worcester, Mass., in THE AUTOMOBILE for April 20 the price as given is $2.25. This was an error, the correct price being $2.50.



Hayes-Diefenderfer frame extension for Fords. Left—Diagram showing method of extension. Right—Parts used in making change

The AUTOMOBILE

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True Efficiency

EFFICIENCY is the watchword of the age. It is another word for civilization, for civilization is nothing but efficiency applied to life. The aim of every man and of every community is to make life as happy a thing as possible and civilization grows because of its efficiency in producing happiness. A savage may be happier than a civilized man, but America to-day is a far happier land than America of five centuries ago. Therefore it may be said truly that everything which improves efficiency in anything also advances civilization and makes for a better condition of living.

It is impossible to think about efficiency in some particular application without seeing the effect that one thing has upon another. Often obtaining more efficiency in one thing leads to a corresponding sacrifice in another; an apparent gain may be an actual loss in the final analysis. Particularly is this so in the highly specialized field of automobile engineering, and it is useful sometimes to examine the aims and ambitions of the automobile user and the automobile industry so far as possible in the light of true efficiency.

The basic thought, which should always be remembered, is that the automobile industry exists by reason of its service to civilization—exists and has grown with such wonderful rapidity because of the efficiency of the automobile as a servant of man.

The value of the automobile to the world was somewhat clouded by the unexpected pleasure-car growth, the efficiency of the truck and the tractor are obvious, but if we consider what the passenger car has done by improving means of communication, by educating the mind while exercising the body, it may well be wondered whether the greater good to civilization has not been done by the touring machine.

Races and Records

LAST year saw racing of a very high order of quality throughout the season. New speedways and new cars combined smashed records right and left. The average speed of racing increased largely, while the reliability of the better cars seemed unaffected by the greater pace. With the first big speedway event of the year about to take place the possible character of this year's racing becomes a topic. Shall we see still higher speeds or still greater durability?

So far we have no hint of the coming of any new team likely to stand out as did the unconquerable Stutzes last year. The two Sunbeams are the only new cars likely to come from Europe. That the Peugeots will show much more speed than last year is doubtful; the Delage team may be a surprise. They are certain to be at least as speedy as their French competitors and later there will probably be one or two new American teams.

Two things point to greater speeds in 1916 racing. One is the number of shorter races and the other the fact that tires to-day are better than they were a year ago. Average speed for the whole field in any event is sure to increase, because several cars that started new last year were only got into proper shape by the end of the season. Lessons on ignition, on carburetion and on lubrication, provided by every race in 1915 have not been overlooked and the cars to face the starter in the classics of 1917 will be the finest group ever gathered together.

Lubrication

IN Europe automobile engineers are still undecided as to the merits of different lubricating systems. While they usually prefer a fully forced scheme for engines but little below the racing type in volumetric efficiency there are many who consider a dipper system is the better for ordinary touring cars. There are many French and British chassis with small engines of high power output which use trough and dipper lubrication with complete success, and recent American developments have shown that the high speed motor does not have to have a pressure oil feed to every bearing.

Splash lubrication is, however, like many other things: it is good if carried out properly, but if designed indifferently, indifferent results are to be expected. Furthermore, exponents of well designed splash systems claim for them the greatest obtainable economy of oil, and this desirable feature is thrown away if the detail is not such as to insure the proper depth of dip all the time.

S. A. E. Aids Army on Trucks

Officials of Society Confer with Military Men on Revised Specifications

New York City, May 10—A conference was held at the rooms of the Society of Automobile Engineers this week with representatives of the United States Army on revised annual specifications for military trucks of 1½ tons' capacity. Lieut.-Col. Chauncey B. Baker of the Quartermaster Corps, U. S. A., addressed the meeting. William M. Britton, electrical and mechanical engineer of the War Department, was also present, together with other S. A. E. members convened for the purpose of conferring in an informal way on standard specifications as to quality of materials, interchangeability of parts, load capacity, road speed, location of control, ground clearance, engine capacity, suspension, electrical equipment and many other elements.

Henry Souther, past president of the society and now consulting engineer of the United States Signal Corps, presided at the meeting, the following being in attendance:

H. W. Alden, chief engineer, Timken Detroit Axle Co., Detroit, Mich.

Joseph A. Anglada, consulting engineer, New York City.

B. B. Bachman, engineer, Autocar Co., Ardmore, Pa.

Chauncey B. Baker, Quartermaster Corps, U. S. A., Washington, D. C.

P. J. F. Batenburg, chief engineer, Four Wheel Drive Co., Clintonville, Wis.

William M. Britton, electrical and mechanical engineer, Quartermaster Corps, War Department, Washington, D. C.

A. Ludlow Clayden, chairman standards committee, S. A. E., New York City.

Chester E. Clemens, mechanical engineer, Perfection Spring Co., Cleveland, Ohio.

H. D. Church, chief engineer truck division, Packard Motor Car Co., Detroit, Mich.

Coker F. Clarkson, general manager, S. A. E., New York City.

Howard E. Coffin, chairman Naval Consulting Board, Industrial Preparedness Committee, New York City.

Herbert Chase, chief engineer, Automobile Club of America, New York City.

D. L. Gallup, professor gas engineering and consulting engineer, Worcester Polytechnic Institute, Worcester, Mass.

R. H. Johnston, New York manager, the White Co.

Lewis P. Kalb, chief engineer, Kelly-Springfield Motor Truck Co.

J. A. Kraus, chief engineer, Garford Motor Truck Co., Lima, Ohio.

Robert McA. Lloyd, consulting engineer, New York City.

A. F. Masury, chief engineer, International Motor Co., New York City.

W. T. Norton, Jr., chief engineer and general superintendent, Selden Motor Vehicle Co., Rochester, N. Y.

H. W. Perry, secretary truck committee, National Automobile Chamber of Commerce, Inc., New York City.

Alfred Reeves, general manager, National Automobile Chamber of Commerce, Inc.

A. L. Riker, vice-president and chief engineer, Locomobile Co. of America, Bridgeport, Conn.

C. B. Rose, chief engineer, Velie Motor Vehicle Co., Moline, Ill.

Arthur J. Slade, consulting engineer, New York City.

G. W. Smith, chief engineer, Thos. B. Jeffery Co., Kenosha, Wis.

Henry Souther, consulting engineer, United States Signal Corps.

W. R. Strickland, chief engineer, Peerless Motor Car Co., Cleveland, Ohio.

F. A. Whitten, chief engineer, General Motors Truck Co., Pontiac, Mich.

John Younger, chief engineer motor truck department, Pierce-Arrow Motor Car Co., Buffalo, N. Y.

S. A. E. Military Standards

The meeting marks the beginning of the establishment of comprehensive S. A. E. military standards. Once the fundamental requirements for the service in mind become clear, any additional detail recommendations necessary can be formulated with due promptness. The work is of a very broad nature and must obviously be conducted carefully. The extremely hard conditions under which trucks operate at the front in time of war constitute a large study in themselves.

President Huff expressed the view that, in addition to the work of formulating ultimate standards, the society should, through what might be called exigent committee work, give all possible advice on specifications submitted to it. Accordingly a committee was appointed this week to take up with the government officials detail data considered pertinent to standard specifications for gasoline motor trucks of 1½ tons' capacity. This committee, which has already held one long session, is constituted as follows: Coker F. Clarkson, chairman; B. B. Bachman, H. D. Church, L. P. Kalb, William T. Norton, Jr., A. L. Riker, C. B. Rose, John Younger, G. W. Smith, W. R. Strickland and A. Ludlow Clayden.

Another meeting of this committee will be held on May 18, at which time further discussion had by correspondence between the members will be considered, together with special reports of the springs division and of the electrical equipment division of the society.

9000 Trucks Monthly for U. S.

Could Be Supplied by Makers if Pressed—Weight Limited to 5000 Lb.

Washington, D. C., May 6—The War Department has made some inquiry as to the number of motor trucks of suitable characteristics available in this country on short notice for use by the army. All the manufacturers in the country, about 200 in number, were approached and 113 responded.

3000 Trucks a Month

It was found that by throwing out motor trucks that are too light or too weak and those that are too heavy or cumbersome, it would be possible to obtain, according to representatives of the manufacturers, something more than 3000 trucks a month of a type that will conform in all main essentials to army needs. It also will be possible to obtain 6000 additional trucks a month of a type that nearly conforms to departmental specifications and that could be used in an emergency. In other words, if the situation were pressing, there would be available an output of 9000 trucks a month.

Weight Limit 5000 Lb.

The specifications, among other things, limit the weight to 5000 lb., for the reason that heavier trucks are apt to cut through the crust of roads or break through country bridges and give much trouble generally over such poor roads as are likely to be used.

Automobile Corps in Military Maneuvers in Mohawk Valley

Utica, N. Y., May 5—War was declared in Utica for a day and military measures of defense worked out in the practice maneuvers of an automobile battalion, April 30. Under command of the officers of Company B of the First Infantry, New York National Guard, the automobile reserves dashed 22 miles through the Mohawk valley to afford emergency relief for the Remington Arms plant at Ilion, N. Y., and the factory of the Savage Arms Co., at Utica, reported besieged by imaginary enemies which the militia and motor reservists met and routed in a sham battle.

Sixteen Studebaker passenger cars and one repair car composed the motor equipment. An automobile reserve corps of twenty cars will probably be organized to participate in the maneuvers of this kind to be held May 21, at the Sheepshead Bay speedway.

A. C. A. Tests Aero Motor

Christofferson Aircraft Product Tested for Power, Economy and Endurance

New York City, May 10—A test has been made by the technical committee of the Automobile Club of America on the aeronautic motor made by the Christofferson Aircraft Mfg. Co., San Francisco, Cal. Two runs were made, one to secure data on horsepower, torque, fuel consumption and speed and the other to get a line on endurance. The endurance run extended to 7 hr. 18 min. when the motor stopped due to magneto trouble. During the interval one stop was made to replace a broken rocker arm. This was at 5 hr. and 40 min.

The information secured on the first test run showed that the motor which is a four-cycle valve-in-head 4¾ by 6-in. watercooled type with vertical cylinders, develops 96.5 hp. at 1199 r.p.m.; 113 hp. at 1390 r.p.m.; 130.9 hp. at 1655 r.p.m.; with fuel consumption at these speeds of 0.68, 0.68 and 0.64 lb. per brake horsepower hour. The weight of the motor including inlet manifold, one carbureter, two magnetos, water manifolds, water pumps, oil radiator, but not including exhaust pipes, propelled flange or flywheel, is 511.6 lb. The weight given includes a small quantity of oil which could not be readily drained from the motor.

The endurance run started at 1.39 p. m. with the intention of making an 8-hr. endurance test. The throttle was open wide and the speed maintained by load at an average of 1449 r.p.m. At 5.40 p. m., that is, 4 hr. and 1 min. after the motor had started, the rocker arm operating the exhaust valve of cylinder six was broken and the motor had to be shut down. At 6.40 p. m. the rocker arm had been replaced by a new one and the motor was again started. The time taken to make the replacement was 24 min. The motor then ran until 7.18, when it suddenly stopped and it was found that neither of the magnetos were operating, the one on the exhaust side had broken its armature while the other had developed troubles of an electrical nature. For about ½ hr. before the motor stopped it had been missing considerably, due to the failure of the magnetos. The test was then discontinued. At this time the motor had been running a total of 5 hr. and 15 min.

The average speed during this test was 1449 r.p.m. The average brake horsepower was 113.6. The average gasoline consumption was at the rate of 75.8 lb. per hr. or 12.4 U. S. gal. The gasoline had a specific gravity of 61 deg. Baumé and during the test 2.26 gal. of lubricating oil were used. The motor was started with 10 gal. of castor in its crankcase and as oil had to be added Mobiloil Arctic, Mobiloil B and Mobiloil B B was admitted to the crankcase. The quantity of water circulated was 210 lb. per minute at an average inlet temperature of 150 deg. and outlet of 168 or at a temperature variation of 18 deg. As 210 lb. of water was circulated per minute the heat energy carried off in the cooling water amounted to 3780 b.t.u. per minute.

The motor was not taken down after the test but except for the broken parts mentioned above seemed to be in good condition.

Woods Has Gas-Electric Car

Chicago, Ill., May 10—Final announcement of the Woods dual-power gasoline-electric vehicle has been issued and shows the price to be $2,650, instead of $2,700, as stated in January, when the plans were first made public. The design is based upon the provision of a gasoline motor and an electric generator to provide current for an electric motor, either directly or through the medium of a storage battery. The gasoline motor is a four-cylinder design manufactured by the Woods factory. It is not a high-powered engine, but is sufficient to drive the vehicle economically, and in case additional power is desired the effort of the gasoline engine is supplemented by the electric motor.

Now Zapon Leather Cloth Co.

New York City, May 8—The Boston Artificial Leather Co., this city, has changed its name to the Zapon Leather Cloth Co. This concern has been in the leather cloth business for more than twenty-five years. The original Boston Artificial Leather Co. was located in Boston, Mass. The main offices were removed to this city in 1899. The original plant in Massachusetts was later removed to Milburn, N. J., and in 1904 to Stamford, Conn., where it is to-day. This plant has just been rebuilt, work having been started on it about one year ago, the size being trebled what it was three years ago.

The large increase in automobile business necessitated an increase in capacity and a larger working force, which now amounts to 600 employees. The company does a large business with the automobile manufacturers in heavy seating material. No light weight goods are made.

The use of the word "Zapon" brings the Celluloid Zapon Co. and that company closer than ever before. These two concerns have for more than a generation been closely affiliated, having always been owned and operated by the same interests. There will be no change in personnel of officers or management.

Miller Rubber 66⅔% Dividend

Common Stockholders to Receive That Sum—To Retire Preferred

Akron, Ohio, May 9—The directors of the Miller Rubber Co. have declared a stock dividend of 66 2/3 per cent on common and taken steps to retire the present preferred at an early date at 120. The present authorized and outstanding capitalization is $1,500,000 common and $500,000 preferred. It will be increased, subject to stockholders' approval, to $5,000,000, half common and half preferred. The new preferred will be offered at 105.

Raymond and Whitney Resign from M. & A. M. Board

New York City, May 8—At a meeting of the board of directors of the Motor and Accessory Manufacturers held May 5 the resignations of H. E. Raymond and C. E. Whitney as board members, as well as members of several committees, were accepted. Raymond explained it was in line with his general policy of retirement, whereas business reasons necessitated Whitney's retirement. H. E. Raymond served the Motor and Accessory Manufacturers as president during the years 1909 and 1910, as vice-president during the years 1904 to 1908 inclusive, as a member of the board since the year 1904, in addition to membership on a great many committees. Whitney served as a board member during the years 1905 to 1916 inclusive, as well as a member of many important committees. W. O. Rutherford, general sales manager of the B. F. Goodrich Co., was elected to fill Raymond's unexpired term as a board member, as well as an executive committee member. The president also appointed him a member of the finance committee. Christian Girl was made a member of the show and allotment committee. The election of Whitney's successor was postponed. The Lumen Bearing Co., Buffalo, renewed its membership at this meeting.

S. A. E. Reservations Going Fast

New York City, May 10—Although it is now more than a month before the start of the S. A. E. summer cruise on the steamship Noronic, there are very few accommodations left. The latest reports show that out of a possible accommodation of 558 there are now 528 engaged. This leaves only room for thirty. The cruise stars on Monday, June 12, from Detroit, and the route lies through the Great Lakes and Georgian Bay. The duration of the trip is four days.

Saxon Plans New Factory

Negotiates for Purchase of 38 Acres in Detroit—Present Quarters Outgrown

DETROIT, MICH., May 10—*Special telegram*—The Saxon Motor Co. is negotiating for the purchase of a tract of land on the Detroit Terminal Railway which comprises about 38 acres in the vicinity of Michigan Avenue. The Saxon company has outgrown its present quarters, and while no definite plans have yet been made as to size or form of structure it is proposed to erect a plant which will adequately take care of next year's production, and this will be added to from year to year as required.

Saxon Opens Detroit Assembly Plant

DETROIT, MICH., May 8—The Saxon Motor Car Co. has opened a branch assembly plant at Franklin and Beubien Streets, which will be devoted to building six-cylinder roadsters. This factory building, containing 60,000 sq. ft. of floorspace has for the past few months been used by the factory as a service station, but owing to the increased demand for cars, it was necessary to install assembling machinery and turn it over to manufacturing.

Haynes Production of Twelves Starts June 10

KOKOMO, IND., May 8—The Haynes Automobile Co. is completing the fifth addition to its plant within the present fiscal year. The new structure that is being completed at the present time, will house the production of the light twelve car. It is expected that the manufacture of the high power, light weight car will be under way by June 10.

Allen Motor Shortens Working Day

FOSTORIA, OHIO, May 6—An 8-hr. working day has been voluntarily put in effect at the Bucyrus plant of the Allen Motor Co., this city, manufacturer of Allen cars.

This plant has been operating on a 10-hr. day basis, and the 2-hr. reduction with 10 hr. pay was announced by the company.

The Bucyrus plant of the Allen company, in which all motors are made for Allen cars, has been working 24 hr. a day for some time.

Westinghouse Strike Ends

PITTSBURGH, PA., May 9—The strike of the 15,000 electrical workers and shell makers of the Westinghouse Electric & Manufacturing Co. ended this morning, and there was a rush of those who had been out to get back to their places.

Threats that they would not be reemployed unless they returned to work this morning broke the strike. President E. M. Herr had refused all the demands, which included an 8-hr. day. He told the strikers that unless they were at work this morning they would lose not only all chances to be employed by the company again, but would also lose all the benefits accruing to them under the company's compensation and pension system.

The strike began April 22 and the employees have lost $1,397,500 in wages.

51,739 Fords in April

DETROIT, MICH., May 8—The Ford Motor Co.'s output for the month of April was 51,739 cars as compared to 46,510 in April, 1915. According to the figures given, the company has now turned out about 370,000 cars since last August.

Record Shipment of Studebaker Cars

DETROIT, MICH., May 8—The biggest single day's shipment of Studebaker cars in the history of the Studebaker Corp. was made on April 29, the output being 490 automobiles, representing a value of approximately a half million dollars.

600 War Truck Order for Pierce

BUFFALO, N. Y., May 5—The Pierce-Arrow Motor Car Co., this city, has received a rush order for 600 5-ton trucks for the French Government, valued at $3,000,000, the last shipment to go forth in June.

First Stephens Car Made

FREEPORT, ILL., May 8—The first complete automobile turned out by the Moline Plow Co., Freeport, which has been forced to embark in this line, due to the decline in the demand for farm vehicles and buggies, was on exhibition this week. It is known as the Stephens, complimentary to a member of the firm by that name. The first car was a roadster and was purchased by a physician of Freeport. The Moline company has decided to make its own fenders, having ample facilities in the plow department and has received requests from other automobile companies to supply fenders for them also.

Liberty Car Deliveries in July

DETROIT, MICH., May 9—Deliveries of the new Liberty motor cars, manufactured by the Liberty Motor Car Co., according to Percy Owen, president and general manager, will probably begin early in July.

Grant Will Move to Cleveland

7 Acres of Land Purchased—Plant to Have 124,000 Sq. Ft. of Space

CLEVELAND, OHIO, May 9—The Grant Motor Car Co., Findlay, Ohio, recently recapitalized at $4,000,000, will locate its plant in Cleveland, where it will build a plant and office building costing $200,000. A 7-acre parcel of land at Colt Road and Kirby Avenue, N. E., has been purchased for the erection of a plant containing 124,000 sq. ft. of floorspace. The plant is to be erected immediately. The structure, including a two-story office building, is required to be completed July 15.

Jackson Concerns Shorten Working Hours

JACKSON, MICH., May 8—It has been announced by three manufacturing concerns here in the automobile field that the hours of labor are to be shortened. They are the Sparks-Withington Co., which will operate on a 9½-hr. working schedule instead of a 10-hr. working day, as heretofore, and will pay the same wages as before; the American Gear Co. after May 11 will give 10 hr. pay for 9 hr. work; the Argo Motor Co. will hereafter give 10 hr. pay for a 9-hr. day, and the workmen will be given the entire Saturday afternoon.

Overland Completes Another Addition

TOLEDO, OHIO, May 8—The completion of another factory structure at the plant of the Willys-Overland Co. adds an additional 500,000 sq. ft. of floor space. The entire plant has an aggregate floor space of 4,486,680 sq. ft., or 103 acres.

Shipments at the present time are averaging almost 900 cars a day.

Movies for Sparton Employees

JACKSON, MICH., May 8—After next week the management of the Sparton plant of the Sparks-Withington Co., this city, will provide a free moving picture entertainment daily for the employees of the company. The shows will take place during the noon hour. The pictures will be selected from the regular releases of the moving picture studios. Free pictures will be shown every Saturday afternoon in the dining room of the Sparton plant if the families of the workmen desire them.

Packard Employees Win Promotion

DETROIT, MICH, May 8—A large number of former factory employees of the Packard Motor Car Co. have been promoted to positions in the engineering department as the result of their study in the factory night school. A class of eighty has just completed the prescribed course in mathematics and mechanical drawing and has been presented certificates. The entire enrolment is more than 150.

These classes have no connection with the school for apprentices. The school work was greatly stimulated by the policy announced several months ago by Alvan Macauley, vice-president and general manager, that the Packard company wants its employees to become loyal Americans and that promotions to positions of responsibility and trust would be given only to employees so inclined. This announcement was followed by a general campaign among all employees, foreign born as well as native born, to help them become more efficient workmen and better citizens.

An additional class in English for foreign-born employees was started May 1.

Pickens Succeeds Schwartz

WALTHAM, MASS., May 8—R. A. Pickens has become managing director of sales of the Metz Co., this city. He succeeds W. H. Schwartz, who resigned last week. Mr. Pickens was formerly sales manager of the Regal Shoe Co.; sales manager of the Emerson Shoe Co.; advertising manager of the American Motor Co. of Texas; and a merchandising man in the same company.

Heartz Switches to Premier

DETROIT, MICH., May 4—Roy Heartz, promotion manager of the Hupp Motor Car Co., has resigned, having been appointed assistant sales manager of the Premier Motor Corp., Indianapolis.

Following the resignation of Mr. Heartz, James G. Roe, who has been doing special work in the sales department under Mr. Heartz, has taken charge of the promotion work and Arthur E. Dixon of the service department has taken Mr. Roe's position in the sales department.

Sawyer Jackson Sales Manager

JACKSON, MICH., May 6—C. B. Sawyer, former secretary of the Detroit Board of Commerce and of the Williams Bros. Co. here, has been appointed sales manager of the Jackson Automobile Co.

Young with Allen Advertising Staff

FOSTORIA, OHIO, May 6—T. L. Young, formerly with the Overland advertising department, is now with the Allen Motor Co., Fostoria, as assistant advertising manager.

Pfau Advertising Manager

CINCINNATI, OHIO, May 4—A. B. Pfau has been appointed advertising manager of the automobile specialty department of the Pfau Mfg. Co., this city.

Freight Situation Improves

Railroads Return Freight Cars to Manufacturing Territory — Relief in East

NEW YORK CITY, May 10—The car situation was reported somewhat better during the last two weeks, railroads having been responding to the efforts of the Traffic Department of the N. A. C. C. to have automobile cars returned from the West and South into the manufacturing territory. New automobile cars of eastern system roads have also been coming out of the shops in greater quantities. Railroad conditions in the East, while they are not normal, are reported showing a gradual improvement. Cars are moving more freely and embargoes are somewhat relaxed. Exports are still embargoed except on freight for which steamship bookings are assured in advance.

Bruenauer Is Gurney Gen. Mgr.

DETROIT, MICH., May 3—O. Bruenauer, formerly western sales manager of the Gurney Ball Bearing Company, will assume duties as general sales manager of the company on June 1 at Jamestown, N. Y., where the factory is located. The service engineering department of the company, herteofore located here, will also be removed to Jamestown.

Welborn Leaves Packard Co.

DETROIT, MICH., May 9—Earl Welborn, former assistant of Henry B. Joy, president of the Packard Motor Car Co., has resigned to become general manager of Isko, Inc., a new corporation which has taken over the old plant of the Grabowsky Power Wagon Co.

Donahue Joins Liberty

DETROIT, MICH., May 6—R. W. Donahue, formerly connected with the Oakland Motor Co., Studebaker Corp. and Dodge Bros., has joined the sales department of the Liberty Motor Car Co.

Freeman Resigns from Denby

DETROIT, MICH., May 9—L. C. Freeman, one of the incorporators and chief engineer of the Denby Motor Truck Co., has resigned his position, but will still retain his interest in the company.

Sullivan Fisk Advertising Manager

CHICOPEE FALLS, MASS., May 6—The growth of the business of the Fisk Rubber Co., and with it the natural increasing of their advertising, has made necessary a revision of this department.

On June 1, G. L. Sullivan, who has been associated with Bromfield & Field, Inc., advertising agency, New York City, will become advertising manager of the company.

Miss M. G. Webber, who has supervised the Fisk advertising in the past and G. B. Hendrick, who has been in charge of publicity, will act as assistants to Mr. Sullivan.

Mr. Sullivan's initial advertising experience was with the Boston Woven Hose & Rubber Co. in the sale of Vim bicycle tires. Later he became advertising and special sales manager of the Daniels & Fisher Stores, of Denver, Col. His first advertising agency viewpoint came with the Cheltenham advertising agency.

His experience in the automobile industry specially fits him for the work with the Fisk Rubber Co. For three years he was with the American Locomotive Co.

Mattison Is Engineering Products Mgr.

DETROIT, MICH., May 8—C. A. Mattison, former sales manager of the Detroit Engineering Products Co., manufacturer of Paramount interrupters and other devices, has been promoted to the position of general manager of the company, having assumed his new duties May 1.

Whyte Joins Prest-O-Lite Staff

INDIANAPOLIS, IND., May 6—J. Whyte has become manager of the storage battery service department of the Prest-O-Lite Co., this city. He was formerly electrical engineer of the Maxwell Motor Co., Detroit, and was at one time assistant chief engineer for the Scripps-Booth Co., Detroit.

Dupree Joins Caskey-Dupree

MARIETTA, OHIO, May 8—S. F. Dupree, Jr., formerly head of the Ford department of the Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., has associated himself as vice-president in charge of sales and advertising of the Caskey-Dupree Mfg. Co., this city.

Gates with Smith Form-a-Truck

LOS ANGELES, CAL, May 9—W. O. Gates, Los Angeles, has been appointed Pacific coast manager of the Smith Form-a-Truck Co., with headquarters in Los Angeles.

New Mich. Stamping Building

DETROIT, MICH., May 8—The Michigan Stamping Co. will erect a new one-story building, 600 by 347 ft., on Mack Avenue near the Lozier plant.

National Can to Build

DETROIT, MICH., May 8—The National Can Co., manufacturer of radiators, is to erect a three-story building, as an addition to the main plant.

Tractors Till 1 Acre to 2½ Gal. Gasoline in Illinois Corn Belt

Department of Agriculture Analyzes Data of Nearly 200 Users as to Sizes Preferred for a Good Acreage and as to the Work Accomplished by These Machines

WASHINGTON, D. C., May 6—Under the title of "An Economic Study of the Farm Tractor in the Corn Belt," the U. S. Department of Agriculture Farmers' Bulletin 719 summarizes the experience of nearly 200 farmers in using different sized tractors on farms of different acreage. The object of the bulletin is not to draw general conclusions from facts and figures, but to place before the farmer the experience of others and leave it to him to calculate the probable value of the tractor for use on his particular farm. Before citing the information, the investigators point out that data on the operation of tractors soon become obsolete because of the changes and improvements in these outfits as well as on account of change in prices and the cost of fuel and oil.

The figures cited in the bulletin, the authors believe, are correct for conditions that existed in the spring of 1916 on the farms in Illinois, and they believe that these figures should be applicable not only in that State but throughout the corn belt, since the Illinois farms reporting are quite typical in most respects of general conditions prevailing in the corn belt.

Corn Principal Crop

On practically all of the farms reporting, corn is the principal crop, approximately 40 per cent of the entire acreage being planted to that crop. Oats are raised in most cases with an acreage of about one-half as great as for corn. Wheat is raised to a limited extent on more than one-half of the farms. Hay, including alfalfa and clover, form a large percentage of the remaining crops. Both spring and fall plowing are practised. The land on these farms is mostly level or gently rolling and quite free from stone for the most part. While there is a good deal of rather heavy loam, the plowing conditions are not severe except in very dry weather. The fields commonly are regular in shape, ranging in size from about 20 acres up.

These conditions under which the tractors were used should be borne clearly in mind in considering the following summary of the principal facts brought out by a careful study of the experience of the farmers as stated in their reports. Moreover, it should be understood that the figures given represent average results obtained in actual service and not maximum possibilities of the tractor. These averages, however, are believed to be worth more to a farmer in determining the possible value of a tractor in his work than are maximum figures from tests which, no matter how carefully conducted, can represent only a limited number of machines and a limited variation in conditions.

2½ Gal. Gasoline per Acre

The summary averages a large number of favorable and unfavorable reports from both competent and incompetent operators. The reports include new tractors with new sharp plows and older tractors using plows that have been sharpened several times and are not in perfect adjustment. For this reason the average fuel consumption of 2½ gal. per acre from so many users possibly is a safer guide to the farmer than would be gasoline rates obtained under fairly ideal conditions.

Three Chief Advantages

The chief advantages of the tractor for farm work, in the opinion of the operators, are: 1, its ability to do the heavy work and do it rapidly, thus covering the desired acreage within the proper season; 2, the saving of man labor and the consequent doing away with some hired help; and, 3, the ability to plow to a good depth, especially in hot weather.

The chief disadvantages are difficulties of efficient operation and the packing of the soil when damp.

The purchase of a tractor seldom lowers the actual cost of operating a farm and its purchase must usually be justified by increased returns.

Suitable Sizes Needed

One of the most important points in connection with the purchase of a tractor is to obtain one of suitable size for the farm on which it is to be used. In this connection experienced tractor owners in Illinois make the following recommendations:

For farms of 200 crop acres or less, the three-plow tractor.

For farms of from 201 to 450 crop acres, the four-plow tractor with the three-plow outfit second choice.

For farms of from 451 to 750 crop acres, the four-plow tractor with the five and eight-plow outfits tied for second choice.

A farm of 140 acres is the smallest upon which the smallest tractor in common use, the two-plow outfit, may be expected to prove profitable.

Medium-priced tractors appear to have proved a profitable investment in a higher percentage of cases than any others.

The life of tractors, as estimated by their owners, varies from six seasons for the two-plow to ten and one-half seasons for the six-plow outfits.

The number of days a tractor is used each season varies from forty-nine for the two-plow to seventy for the six-plow machines.

No definite figures on the repair charges for late model tractors can be given; it would not seem safe, however, to count upon less than 4 per cent of the first cost annually, this representing the average for farm machinery in general.

Under favorable conditions a 14-in. plow drawn by a tractor covers about three acres in an ordinary working day. Under unfavorable conditions large gang plows will cover less ground per day per plow pulled than will the small ones.

Tractor Size and Fuel

Two and one-half gal. of gasoline and 1/5 gal. of lubricating oil are ordinarily required in actual practice to plow 1 acre of ground 7 in. deep. The size of the tractor has little influence on these quantities.

Plows drawn by tractors do somewhat better work, on the whole, than horse-drawn plows. In Illinois the depth plowed by tractors averages about 1½ in. greater than where horses are used.

Efficient operation is essential to success with a tractor, and proficiency usually can be obtained more cheaply and easily by previous study and training than by experimenting with one's own tractor.

With a proficient operator the tractor is a very reliable source of power.

The use of the tractor for custom work is usually an indication that the home farm is not large enough to utilize it economically. The doing of custom work with the tractor, on the whole, appears to be a questionable practice, although nearly 45 per cent of machines are used for such work to some extent.

Displaces 25 per Cent of Horses

A tractor displaces on an average about one-fourth of the horses on the farm where it is used.

On a large number of Illinois farms brood mares constituted 33 per cent of the work stock before the purchase of the tractor. The use of the tractor increased this proportion only 3 per cent.

Experienced tractor owners do not consider even a two-plow outfit profitable on a farm of less than 140 acres. The average size of farm on which two-plow outfits are used in Illinois is 270 acres.

The four-plow tractor is most recommended by experienced owners.

Both increases and decreases in the crop yields are reported from the use of the tractor, although favorable effects are more common than unfavorable. However, increases are not sufficiently frequent to warrant a farmer placing much dependence on the tractor in this respect.

Department Store Trucks a Feature of French Army

PARIS, April 28—Department store trucks, from which commodities are sold to troops along the front, are now an established feature of the French army. The high cost of living in France is most severely felt by men in the active army, for they are obliged to purchase at the few village stores open just behind the lines, and have to pay the fancy prices imposed on the plea of high freight, danger, and scarcity. It was in order to remedy this unsatisfactory condition that the military authorities fitted up a certain number of Peugeot 3½-ton trucks as general stores, and sent them out to travel among the various armies in the field. All kinds of necessary articles likely to be required by men in the field—candles, soap, shoelaces, towels, paper, ink, shirts, socks, brushes and simple medicaments — are to be found aboard the automobile stores and are sold at practically cost price. These trucks have definite routes through the small towns and villages in which troops are quartered during their rest periods from service in the trenches. At first adopted as an experiment, this service has proved an immense success and has been extended to the whole of the French army.

Recently the French authorities have decided to equip and send to the front a series of automobiles specially equipped for giving shower baths, hot baths, for disinfecting clothing, and for washing linen. These automobiles will operate just behind the French front, among soldiers relieved from the trenches and the troops held in reserve.

F. W. D. Auto Co. Takes Over Four-Wheel Tractor?

CLINTONVILLE, WIS., May 6—It is reported on good authority that the Four Wheel Drive Auto Co., Clintonville, Wis., has taken over the Four Wheel Tractor Co., organized some time ago at Antigo, Wis., to manufacture a general utility machine employing the four-wheel-drive idea. The report says the entire business at Antigo will be moved to Clintonville at once and consolidated with the F. W. D. factory.

Hunting in Cars Prohibited in New York

ALBANY, N. Y., May 5—Hunting in automobiles in New York State is barred according to a bill which has just been signed by Governor Whitman.

Metal Wheels Gain in Europe

Cast Steel Type Employed on Trucks—Disk Wheels Also Used

PARIS, April 28—The war has been responsible for the almost complete elimination of the wood artillery wheel. For truck service the cast-steel wheel is generally employed by the French and Italian armies. The British, while large users of cast-steel wheels, also employ a percentage of disk wheels. For automobile ambulance service and light trucks, particularly those with twin pneumatics at the rear, the steel disk wheel is in a decided majority. American trucks brought into Europe for army service are all fitted with wood artillery wheels. These are allowed to remain, but in most cases when renewals are necessary they are replaced by steel.

Fiat, one of the largest manufacturers in Europe, and certainly the largest in Italy, uses no wood wheels. Heavy trucks are fitted with cast-steel wheels, ambulances and light trucks on pneumatic tires with steel disk wheels, and lighter touring cars with Sankey steel wheels. Renault, the biggest manufacturer in France, has ceased to use wood for commercial vehicles, although employing it for touring cars.

Require No Attention

The advantage of the metal wheel over wood is that it requires no attention. This is particularly important in military service, where trucks have to do a very great variety of work. While some trucks may have to run daily on a fixed schedule, many others have to stand for weeks by the roadside fully loaded, probably with one pair of wheels exposed to the sun and the opposite pair in the shade. It has been found, too, that when a truck is set on fire it becomes a total loss if fitted with wood wheels, for the spokes burn out and it is impossible to tow the vehicle home. If fitted with metal wheels the truck can always be salvaged. In most cases a burned-out truck can be put into condition at comparatively small cost, provided it can be towed to the repair shop. As one of the constant aims of the enemy is to destroy automobile convoys, it is important that the wheels should be the least destructible portion of the vehicle.

National Gas Engine Program

LAKEMONT, N. Y., May 10—William N. Hurley, vice-chairman of the Federal Trade Commission, and Dr. W. C. Huntington, commercial agent with the bureau of foreign and domestic relations, Washington, D. C., will be the speakers at the dinner of the National Gas Engine Assn. when the annual meeting is held in Chicago, June 27 to 29. A tentative program has been arranged by the secretary. A discussion of cost accounting will take up the afternoon session on the opening day, Chairman C. B. Segner to be in charge. The following papers will be read: Tractor Engines, W. J. McVicker; Tractor Design, William A. Horthy; Tractor Drawbar Ratings, Raymond Olney; Tractor Designing from the Automobile Designer's Viewpoint, William McGlashan; The Data Work, P. S. Rose; Ignition Selection, Harry G. Osburn: The Heavy Oil Engine, speaker announced later; Reducing Shop Costs, Theodore C. Menges; The Fuel Situation, E. E. Grant; Carburetion, E. E. Dean; Liquid Fuels, Present and Future, E. W. Roberts.

Experimenting with Ford Tractors

DETROIT, MICH., May 8—The little plant at Dearborn where Ford tractors are being experimented with, and which is destined to be the nucleus around which a great industrial organization is very likely to be built, is now busily turning out fifty of the latest type of Ford tractors for experimental purposes. These will be put to work on Henry Ford's estate at Dearborn, and if they prove satisfactory they will very likely be the design eventually built in large numbers. The public, however, need not look for the tractor on the market for a long time yet.

Tractor Demonstrations Without Medals

NEW YORK CITY, May 6—There will be no competing for medals by tractor manufacturers at the tractor farming demonstrations to be held this year in eight sections of the United States, under the auspices of the National Power Farming Committee. Nor will blue ribbons be awarded to the tractor which finishes its land first, or performs the most spectacular stunts.

Demonstrations will not be limited to plowing. Opportunities will be afforded to exhibit the work of disking, seeding, packing, manure spreading, and operating all other kinds of power equipment found on the average farm.

Ordnance Co. Buys Sterling Motor

BROCTON, MASS., May 7—The Sterling Motor Car Co., this city, has been acquired by the Consolidated Ordnance Co., recently incorporated in Delaware to engage in various forms of ordnance manufacture. The deal includes the taking over of the list of contracts the Sterling company has for the manufacture of shrapnel adapters, also the orders on regular commercial business for automobile companies.

Good Outlook in K.C. Territory

Bankers Report Business Conditions Are Excellent—Car Dealers Increase Sales

KANSAS CITY, MO., May 6.—Bankers in Kansas City have declared recently that the prospects for business in this territory are the brightest they ever saw, with another good crop coming on top of those of the past year or so, and high prices generally sure. Their statements followed an especially favorable report on conditions by the Federal Reserve agent at Kansas City.

These statements have the support of figures of gains in the automobile and accessory business. One jobber said, for instance, that his trade had shown a gain of 54 per cent in the first three months of the year over the same months of 1915. This was E. J. Hess of the Equipment Co. "And April was even better, though we haven't figured the exact percentage," he added.

For some reason not explained some of the towns in the territory have not been sharing this advance. In the Wichita district it is reported that business has been good only since April 20, prior to that time dullness having prevailed throughout the winter. Wichita dealers fared fairly well, however, though they suffered also from the slump in trade, and especially from the slowness of collections until the past few weeks.

Market Prices Steady

NEW YORK CITY, May 9—Market prices on automobile materials last week were steady with the usual fluctuations. Ceylon rubber continued its decline of the previous week when it dropped 2½ cents to 79. Yesterday it closed at 73 cents a pound. Para rubber is also quoting lower than last week, its lowest mark for the week being 67½ cents. Friday it rose to 69 and held at that price until the closing yesterday.

Lead has again dropped, this time 8 cents per 100 lb. to $7.30. Sulphuric acid has risen $1.00 to $3.00. These changes and the rubber situation were the features of the materials markets last week.

Rubber manufacturers are among those in the industrial field who are facing the problem presented by the high price of gasoline. Naphtha has been almost a necessity in rubber manufacture. The lines most dependent upon it are tire repair; dipped goods; tires and mechanical rubber goods. Wherever any union of parts is desired, naphtha is the usual agent to bring it about.

Gasoline is still quoting wholesale at from 20 to 24 cents a gallon. A rise is expected on account of the scarcity of crude oil. The present prices of crude oil are being watched eagerly by the gasoline interests as a rise in oil is expected to affect fuel prices in general.

Gasoline Prices Unchanged

NEW YORK CITY, May 8—Automobile owners are still paying from 27 to 31 cents a gallon for gasoline in the East, the retailers taking a profit of from 3 to 7 cents, according to the location of the garage and the overhead expenses.

The price has remained stationary so long that the opinion is frequently expressed that a change must come soon. It is now fully two months since the advance stopped, while all the factors in the situation appear to point to a further rise. Activity in the oil fields has failed to uncover any large wells.

The Maxim Munitions Corp. has closed a contract for the exclusive manufacturing rights of Louis Enricht's substitute for gasoline.

The Maxim company is now making experiments to prove conclusively that this invention is practical for commercial purposes as a fuel. The corporation has bought near the property of the inventor an acre of land on which it will build its laboratory and factory.

Another Fuel Substitute

BOSTON, MASS., May 8—Another man with a substitute for gasoline has made his appearance, this time at Stoneham, a suburb of Boston. His name is D. E. Smith, an attorney. While he claims to be the inventor, it is believed that a young fellow who has a reputation for experimenting in chemistry is the real inventor and Smith is representing him.

Last Saturday Mr. Smith went to Stoneham Square to the garage of D. G. Pratt, who handles the Maxwell line in the town, and said he wanted to prove that he had a gasoline substitute. Pratt allowed him to use one of his cars. In the presence of Mr. Pratt and some newspaper men the gasoline tank of the car was emptied.

The witnesses then certified to the conditions. Then Mr. Smith poured in a quart of colorless liquid from a glass milk bottle. The party of five then got into the car and it was started without trouble. A trip was made to Greenwood and back, maintaining a speed of from 20 to 25 miles an hour. Upgrades had no effect upon the fuel, which for lack of a better name Mr. Smith calls motive gas.

According to Mr. Smith, the chemicals are simple, and they are of American manufacture. They may be procured anywhere, and when mixed with water furnishes a fuel at 3 cents a gallon. He says all the operator of a car has to do is to fill the car with the mixture, and then by carrying a few bottles along and when the tank is empty pour in 5 gal. of water, empty the contents of a 6-oz. bottle in the water and continue on his journey.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.58	.58	.58	.58	.58	.58	...
Antimony	.36	.36½	.36½	.36½	.36½	.36½	+.00½
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.29½	.29½	.29½	.29½	.29½	.29½	...
Copper, Lake, lb.	.29½	.29½	.29½	.29½	.29½	.29½	...
Cottonseed Oil, bbl.	10.75	10.73	10.93	10.90	11.00	10.98	+ .23
Fish Oil, Menhaden, Brown	.54	.54	.54	.54	.54	.54	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	1.03	1.03	1.03	1.03	1.10	1.10	+ .07
Lead, 100 lb.	7.38	7.38	7.38	7.30	7.30	7.30	— .08
Linseed Oil	.76	.76	.76	.76	.76	.74	— .02
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kan., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para	.67½	.67½	.67½	.69	.69	.69	+ .01½
Rubber, Ceylon, First Latex	.76½	.73½	.73	.73	.73	.73	— .03½
Sulphuric Acid, 60 Baume	2.00	2.00	2.00	3.00	3.00	3.00	+1.00
Tin, 100 lb.	52.00	51.50	51.50	51.00	51.00	50.00	—2.00
Tire Scrap	.05⅞	.05¾	.05¾	.05¾	.05¾	.05¾	—.00⅛

Goodyear to Increase to $25,000,000 Capital Stock

AKRON, OHIO, May 5—The Goodyear Tire & Rubber Co., Akron, has applied to the Secretary of State for permission to increase its authorized capital from $7,000,000 to $25,000,000. The increase is necessary to take care of the rapid expansion of the concern and the erection of additions to the plant.

To Investigate Foreign Market Conditions

WASHINGTON, May 8 — It will probably interest automobile manufacturers who are interested in foreign trade that the most extensive investigations into foreign market conditions ever undertaken at one time by the Bureau of Foreign and Domestic Commerce, Department of Commerce, will be under way soon after the beginning of the new fiscal year in July. These investigations will be aimed at the newer and more undeveloped markets lying well outside of the fighting zone, especially those in South America, China, India, Africa and Australia. Twelve different lines are to be investigated, and fifteen distinct examinations to find suitable agents for the work have been announced for some time in May.

For South America agents are being sought to study and report on markets for motor vehicles and other American productions. In the Far East, Africa and Australia a study will also be made of the markets for motor vehicles. One agent is also sought to look into possibilities for American commercial and industrial investments in South America and another to make a similar study in the Far East.

New Financing for Perfection Spring

Cleveland, Ohio, May 5—Stockholders of the Perfection Spring Co., this city, have been notified that the company will issue treasury stock, $250,000 common and $250,000 7 per cent preferred. Arrangements have been made to sell the new preferred to a syndicate; the common is offered to shareholders at par, the entire offering being underwritten.

The company with these issues will have outstanding $1,000,000 preferred and $1,250,000 common, and will have all of its financing completed, having no obligations but current accounts.

Advance-Rumely Re-elects Directors

South Bend, Ind., May 8—At the annual meeting of the stockholders of the Advance-Rumely Co., Laporte, all members of the board of directors were reelected as follows: F. P. Mount, Maurice Fox and William Taylor of Laporte; Elisha Walker, J. W. Platten and F. N. B. Close of New York; S. S. Strattan and Edgar Elliott of Chicago; B. T. Skinner of Battle Creek; H. H. Wehrhane and S. B. Fleming of New York.

Maxwell Features Securities

Common Goes Up 5 Points on Dividend Rumors—Preferred Issues Higher

New York City, May 9—Rumors of mergers and dividend action were rampant last week and had their desired effect on security prices. Chevrolet, Studebaker and Maxwell shares advanced enthusiastically in the early trading on the Stock Exchange on Saturday on a report from Detroit which stated that there was in process of formation a huge merger embracing Chevrolet, General Motors, Maxwell, Continental, and Studebaker companies under the leadership of W. C. Durant, P. S. du Pont and L. G. Kaufman, with a capitalization of several hundred million dollars. While the rumor was subsequently denied by interests connected with the companies mentioned the result was a sensational rise in a few of the stocks.

On the curb Chevrolet sold up to 207, a new high record and an advance of 3 points over the old mark. On the Stock Exchange Maxwell common advanced to the new high price of 82⅝, a gain of 1½ points over the previous close and an advance of 9⅝ points over the low of Friday. Studebaker was another stock that made a considerable advance for the day, closing at 132¾, up 5½ points from the previous close.

Yesterday Maxwell common sold up to 86⅞ in anticipation of early dividend action on both that class of stock and on the second preferred as well. It was among the most active stocks on the list, 34,500 shares changing hands. About 80 per cent of the convertible warrants issued last January, in payment of the 14¼ per cent back dividends on Maxwell first preferred stock at par, leaving about $350,000 outstanding. The wiping out of the accumulation of dividends on the first preferred opens the way for the placing of the $10,127,467 second preferred on its 6 per cent basis.

Notice has been sent to holders of Chevrolet motor stock that all restrictions as to sale of their stock received in exchange for General Motors common have been removed. An offer is made of $2 a share for an option good until Aug. 1 next to purchase all or any part of their holdings at $210 a share.

Dividends Declared

Pratt & Whitney, quarterly of 1½ per cent on preferred, payable May 15.

Maxwell Motors quarterly of 1¾ per cent on first preferred.

Ajax Rubber Co., quarterly of $1.25 per share. Initial payment of $1.25 a share was made on March 15, payable June 15 to holders of record May 31.

K. C. Tire Capital $575,000

Kansas City, Mo., May 6—The Kansas City Tire and Rubber Corp., this city, has been chartered with a capital of $575,000. Harry Goodman of Chicago is president, P. E. Werner of this city is vice-president, W. R. Swisler of Chicago secretary and L. J. Smith, this city, treasurer. The factory covers a 3½-acre tract at the northwest corner of Fourth Street and Central Avenue.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	65	67½	..
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	81	87	..	..	..
Chalmers Motor Co. com	93	96	150	158	—4
Chalmers Motor Co. pfd	94	98	89	99¼	—9½
Chevrolet Motor Co	..	..	205	207	—9
Electric Storage Battery Co	51	52	58	60	— ½
Firestone Tire & Rubber Co. com	485	..	820	850	+20
Firestone Tire & Rubber Co. pfd	110	112½	114	116	..
General Motors Co. com	138	140	425	440	—1
General Motors Co. pfd	97	99	119½	120½	+6
B. F. Goodrich Co. com	43	44	77	77½	+ ¾
B. F. Goodrich Co. pfd	101½	103	114	116	..
Goodyear Tire & Rubber Co. com	245	255	385	393	—20
Goodyear Tire & Rubber Co. pfd	105	106½	119	121	+2
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	10	12	9	12	—1
International Motor Co. pfd	25	30	20	30	—2
Kelly-Springfield Tire Co. com	116	129	72½	73½	+1¼
Kelly-Springfield Tire Co. 1st pfd	83	86	96	98	..
Kelly-Springfield Tire Co. 2nd pfd	130	140	..	..	— ½
Maxwell Motor Co. com	46½	47½	82	82½	+5
Maxwell Motor Co. 1st pfd	81	83	86⅛	86⅝	+1⅛
Maxwell Motor Co. 2nd pfd	38	39	59¾	60¾	+2¼
Miller Rubber Co. com	180	188	255	270	—10
Miller Rubber Co. pfd	104	105	115	..	+1½
New Departure Mfg. Co. com	..	..	190	195	..
New Departure Mfg. Co. pfd	..	..	112	..	..
Packard Motor Car Co. com	105	..	165	175	..
Packard Motor Car Co. pfd	95	100	100	104	..
Paige-Detroit Motor Car	..	..	750	850	..
Peerless Motor & Truck Corp	..	..	23	25	+1
Portage Rubber Co. com	35	38	85	88	+10
Portage Rubber Co. pfd	85	88	107½	108½	— ½
Regal Motor Co. pfd	..	..	18	25	+3
*Reo Motor Truck Co	14½	16	28½	29¾	+1½
*Reo Motor Car Co	31	33	38¾	39½	+ ¼
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	68	69	85	87	+ ½
Stewart-Warner Speed. Corp. pfd	103	105	109	..	..
Studebaker Corp. com	66	67	132½	133½	+1½
Studebaker Corp. pfd	101	103	107	110	—1
Swinehart Tire & Rubber Co	80	90	83	84	—1
Texas Co.	129	131	190	192	+3
U. S. Rubber Co. com	60	62	53½	54½	—21½
U. S. Rubber Co. pfd	106	107½	109¼	110	+2¾
Vacuum Oil Co	213	215	237	240	—2
White Motor Co. (new)	..	..	49	51	+1
Willys-Overland Co. com	117	119	228	230	..
Willys-Overland Co. pfd	100	102	104	105	+1

*Par value $10.00.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	31	..	..
Chalmers Motor Co. com	..	95	158	164	+3
Chalmers Motor Co. pfd	93	98	97½	101½	+1
Continental Motor Co. com	170	185	36	37¼	+ ¼
Continental Motor Co. pfd	82	85½	..	10¼	..
Ford Motor Co. of Canada	700	..	375	395	—5
General Motors Co. Com	136	144	400	430	—20
General Motors Co. pfd	98	100	116	120	+6¾
Maxwell Motor Co. com	45	49	83	87¼	+12¼
Maxwell Motor Co. 1st pfd	80	82½	85	89	+4
Maxwell Motor Co. 2nd pfd	36	38½	58½	61½	+4½
Packard Motor Car Co. com	103	..	166	..	..
Packard Motor Car Co. pfd	97	100½	..	104	..
Paige-Detroit Motor Car Co	..	..	840	875	+25
*Reo Motor Car Co	31	32¾	..	40	+ ⅞
*Reo Motor Truck Co	..	15¾	28¼	29	..
Studebaker Corp. pfd	100	102	107	..	..
Studebaker Corp. com	66	70	134	134¼	+3¼

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	195	..	320	365	..
*W. K. Prudden Co	19½	21	30	32½	..
Regal Motor Car Co. pfd	..	25	15	22	..

*Par value $10.

23 Sheepshead Bay Entries

Mulford Special Withdrawn—Will Probably Appear Later in Season

New York City, May 9—Up to date there are twenty-three entries for the Metropolitan trophy race to be held at Sheepshead Bay Speedway on May 13. The Mulford Special has been withdrawn due to motor trouble which could not be overcome in time to enter the race.

Four events will be held on the Sheepshead Bay track on that day. The feature event will be the Metropolitan Trophy, a 150-mile race for cars within the 300-cu. in. piston displacement limit. Entrants will be required to make 90 m.p.h. to qualify, and the race will be limited to 90 min. It is an A. A. A. championship award event under the new plan of the contest board of that organization for determining racing champions. The trophy will be contested for over three or five years. There will be $15,000 in prizes, distributed over seven places, varying from $6,000 for first to $400 for seventh.

The other events are: The 50-mile Queens Cup race, carrying $2,500 spread over five places, both being for cars within the 300-in. limit; the 20-mile Coney Island Cup, with $1,500 for five places, both being for cars within the 300-in. limit, and the 10-mile Brooklyn Handicap for non-winners, the prize being the William Kemble Cup and $1,000 in five prizes. Anyone not taking a prize in the previous events is entitled to compete in this race. These three cups are given outright to the winners.

Special trains will carry the sportsmen from Chicago, Boston, Baltimore and Washington, while thousands from all over the country will tour to the speedway in automobiles. Inquiries sent out by the speedway management to automobile clubs have resulted in excellent reports on road conditions. A personal inspection has been made and motorists advised as to the best route to take.

Some of the times which were snapped were Henderson in the Maxwell, who reeled off a lap in 1 min. 9 1/5 sec., which is a speed of 104 m.p.h. Resta was timed in 1 min. 12 2/5 sec., which is 99½ m.p.h. Jack Lecain was out with the Delage and Billy Chandler with his Crawford. Jules Devigne also had his Delage out and J. Christiaens made a lap at 100 m.p.h. in his new Sunbeam. It is expected that there will be a feature race between the twelve-cylinder Sunbeam owned by Adams Bros. and the Blitzen Benz owned by Harry S. Harkness. These are supposed to be the two fastest cars in the world.

H. S. Harkness has made an added entry of a Pusun which will be driven by Aldo Franchi, an Italian. This car is built from a Peugeot chassis, with a Sunbeam motor. In its initial tryout the car averaged 106 m.p.h. Entries are:

Car	Driver
Adams Special	George Adams
Erwin Forty	Grover C. Bergdoll
Erwin Forty	Eugene Stecher
Peugeot	Ralph Mulford
Peugeot	Dario Resta
Peugeot	John Aiken
Crawford	Billy Chandler
Crawford	Dave Lewis
Crawford	Unnamed
Duesenberg	Eddie O'Donnell
Duesenberg	C. T. Devlin
Maxwell	Pete Henderson
Maxwell	Eddie Rickenbacker
Delage	Carl Limberg
Delage	Jack Lecain
Delage	Devigne
Delage	Unnamed
Sunbeam Six	Joseph Christiaens
Sunbeam Six	Aldo Franchi
Sunbeam Six	Unnamed
Mulford Olsen Special	C. W. Thompson
J. J. R. Special	Bert Watson
Pusun	Aldo Franchi

Chevrolet Takes Gardena Race

Gardena, Cal., May 6—George Hill, formerly Barney Oldfield's mechanic, won the Garden road race for cars of 231 cu. in. piston displacement and under in a Chevrolet here to-day, covering the 75 miles over the 2.2-mile course in 1:47:13. Robert Conner in a Ford Special was second, in 1:49:02. Dochterman in a Chevrolet was third and Bacon was fourth in a Fiat. The latter two were flagged as Conner finished, spectators crowding on the course to congratulate winners making it dangerous for the race to proceed. Stutzman in a Grant Six went out in the lead on the first lap and for eight laps had things his own way. He came to the pits for a tire change and, as he was using wooden wheels, lost almost a lap, Hill going into first, where he stayed until the finish. The Grant never got up into the lead again, going into the ditch in the eighteenth lap. Heacox, driving a Cadillac, went into the ditch with a broken steering knuckle in the twenty-ninth lap.

The Gardena race is to be an annual affair for 231-in. cars, to-day's event being held in connection with the annual Gardena Valley strawberry day fête.

Hyatt Branch Service Managers to Meet May 18-20

Detroit, Mich., May 9—The managers of the service branches of the Hyatt Roller Bearing Co. will gather at the general sales offices in this city May 18-20 for their first annual convention. The business sessions will be devoted to talks by officers of the company and to conferences on engineering, sales and advertising matters.

Thomson Sheepshead Director

New York City, May 5—A. E. Thomson has been appointed managing director of the Sheepshead Bay Speedway. Everard Thompson will continue as general manager and vice-president.

30 Entries for Indianapolis

Elimination Trials Will Be Held May 26-27—Three Crawfords Late Entrants

Indianapolis, Ind., May 5—The entry list for the Indianapolis 300-mile race May 30 closed May 1 but the records were held open until all entries which were mailed on the last day were received. The final list shows thirty entries for the International sweepstakes. The late comers included the three Crawfords which Billy Chandler is building at Hagerstown, Md., and two entries to be known as the Erwin Specials. These are entered by Grover Bergdoll, the Philadelphia millionaire.

The entry of Tom Alley in an Ogren car raises the total number of entries to date to twenty-eight. The speedway officials admit they have two more entries which they will not make public at present and a possible third.

Ralph DePalma, winner of the 500-mile race at the Indianapolis speedway last year, has wired for permission to enter his Mercedes car, stating that he has sold this car to Frank P. Book, a wealthy young Detroiter, who has had some racing experience and wants to drive at Indianapolis. Book will drive a Cadillac in the Chicago amateur race. DePalma did not get his entry in before the opportunity closed at midnight, May 1, so consent in writing must be obtained from all the other entries.

Rigid Tests Provided

Rigid physical tests must be passed by all entrants. Following are but samples of a whole volume of rules that are necessary to regulate such an enormous undertaking as this race: Each car must show 80 miles an hour in an official speed trial of one lap of the track to be eligible. Speed trials will be held on May 26 and 27. Cars shall start in the order of the time they make in the official speed trials; the fastest car starting in first position, next the pole. The racing numbers will be assigned in the same manner, the fastest car receiving No. 1. In event of rain the race will be postponed until Wednesday, May 31, or some subsequent date. Any driver who in the opinion of the officials or speedway management does not show sufficient skill and judgment in the handling of his car to make him a safe factor in competition shall be barred from the track. Any driver who on the day of the race gives evidence of exhaustion or other physical incapacity, making him a potential danger to others on the course, may be barred from further competition. The status of his eyesight, heart action, blood pressure and general condition must have been approved by the speedway surgeon at least five days before the contest. Steering wheel spiders other than steel or bronze will not be permitted. All chain-driven cars must be equipped with chain guards. All parts of cars, with respect to safety, shall be subject to the approval of the speedway technical committee.

The entries follow:

Car.	Driver.
Maxwell	Richenbacker
Maxwell	Henderson
Frontenac	Louis Chevrolet
Frontenac	Arthur Chevrolet
Frontenac	Gaston Chevrolet
Peugeot	Resta
Peugeot	Aitken
Peugeot	Merz
Peugeot	Mulford
Sunbeam	Christiaens
Sunbeam	
DuChesneau Special	DuChesneau
Cleveland Special	
Premier	Anderson
Premier	Rooney
Premier	Stillman
Duesenberg	O'Donnell
Duesenberg	D'Alene
Crawford	Chandler
Crawford	Lewis
Crawford	Johnson
Delage	Oldfield
Delage	LeCain
Delage	Limberg
Delage	
Erwin Forty	Bergdoll
Erwin Forty	Stecher
Ogren	Tom Alley
Duesenberg	Not named
Osteweg Special	Osteweg

To Try for West-to-East Record in Cadillac Eight

LOS ANGELES, CAL., May 8—E. G. Baker and W. F. Sturm, both of Indianapolis, left here in a Cadillac Eight at midnight on the first leg of their 3375-mile trip across the United States. They will try to better the West-to-East record made by Baker in a Sutz last May, which is 11 days, 5 hr., 25 min.

Their route for the first 24 hr. lies through San Bernardino, Barstow, Needles, Kingman, Williams, Flagstaff and Albuquerque. The finish will be at New York.

In the route they have selected this year Baker and Sturm hope to cut down the mileage from that of last year by taking a more direct route. Last year's mileage was 3728.4, and touched Phoenix, El Paso, Plains, Kan., and Emporia, Kan. The mileage of the route which they hope to follow is as follows:

Los Angeles to San Bernardino	63
To Barstow	79
To Needles	165.8
To Kingman, Ariz	72
To Williams	138.5
To Flagstaff	34.8
To Albuquerque, N. M	381
To Santa Fe	66
To Las Vegas	72.9
To Raton	136.6
To Trinidad, Col	25
To La Junta	94.2
To Syracuse, Kan	114
To Dodge City	104.8
To Hutchison	153
To Florence	121.7
To Kansas City, Mo	134.5
To Columbia	159
To St. Louis	140.7
To Greenville, Ill	52
To Dayton, Ohio, via Indianapolis	322.1
To Greensburg, Pa	303
To Philadelphia	275.8
To New York	103
	3,375.7

Omar Wins Kern Co. Race

Hughes Driving Makes 100 Miles at 61.6 m.p.h.—Good in Stutz Second

BAKERSFIELD, CAL., May 7—*Special Telegram*—Hughie Hughes in the Omar won the 100-mile track race staged by the Kern County Fair Association here to-day, taking the event at 61.6 m.p.h. He jumped into the lead in the first lap and held front position to the finish, with but one stop at the pit. The 100-mile ramble was made in 1 hr. 36 min. 8.4 sec. Frank Good in a Stutz won second money, at 61.18 m.p.h., covering the 100 miles in 1 hr. 38 min. 4.8 sec. Third money went to Clyde Rhodes, a local speed king, who drove his Studebaker Special to the tune of 60.9 m.p.h. The Studebaker made the course in 1 hr. 38 min. 30.6 sec. Frank Elliott, in the old Mercer Monk, which now is known as the Gordon Special, won fourth place at 60.4 m.p.h., with 1 hr. 39 min. 20.6 sec. charged up to him on the timer's sheet. Lou Gandy in a Gandy Special was running fifth and was flagged in the ninety-seventh lap. Debolt in the McKees Special went out in the thirty-third lap with a broken oil line and Ed Waterman in a Gandy Special went out with a burned-out bearing in the sixty-sixth lap after driving a wonderful race.

Narrow Escapes from Accidents

Frank Good had a narrow escape when he blew a tire on the backstretch just after coming out of the turn. Only the clever driving of the pilot saved the crew and car. As the tire blew the car leaped into the air in a cloud of smoke, and the ambulance started across the field, but a second later the car was seen flopping across the course like a wounded animal. Good mastered the machine and rolled into his pit for a tire change.

Hughes Has Trouble

Hughes had a narrow escape also in the eighty-first lap when Rhodes crowded him on the turn, and he fought for his life in the dust. Hughes was called into the pit by Fred Aubert, chairman of the technical committee, in the eighty-sixth lap to wire up a loose tie rod which had jarred loose and at this time Hughes filled up with gasoline and went on through the race with a leak in the gas tank which was expected to put him out before he was given the checkered flag. The course was well policed and it was the best managed race staged in southern California this season, although there were only 3000 spectators.

In the 25-mile light-car race, Walter Smith in a Maxwell won first money. His time was 28 min. 58.8 sec. Fred Docherman in a Chevrolet was second. Ed. Gibson in a Studebaker went out with engine trouble in the twenty-first lap after leading for practically the entire race. Dominic Basse, who was to drive the Milac, was excused by Referee Bird when he reported that his car had been attached in Los Angeles.

Des Moines Speedway Changes Hands

OMAHA, NEB., May 10—Henry Gering of this city has sold his interest in the Des Moines mile and a quarter speedway to a syndicate of Des Moines men, the deal representing $50,000. Samuel Orloff of Des Moines, who with Gering promoted the speedway, has also disposed of a $10,000 block of stock to the same syndicate. He retains the rest of his interest and will continue to act as secretary of the organization. Gering, retiring as president of the company, is succeeded by A. H. Banks, with C. C. Taft as vice-president.

$1,000 Prize for 2-Mile Record on Chicago Speedway

CHICAGO, ILL., May 8—A cash prize of $1,000 has been announced to-day by the Speedway Park Association of Chicago to any driver who at the end of the season holds the world's 2-mile speedway record, providing this record is made on the Chicago speedway and in official time trials. The offer is open to any A. A. A. registered driver, whether American or foreign, and to any car of any displacement. The trials must be under the observation and rules of the American Automobile Association, upon whose certificates of performance the award will be made at the end of the season. This offer remains open until the close of the Chicago speedway season, Oct. 31. In the event that a record of 120 m.p.h. for one lap is made, $1,500 will be added to the prize. Any A. A. A. registered driver wishing to try for the record must give the Speedway Park Assn. ten days' notice and pay expenses of the trial, unless the driver is invited by the speedway to try for the record, in which case the expense will be borne by the speedway. It is intended to invite all of the more prominent drivers to try for the record.

Amateur Drivers Make Fast Time

CHICAGO, ILL., May 8—Entrants in the non-professional drivers' invitation race May 20 made some very fast time in practice yesterday on the local speedway. F. C. Sawyer made the fastest lap in practice so far when he drove his Mercer roadster one lap of the 2-mile course in 1 min. 30 and 4/10 sec. This is close to 80 m.p.h. There were twelve owner drivers in yesterday's practice, and in addition a number of tradesmen and preliminary workouts for the proposed trade race, which may be staged on the day of the owner drivers' event.

Factory Miscellany

Wisconsin Plant News—The Racine Steel Casting Co., owned and operated by the Belle City Malleable Iron Co., Racine, Wis., is now operating its new plant, which will have a monthly capacity of 300 tons of electric steel castings and 500 tons of electric steel ingots, produced by a 3-ton Heroult electric furnace. The foundry is 80 by 322 ft. in size, and the center bay, 50 ft. wide, is commanded by a 7½-ton Pawling & Harnischfeger crane. The company will make a specialty of manufacturing alloy steels to specifications. The subsidiary, as well as the parent company, has a large clientele in the motor car and tractor industry.

The Werra Aluminum Co., Waukesha, which specializes in aluminum castings for motor builders, is contemplating the enlargement of its foundry, established three years ago in the former Wisconsin Central car shops. The present facilities are not adequate to handle the great volume of business on the books.

The Thurner Heat Treating Co., 126 Ferry Street, Milwaukee, is installing a small furnace for producing high-speed tool steel.

The Milwaukee Auto Engine & Supply Co., 841 Twenty-ninth Street, Milwaukee, is enlarging its hardening furnace capacity.

The Warner Mfg. Co., South Beloit, has been incorporated with a capital stock of $10,000 to manufacture the Warner "Auto-Trailer" recently described. At the head of the company is A. P. Warner. J. W. Menhall and A. B. Cadman of Beloit are associated with him. A large production of trailers is now being made in the spacious shops leased by the company and re-equipped.

The Falls Machine Co., Sheboygan Falls, a large manufacturer of motors for several leading motor car manufacturers, has taken occupancy of its new assembling and testing floor shop, measuring 40 by 250 ft., and is making other important improvements looking toward enlargement and efficiency. A new record in motor construction was established at the Falls plant several days ago, when a cylinder block was finished in 38 min. This compares very favorably with the average made for similar work at the Ford works in Detroit, where a block is finished in 45 min. The Falls record was established on a six-cylinder motor casting, while the Ford average is on a four-cylinder. The Sheboygan Falls concern is also establishing commercial records. While 1915 business aggregated more than $1,000,000, the volume of the first three months of 1916 was more than $500,000, and at this time the company has orders for future delivery amounting to $2,500,000. Nearly 400 persons are on the payroll.

Van on 24-Hr. Schedule—The Van Sicklen Speedometer Co. has started continuous production in the assembly and machine departments of its Elgin, Ill., factory. These portions of the plant are now operated 24 hr. per day.

Tire Plant for Farwell—The Western Tire & Garage Co., Farwell, Tex., will shortly open a plant for the manufacture of automobile tires and rubber accessories. The plant when opened will give employment to 500 men. The officers are: Judge J. D. Hamlin, president; C. A. Robeson, vice-president; M. M. Craig, secretary, and C. L. McCallan, treasurer.

Jackson Shaft to Double Output—The Jackson Motor Shaft Co., Jackson, Mich., will erect an addition in the eastern part of the city, which will be 24 by 100 ft., directly adjoining the present structure. The new machinery required will cost nearly $15,000 and give employment to about fifty men, making a total of 200. The new addition will increase the output about 50 per cent. Between 10,000 and 12,000 cam shafts per month will be turned out. July 1 the plant will be taken over by the Briscoe Motor Corp., at which time the concern will be reorganized and the name of the firm changed, but the management as it now is will continue and the manufacture will go on as before.

The Automobile Calendar

ASSOCIATIONS

May 9-12—Hot Springs, Va., N. A. A. A. J. Meeting.
May 18—S. A. E. New York Section, May Meeting.
May 22-26—Chicago, Ill., N. E. L. A. Convention, Electric Veh. Section, Congress Hotel.
May 26-27—Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
June 12-16—S. A. E. Summer Trip on Great Lakes.
July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.

CONTESTS

May 13—New York City, Sheepshead Bay Speedway Race. Metropolitan Trophy, 150 miles; Queens Cup, 50 miles; Coney Island Cup, 20 miles, and Brooklyn handicap for non-winners, 10 miles.
May 20—Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.
May 30—Des Moines, Iowa, Iowa Derby, 20 miles; Des Moines Special, 10 miles.
May 30—Tacoma, Wash., 10, 20, and 30-Mile Races, Tacoma Speedway Assn.
May 30—Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn.
May 30—Indianapolis Speedway 300-Mile Race.
May 30—Minneapolis, Minn., Speedway Race.
June 4—Sheepshead Bay Speedway, 30-mile Race, American Liberty Day Committee.
June 10—Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 16-17—Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.
June 20—Galesburg, Ill., Track Race, 100 miles.
June 28—Des Moines, Iowa, Speedway Free-for-All, 300 Mile Race.
July—LaGrande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash, Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300-Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hillier-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hillier-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4—Indianapolis Speedway Race.
Sept. 4-5—Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30—New York City, Sheepshead Bay Speedway Race.
Oct. 7—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14—Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Nov.—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

May 14-20—Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.
May 25—Pennsylvania's Second Good Roads Day.
Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

MISCELLANEOUS

June 8—New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphans' Automobile Day Outing Assn.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16—Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Columbus News Notes—A new Westinghouse service station has been opened by Thane C. Hecox, under the name of the Auto Electrical Supply Co., at 269 North Fourth Street. The concern carries a full line of auto and electric accessories.

John Hoffman, 2522 North High Street, has taken the central Ohio agency for the Case.

Northwest News—The Roesch Motor Car Co., Seattle distributor of Velie cars, has secured new quarters in the Queen City at 1109 Pine Street. A new service department has been added by this company.

The Ahlberg Bearing Co. has opened a northern office in Portland, Ore. C. J. Bender is secretary and B. H. Bodley has been named Portland manager.

The Foster-Larson Co., Spokane, Wash., has opened a sub-agency in Walla Walla, Wash., which will handle the Paige and National automobiles and Stewart and Garford trucks. S. A. Heist is the new manager in the Walla Walla territory.

New England Trade Items—G. S. Bishop, who has the Premier and Westcott cars at Boston, Mass., has added the H. A. L. to his line.

F. H. Grow, manager of the Langham Motor Co., Boston, Mass., has taken on the Davis car, his territory extending from Boston to Portland, Me.

F. A. Dutton, who has the Empire for New England, has placed an agency at Waterville, Me., with R. C. Whitney.

L. A. Vanchon, Brookline, Mass., has taken on the Overland for that town.

Earl Davis, who has been a special factory representative for the Paige-Detroit, has gone to Providence, R. I., to take charge of the Paige service department.

Large Spark Plug Order—The Beckley-Ralston Co., Chicago, Ill., has ordered 300.000 A.C. spark plugs.

New Bosch Contracts—The Bosch Magneto Co., New York City, has signed contracts with six concerns to use its magnetos for the coming season. They are the Roberts Motor Co., Sandusky, Ohio; Henderson Bros., North Cambridge, Mass.; Jordan Motor Car Co., Cleveland, Ohio; Republic Motor Truck Co., Alma, Mich.; Nordyke & Marmon Co., Indianapolis, Ind., and the Ogren Motor Works, Chicago, Ill. The contracts of the two concerns last mentioned also include complete lighting and starting equipment.

Trade Happenings

Hanks Goes to Chicago—M. W. Hanks, who is in charge of the Western sales of the automobile equipment department of the Westinghouse Electric & Mfg. Co., now has his headquarters in Chicago. Mr. Hanks was formerly located in the sales service station of the company at Indianapolis. Service work at Indianapolis is now handled by the Kelly-Springfield Co. of Ind., and the sales of the Westinghouse automobile equipment in this district by H. H. Johnson.

Ritchie Transferred—R. C. Ritchie, formerly in charge of the office of the Automobile Equipment sales service station of the Westinghouse Electric & Mfg. Co. in Chicago, has been transferred to the main office at Shadyside Works, Pittsburgh, Pa.

Seaman Knight Tire Representative—L. I. Seaman, formerly with the Ajax Tire Co., has been appointed district representative of the Knight Tire Co. for western and northern New York.

Higgins Burd Ring Factory Manager—G. H. Higgins has been appointed factory manager of the Burd High Compression Ring Co., Rockford, Ill.

Service Station for New York Metz—Robert Lurie & Co., Eastern agent for the Metz, leased two buildings at 307 and 309 West Sixty-seventh Street, New York City, for a service station.

Graham to Manage Goodrich Plant—L. K. Graham will manage a branch factory to be established by the B. F. Goodrich Co., Akron, Ohio, in El Paso, Tex.

Austin Cleveland Saxon Sales Manager—L. A. Austin has been appointed retail sales manager of the Loveland Co., Cleveland Saxon distributor.

Ahlberg Opens New Factory Branches—The Ahlberg Bearing Co., Chicago, Ill., has opened two new factory branches at San Francisco, Cal., and Portland, Ore., completing a chain of eleven branches at New York City, Boston, Detroit, Cleveland, Minneapolis, St. Louis, Portland. Atlanta, Los Angeles, San Francisco and Chicago.

Mountain Retail—Tom Botterill, East Thirteenth Avenue and Broadway, Denver, Pierce and Hudson distributor for Colorado, Wyoming and Utah, and Dodge dealer for Denver, has added to his salesroom and garage a $12,000 building, for adjustments and quick repairs, on an adjacent site directly across the alley. The new service building is 50 by 125 ft., faces on Thirteenth Avenue and also Lincoln Street, thus extending the Botterill business place the entire width of the block from Broadway to Lincoln Street.

The Mitchell Tire Co., a new concern formed by C. E. Mitchell and F. W. Graham, has opened a Defiance and Midgley Wire Tread Tire agency at 1622 Court Place, Denver.

W. G. Dickey, 1441 Wazee Street, Denver, Monogram Oil distributor for Colorado, Wyoming, New Mexico, Nebraska, Kansas, Oklahoma and Western Missouri, has opened a warehouse and branch office at Kansas City.

The Roberts Auto Co., 1618 Court Place, Denver, Marmon distributor for Colorado and Wyoming and Stevens-Duryea service station, is moving into a remodeled garage building at 220 Sixteenth Street.

The Downey Garage, 3312 East Colfax Avenue, Denver, has been appointed official service station for the Chalmers and Hupmobile and has bought a Chalmers demonstrator for agency use.

The National Motor Co., 1616 Broadway, Denver, National distributor for Colorado and Wyoming, has taken the Elgin distributing agency for the same territory.

The White Automobile Co., Perry A. Mead, manager, Denver agent for the White, has moved into new quarters in a $12,000 building at 1330 Broadway, with 50 by 125 ft. of floor space for salesroom and garage.

D. M. Gillespie, district sales manager for the White in the Rocky Mountain district, has moved his Denver headquarters from 424 Broadway to the new local agency building of the White Automobile Co. at 1330 Broadway.

The Chandler Motor Co. of Colorado, 1518 Broadway, Denver, Chandler distributor for Colorado and Wyoming, has taken the Denver agency for the Stutz.

The Headington Auto Co., 1636 Broadway, Denver, Metz, Enger and H. A. Lozier distributor for Colorado and Wyoming, has secured the distributing agency for the same territory on the Inter-State.

The Stutz Motor Sales Co.. Greeley, Col., is the name of a new Stutz distributing agency for Colorado and Wyoming, managed by C. T. Ahlstrand.

Harold Beggs, formerly of the Boss Rubber Co., Denver, has opened a local agency at Pueblo, Col., for Knight and Blackstone tires exclusively.

Omaha Trade Items—The Overland Stores have bought a large block of property in the heart of Omaha's growing business section, the deal representing $55,800 in sales and $12,000 in leases. It is planned to hold the property as an investment until the company shall decide to build.

The Briscoe Nebraska Car Co. is being organized in Omaha, with A. Koppenhaver of this city as probable president. The concern will handle the Briscoe car in this territory.

The Foshier-Enger Co., Omaha, has moved its distributing agency and salesrooms from 1122-1124 Farnam Street to more commodious quarters at 2211-2213 Farnam Street, among its old associates along Auto Row. The firm handles the Enger and Dort cars.

The C. W. Francis Auto Co., Omaha, has enlarged and remodeled its space in the building at 2218 Farnam Street and now presents one of the most attractive interiors in the city.

Northwest News—One of the most important transactions in the commercial vehicle line ever made in the Pacific Northwest was recently consummated between the Northwest Buick Co. and W. H. Barnes, factory representative of the General Motors Co., whereby the Buick company will handle the entire truck line of the G. M. C. people throughout their territory, covering the States of Oregon, Washington, Idaho, British Columbia and Alaska.

Additional space has been added to the Seattle plant of the Northwest Buick Co. and particular attention will be given to the supplying of parts, the extension of service and the general welfare of the truck owners.

Will O. McKay has resigned as manager of the Newton Foster Co., Seattle, distributor of the Paige, Saxon, National and Garford truck lines. Mr. Foster has assumed the management of the business.

The Northwest branch of the Metz Co., under the management of J. P. Scearce, is now located in its new home at 1016 Pike Street.

The selling privileges on the Chevrolet line for Portland, Ore., and Multnomah county have been acquired by the Benj. E. Boone Co.

Thirty-three new Willard service stations were established by J. P. Schiller, Jr., district supervisor of the Willard Storage Battery Co. in the Pacific Northwest. There are now forty-six Willard stations in the territory, comprising Idaho, Montana, Oregon, Washington and western Canada.

The Oakland agency of Everett, Wash., has moved to its new building on Rucker Avenue.

Barnes and Beidler of Seattle, Wash., have taken the agency for the Vim delivery truck and opened salesrooms at Broadway and Pine Street.

The Simmons Co., Kenosha, the largest manufacturer of metal beds and springs in the world, which produces a large part of the spring sets used in motor car upholstery in this country, has purchased its largest competitor, the Rudgear-Merle Co., San Francisco, at a price said to be in excess of $2,000,000. The Pacific Coast plant will be enlarged at once and $100,000 will be expended for new machinery alone. Andrew Rudgear, president of the San Francisco concern, becomes a vice-president of the Kenosha company, in charge of the western division. L. C. Lance, formerly western manager for the Simmons Company, is made treasurer of the division.

Conn. Trade News—The White Motors Co., New Haven, has opened a branch in Hartford, at 45 Gold Street, under the managership of S. A. Foster, who has represented in Hartford and surrounding territory White automobiles during the past five years. A service station will be located temporarily at 22 Chapel Street. Next autumn it is the intention of the White Motors Co. to have a complete salesroom and service station under one roof.

A real estate deal involving $39,500 was consummated at Hartford this week when the Willys-Overland Co., Toledo, acquired a tract of land at the corner of Asylum and Hurlburt streets, on which will be erected a three-story concrete and steel service station and salesroom. The building will be 90 ft. on Hurlburt Street and 130 ft. on Asylum Street. There will be two levels, that from Hurlburt Street leading to the first floor or service station and that on Asylum Street to the salesroom. The building is to be ready for occupancy July 1.

Ill. Trade Items—M. S. Steele, formerly stationed in the home offices of the Moline, Ill., Plow Co., and later resident manager of the Henney Buggy Co. and the Freeport Carriage Co., both of Freeport, Ill., has been appointed Chicago sales manager for the Stephens Six, the automobile that is now being manufactured in Freeport by the Moline Plow Co., having recently added this line to the manufacture of plows and horse propelled vehicles.

The Castendyck-Hamel Co., Elgin, has outgrown its present quarters and is remodeling the building at 326 Third Street, that city, for a modern garage. In addition to a repair and storage business the firm will maintain a sales agency and carry supplies and accessories. The new building will be ready for occupancy by June 1.

The Charles Bradley Co., Springfield, Ill., has been organized and will open a salesroom and service station at 326-328 South Sixth Street about May 15. The company will be distributors for the Cole car.

The O. A. Zarth Wire Wheel Co., Aurora, located at 99 South Water Street, is now seeking larger quarters, having just secured an order from the Cole company of Indianapolis for 100,000 sets, and many other smaller orders. The Zarth wheel has several new features, particularly the method of attaching the spokes to the rim, and the lock which holds the removable wheel to the axle. The spokes are screwed into the rim, a new departure, which is said to make the joint permanent.

The new owners of the Stover Mfg. & Engine Co., Freeport, engaged in the manufacture of tractors and farm vehicles, made a thorough inspection this week of the property which came into their possession by reorganization and consolidation. The party included directors, investors and experts engaged to outline a plan of efficiency. Following the inspection the directors met and elected the following officers: President, W. A. Hance; first vice-president, J. F. Smith; second vice-president, H. H. Antrim; secretary, J. F. Smith; assistant secretary, R. H. Hubbart; treasurer, W. A. Hance; assistant treasurer, H. H. Antrim.

The Henton-Roberts Sales Co., Decatur, has opened an agency for the Enger and Argo cars at 252 East Main Street.

The Fisk Rubber Co. opened a branch at 434 Maine Street, Quincy, this week with A. R. Forse in charge as manager. A line of general supplies will be carried in addition to tires, and a complete repair shop for tires will be operated.

H. M. Wakelin, Melvin, has purchased the C. A. Platz garage. He will enlarge the plant.

A. F. Bloomfield of Indianapolis, and L. Saazer of Milwaukee, opened an automobile and commercial car body factory in the building in Streator, Ill., formerly occupied by the Central Garage at 125 South Park Street. Suitable machinery has been installed and a specialty will be made of woodwork for all makes of pleasure and commercial cars.

The King garage, Quincy, Ill., has been opened at 215 South Fourth Street by J. B. Thomas and B. F. Thomas. These quarters are but temporary, however, as a larger building is being sought in which show rooms can be arranged. A repair shop will be operated and a complete line of supplies and accessories will be carried.

Donald S. Hubbell, Elgin, Ill., has let the contract for a fireproof garage at 162 Douglas Avenue which will be 126 by 48 and two stories in height. The Ford agency will be housed in this building and a line of supplies and accessories will be carried and a general repair business conducted.

The AUTOMOBILE

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No. 20

NEW YORK, MAY 18, 1916

Ten cents a copy
Three dollars a year

Suggestion No. 18

$10

A Special

Stewart

Speedometer

Ford—Saxon Chevrolet

This special (Magnetic) Speedometer is a necessity for every Ford, Saxon and Chevrolet car.

It insures economical operation for it is an indisputable record in securing fair tire adjustments and in keeping tab on gasoline and oil consumption.

It adds a pleasure to driving which owners of these cars appreciate and are willing to pay a fair price for.

These manufacturers are building hundreds of opportunities every day for the sale of this special Stewart at $10.

Are you overlooking a big bet?

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Illinois, U. S. A.

Vol. XXXIV . New York—Thursday, May 18, 1916—Chicago No. 20

The Automobile

Metropolitan Trophy, 150 Miles

Car	Driver	Time	M.P.H.	Prize
Maxwell	Rickenbacher	1:33:31	96 23	$6,000
Delage	Devigne	1:35:11	94 56	3,500
Hudson	Vail	1:38:44	91.0	2,000
Duesenberg	Devlin	1:43:04	87.4	1,500
Adams Special	Adams	1:51:00	81.0	1,000

Queens Cup, 50 Miles

Car	Driver	Time	M.P.H.	Prize
Peugeot	Mulford	28:45:04	101.34	$1,000
Duesenberg	Devlin	30:15:98	99.11	600
Peusun	Franchi	30:16:26	99.09	400
Delage	Limberg	31:35:30	94.5	300

Coney Island Cup, 20 Miles

Car	Driver	Time	M.P.H.	Prize
Peugeot	Aitken	11:15:8	106.71	$600
Sunbeam	Christiaens	11:26:52	104.77	350
Delage	Limberg	11:27:6	104.55	250
Maxwell	Rickenbacher	11:27:6	104.55	200
Maxwell	Henderson	11:56:17	100.50	100

Maxwell Wins Trophy

Short Events Are Won by Peugeots—Limberg Killed

By J. Edward Schipper

ONCE again America has triumphed in the arena of speed. Eddie Rickenbacher, driving his Maxwell car at a pace of over 96 m.p.h., won the Metropolitan cup classic at Sheepshead Bay against a field of the best that the world could do in speed and endurance.

Close behind the Yankee winner came Jules Devigne in a Delage, one of the products of engineering skill of France. Less than 2 min. behind the winner he had covered the cruel course at over 94 m.p.h., having fought every inch of the way in the relentless struggle.

And, most remarkable of all, a car which two short weeks ago was attached to a touring body and was acting as a demonstrator came across the line in third position, just 5 min. and 13 sec. behind the winner. This was Ira Vail in a Hudson.

Popular as was the victory of Eddie Rickenbacher in his milk-white Maxwell, it was not without a touch of sadness. Carl Limberg and his mechanician, R. Pallotti, who were leading the race at the thirtieth mile in a Delage car, were both killed almost instantly by an

Rickenbacher in his Maxwell after winning 150-mile Metropolitan Trophy

Line up of the cars for the 50-mile Queens Cup race. Aitken has the pole, with Franchi, Rickenbacher, Vail and Mulford in the front row. Behind are Devlin, Devigne, Limberg and Henderson

accident occurring on the steeply banked curve just before entering the home stretch. Limberg had led the field from the start until Eddie Rickenbacher, who eventually won, and two others passed him on the back stretch. Urging his speedy mount to a pace of over 104 m.p.h. to regain his place, Limberg took the steeply-banked curve without hesitation. Then, just as he had reached that part of the curve at which the drivers prepare to straighten out to enter the home stretch, his right rear tire blew out, causing his car to waver and strike the fence at the topmost point of the banked turn. A wrench of the steering wheel brought the car momentarily back on the track but it was out of control and immediately struck the fence again a few feet beyond, pitching both driver and mechanician out over the edge while the car itself, broken in many parts, rolled down the steep side of the saucer a mass of fractured metal, flame and dense black smoke. Death came to both men almost instantaneously.

Aitken Breaks 20-Mile Record

Two shorter events preceded the 150-mile Metropolitan Trophy race, one of 20 miles for the Coney Island cup and a list of prizes starting at $600 for first and ending at $100 for fifth. This was won at a pace which makes a new world's record. Johnnie Aitken hurled his Peugeot ten times around the 2-mile track at a speed of 106.54 m.p.h., requiring but 11 min. and 15 sec. to cover the distance. Second in this was Joseph Christiaens in the Sunbeam six who crossed the line 6 sec. behind the winner. One second behind Christiaens was Carl Limberg in the ill-fated Delage car.

The second of the shorter events was the Queens Cup, a 50-mile race in which the first prize was $1,000. Ralph Mulford broke through his streak of bad luck long enough to win this at an average speed of 104.34 m.p.h. Twenty-eight minutes and 45 sec. were needed to cover the course. Second in this event was C. F. Devlin in a Duesenberg car and third a combination of a Peugeot chassis and a Sunbeam motor known as the Peusun driven by Alde Franchi.

Perfect Day for Race

A WARM sun tempered by a breeze from the bay afforded perfect weather for the race. It was about 2 o'clock in the afternoon when the stands began to rapidly fill with spectators and by 3 o'clock when the first race started the crowd of 25,000 presented a vari-colored picture which, from a distance, looked for all the world like an animated rag carpet. The events were opened by the graceful flights of a young girl aeronaut in a biplane who entertained the vast crowd by gracefully-executed spiral dips, loops and upside down flights.

Aeroplane Flights First

Around the board ellipse she flew while the drivers were lining up their equally fast but earth-confined mounts along the starting line.

One of the brushes in the Metropolitan Trophy race. Rickenbacher is taking the lead, passing Vail and Mulford just behind. Franchi and Aitken following close to the pole

Position by Lap of Each Car and Driver in the 150-Mile Race for the Metropolita

Car	Driver	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Maxwell	Rickenbacher	3	5	5	5	5	5	5	5	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Delage	Devigne	2	2	4	4	3	4	4	4	3	3	3	3	3	3	3	4	4	3	3	3	3	4	4	3	3	4	4	4	4	4	4
Hudson	Vail	7	8	8	8	9	8	8	8	7	8	8	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	5	5	5	5	5
Duesenberg	Devlin	4	3	6	6	6	6	6	6	5	5	5	5	5	5	4	3	3	4	4	4	4	3	3	4	4	3	3	3	3	3	3
Adams	Adams	8	9	9	9	9	9	9	9	8	7	7	8	8	8	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	3
J.J.R. Special	Watson	10	10	10	10	10	10	10	10	9	9	9	9	9	9	8	8	8	8	8	8	8	8	8	8	8	8	7	7	7	7	7
Peugeot	Resta	5	4	2	3	4	3	3	2	1	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Peusun	Franchi	9	7	7	7	7	7	7	7	6	6	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5	5	out				
Delage	Limberg	1	1	1	1	1	1	1	3	2	1	1	1	1	1	out																
Peugeot	Mulford	6	6	3	2	2	2	2	1	out																						

In the second lap of the Metropolitan Trophy race with Rickenbacher, Franchi and Watson followed by Lewis, Mulford and Limberg

Start of the 150-mile race with J. J. R. Special, Limberg's Delage, Devigne, Mulford and Rickenbacher in the front row and Franchi, Devlin, Adams, Vail and Resta behind

It was just 3 o'clock, lacking 2 min., when Fred Wagner started the thirteen entries around the track for a rolling start in the 20-mile event. Even then, the superstitious were shaking their heads as they counted the cars lined up across the track, but all superstition vanished in the whirling excitement as the cars flashed away on the 20-mile sprint. A 108-mile pace was immediately set up as Mulford's Peugeot took the lead in the first lap. Aitken, his team mate, was close behind followed by Rickenbacher in the Maxwell, then Devigne in the Delage, Limberg in another Delage and the hybrid Peusun with Franchi in sixth place. Christiaens' Sunbeam trailed along in seventh position.

Almost before the spectators had time to note the relative positions of the cars they were around again with Mulford still in the lead trailed by his team mate Aitken. These two were 300 yd. in advance of a group of five cars made up of Rickenbacher's Maxwell, Limberg's Delage, Devigne's Delage, Christiaens' Sunbeam which was now in sixth place having passed the Peusun which was seventh.

The third lap saw the two Peugeots with Mulford and Aitken an eighth lap ahead. Third place was still being held by Rickenbacher in the Maxwell and fourth place by Christiaens in the Sunbeam who had forged ahead of Limberg's Delage and Devigne's Delage. In the fourth lap Mulford and Aitken were increasing their lead, they were now almost a quarter lap before a group of three cars consisting of Limberg's Delage, Christiaens' Sunbeam and Rickenbacher's Maxwell. The other cars were trailing.

On the fifth lap the two leading Peugeots lapped the Adams Special directly in front of the stand. The group of three pursuers were still one-quarter lap behind the leaders with Christiaens in his Sunbeam back in fifth position. Thus they spun around the saucer, with the two Peugeots flying like hawks in advance of the field, followed a quarter lap behind by the group of three cars until in the seventh lap Christiaens began to creep up on the two flying Peugeots bringing his car into third position.

It was at this point that the break in the race came. Mulford had to stop for a tire and when, after making a quick change, he sought to again enter the race, his engine could

Trophy Held on the Sheepshead Bay Motor Speedway, Saturday, May 13

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1
4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3
3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	6	6	6	6	6	6	7	7	7	7	6	6	6	6	6	6	6	6	6	6	6	6	6	out			
1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	out																

Times of the Cars and Drivers at Various Periods in the 150-Mile Race for the Metropolitan Trophy

Time for distance expressed in miles

Car	Driver	2	4	6	8	10	20	40	60	80	100	120	140	150
Maxwell	Rickenbecher	1:20	2:31	3:41	4:49	6:00	11:47	23:34	35:36	47:41	1:2:12	1:14:45	1:27:14	1:33:31
Dalege	Devigne	1:19	2:30	3:41	4:50	5:59	11:46	24:28	38:32	50:34	1:2:38	1:14:40	1:29:16	1:35:11
Hudson	Veil	1:26	2:45	4:20	5:22	6:42	13:15	30:20	39:33	52:46	1:5:55	1:19:40	1:32:18	1:38:44
Duesenberg	Devlin	1:20	2:31	3:42	4:52	6:50	12:12	24:29	36:36	51:70	1:3:23	1:15:50	1:31:20	1:43:03
Adems	Ademe	1:28	2:48	4:50	5:22	6:41	13:15	29:26	40:00	54:52	1:10:08	1:25:40	1:42:32	1:51:00
J.J.R	Wetson	1:31	2:59	4:26	5:53	7:21	14:34	25:58	40:70	54:26	1:11:32	1:35:12	1:51:10	flagged
Peugeot	Reste	1:21	2:31	3:40	4:50	5:59	11:45	23:34	35:36	49:20	1:01:58	1:10:56	time for 58	laps retired
Peusun	Frenchi	1:30	2:44	4:20	5:21	6:41	12:50	25:27	33:31	time for 25	laps retired			
Delega	Limberg	1:19	2:29	3:38	4:47	5:56	11:45	16:21	time for 14	laps retired				
Peugeot	Mulford	1:22	2:32	3:40	4:49	5:58	*10:51							

*Time for ninth lap; stopped and retired.

not be started. Glancing beneath his car a pool of gasoline could be seen and examination showed that a bolt had fallen from the carbureter, rendering necessary many precious seconds before it could be repaired. With this race a short sprint of 20 miles, it was hopeless for Mulford to go back, so he saved his car and strength for the next race. This left Aitken in the lead with Christiaens second and Limberg third followed by Rickenbacher in the Maxwell. These positions were held until the end.

Had the race lasted another lap it is doubtful if Christiaens could have finished. His engine faltered even as he crossed the finishing line and as he drew up in front of his pit he turned his car over to his attendants with a shake of the head signifying the doubt that was in his heart. Examination showed that the pulley wheel mounted on the end of the camshaft intended to drive the dash tachometer had broken through the housing and allowed oil to escape from the crankcase. This in turn caused seized bearings, which ended the activities of the Sunbeam car for the day.

Chandler Out on First Lap

Bill Chandler in the Crawford Special was another one whose ill fortunes came early. Chandler completed just one lap in the first event and was no longer a factor in the day's program. A piston seized and broken at the very start ended all the activities of this favorite of the speed world until he pilots his mount in the events at Indianapolis.

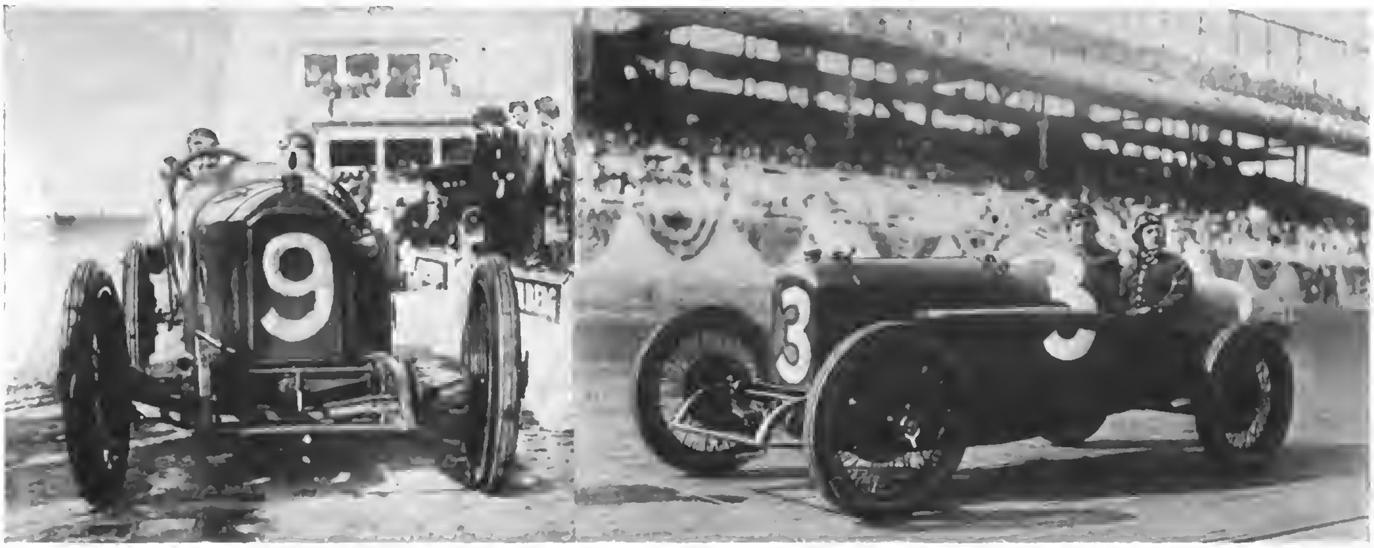
Above—Rickenbacher's Maxwell, which won the 150-mile race. Below—Vail's Hudson, which finished third in that race without making a single stop at the pits

Queens Cup Race 50 Miles

IN the interval between the 20-mile race and the Queens Cup, Katharine Stinson, a bundle of feminine courage of 20 years, entertained the spectators with some brilliant flying in a biplane. With two thin trails of smoke flying from the outer extremities of the wings of her air machine Miss Stinson drew figures of spirals and loops across the sky over the Sheepshead track.

Nine cars lined up before the judges' stand for the 50-mile event. This was started in the same way as the shorter race with a rolling start and all realized that the distance meant another sprint with better than 100 m.p.h. average to win. As the cars burst across the starting line Aitken's Peugeot, which had shown itself the fastest in the shorter race, again leaped forward to claim first honors, and at the end of the first lap the numbers 3 and 9 held respectively by Aitken and Mulford repeated the feat of holding the lead. The end of the first lap found Aitken and Mulford just ahead of Limberg in his Delage and Rickenbacher in the Maxwell. The next lap was covered in the same order with Henderson's Maxwell fifth, Devlin's Duesenberg sixth and Devigne's Delage seventh. Trailing behind were Franchi in the Peusun and Ira Vail in the Hudson. So close were the leaders to each other that the guidon of speed passed from hand to hand with Limberg in the Delage ahead at the end of the third lap. Aitken's Peugeot was now second with Mulford close behind in third position and Rickenbacher fourth.

The three leaders with their Nos. 6, 3 and 9 kept running around the track as regularly as clockwork through the interval between the third and thirteenth laps. The struggle for fourth place between Devlin in the Duesenberg and Devigne in the French Delage was keen until in the fifteenth lap when Mulford's Peugeot flashed to the front with Aitken in second place and Devigne's Delage in third, Devlin in the Duesenberg lodged himself safely in fourth place. Mulford



Left—Ralph Mulford in his Peugeot, which won the 50-mile Queens Cup race. Right—John Aitken's Peugeot, which won the 20-mile race in world's record time

was never again passed. Devlin crept up gradually holding third until the twentieth lap when he was passed by Franchi in the Peusun who had fought his way gamely all the way up from eighth place which he held in the second lap. The breaking point came for second place in the twenty-first lap when Aitken's Peugeot had to drop out with a burned-out bearing. Devigne's Delage which had been running fifth went out for good immediately afterwards for a second tire change which he realized destroyed his chances of finishing in the money. The four to finish were Mulford in the Peugeot first; Devlin, Duesenberg, second; Franchi, Peusun, third; Limberg, Delage, fourth.

Position Table of the 20-Mile Race for the Coney Island Cup

Car	Driver	1	2	3	4	5	6	7	8	9	10
Peugeot	Aitken	2	2	2	2	2	2	2	1	1	1
Sunbeam	Christiens	8	7	5	4	5	5	3	3	2	2
Delage	Limberg	5	4	3	3	3	3	4	4	3	3
Maxwell	Rickenbacher	3	3	4	5	4	4	5	5	4	4
Maxwell	Henderson	9	8	8	9	8	7	7	7	6	5
Delage	Devigne	4	5	6	6	6	6	6	6	5	6
Duesenberg	Devlin	6	9	9	7	7	8	8	8	7	7
Peusun	Franchi	7	6	7	8	9	9	9	9	8	8
Crawford	Lewis	10	10	10	10	10	10	10	10	9	9
Hudson	Vail	11	11	11	11	11	11	11	11	11	
Peugeot	Mulford	1	1	1	1	1	1	1	2	out	
Adams	Adams	12	12	12	12	12	out				
Crawford	Chandler	16	out								

Metropolitan Trophy Race—150 Miles

WITH the two short events over, the great crowd settled back with an air of expectancy to await the crowning affair of the day. This was to be a race of 150 miles for the Metropolitan trophy and a total of $15,000 in prize money. The winner was to secure $6,000 in cash with $3,500 for second place, $2,000 for third and graduated amounts down to $400 for seventh.

There were ten starters in this main event. Like greyhounds straining at their leashes as if it were with difficulty that they could be restrained from starting on their arrow-like whirl, they awaited the starter's word. Just shortly after 4 o'clock they were sent on their way for a flying start and crossed the line with a roar as they steadily gathered speed in a determined dash for a complete century and half another.

The slower of the cars had maximum speeds of close to 95 m.p.h. The fastest had speeds which none could tell as even the daring drivers hesitated to trust the masses of superfine steel to the powerful impulses which could thrust them forward at 120 m.p.h.

Every driver knew the race his car could run, and each was prepared to secure from it the best that was possible. The slower cars relied upon the destruction of metal and rubber that would accompany the speed of the high-strung pacemakers while the fast cars struck a pace which they knew would safely win if it could be sustained for the dis-

Position Table for Each Lap of the Race for the 50-Mile Queens Cup

Car	Driver	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Peugeot	Mulford	2	2	3	3	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1	1	1	1	1	1	1
Duesenberg	Devlin	8	7	6	4	4	5	4	4	5	5	5	4	5	5	4	3	3	3	3	3	4	2	2	2	2
Peusun	Franchi	7	8	8	8	7	7	7	6	7	7	7	6	6	6	6	5	4	4	4	4	3	3	3	3	3
Delage	Limberg	4	3	1	1	1	1	1	1	1	1	1	1	1	2	7	7	7	6	6	6	6	4	4	4	4
Delage	Devigne	6	6	7	6	5	4	5	5	4	4	4	5	4	4	3	4	6	7	7	7	6	5	out		
Peugeot	Aitken	1	1	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	out			
Maxwell	Henderson	5	5	5	5	6	6	6	7	6	6	6	7	7	7	5	6	5	5	5	out					
Maxwell	Rickenbacker	3	4	4	9	9	9	8	out																	
Hudson	Vail	9	9	9	7	8	8	out																		

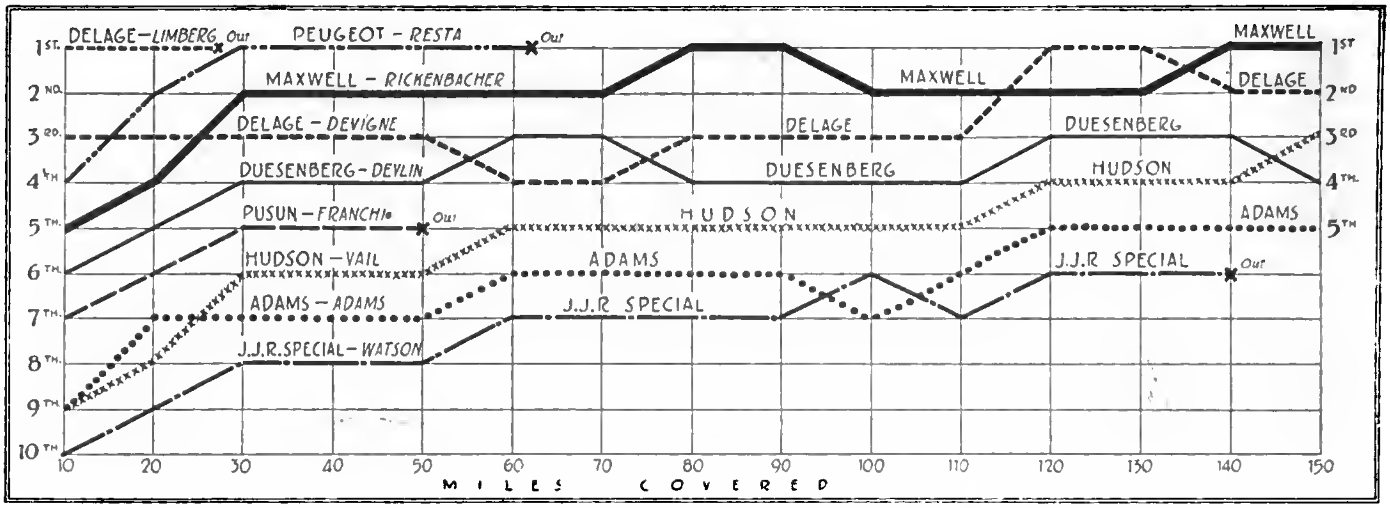


Chart showing the changes in the relative positions of each car in the 150-mile Metropolitan Trophy Race

tance. It was a compromise with them between speed and material with the nerve of the driver and ability to hold his mount in control, taken for granted.

First to seize the lead in this event was Limberg in the Delage. The end of the first lap found him opening his space between the tail of his flying Delage and the radiator of Devigne in another car of the same make. Rickenbacher's Maxwell was third and Devlin's Duesenberg fourth.

Hot Pace Begins to Tell

Immediately the pace began to tell, and shifting positions among the leaders occurred. Limberg's Delage, however, was ever to the fore closely followed in the third lap by Resta and Mulford in their Peugeots. These cars set the pace. Close together they remained with Devigne in his Delage always struggling to be among the first three. He held this cherished position in the fifth lap but lost it again in the sixth and the order maintained until the end of the seventh lap was, with this momentary exception, Limberg, Mulford, Resta, Devlin and Rickenbacher. At the eighth round the two flying Peugeots nosed ahead of Limberg's Delage putting him into third place, but here the hot pace had its first telling effect when Mulford was forced to abandon the race with a broken piston head.

This left Resta in the lead in the ninth lap with Limberg second; Devigne, third; Rickenbacher, fourth; Devlin, fifth; Franchi, sixth, with Vail in the Hudson, Adams in the Adams Special and Watson in the J. J. R. trailing behind as seventh, eighth and ninth.

Resta's lead lasted but one lap as it was snatched away from him again by Limberg in the Delage. The Delages were proving to be fast as Devigne in his car was a close third and between these two French cars a hot pace was set. In the thirteenth lap a group of five cars was in the lead, the order being, Limberg, Resta, Devigne, Rickenbacher and Franchi. These were fully a half lap in front of the field and running at a speed which caused the spectators to prophesy well over 100 m.p.h. for the winner.

Limberg's lead was hotly contested. Resta, Devigne and Rickenbacher, closely pursuing, caught him on the back stretch after he had completed his fourteenth lap and then ensued one of the fastest sprints of the event. Danger was forgotten. None of the contestants thought of anything but the struggle for supremacy in the strife of speed. None would be first to obey the cry of caution to release to some slight degree the pressure of the foot on the accelerator pedal. Never did the gladiators of Rome battle better.

Up to this time there had been two stops at the pits, one on the ninth lap when Mulford was forced to abandon the race and one on the twelfth when the Adams Special had to change a right rear tire. Like meteors the speeding leaders were flying about the inverted dome but their positions varied from time to time as they fought for the key position. Limberg's gallant driving had won him a host of admirers and every time he passed the crowded stands he received a round of well-earned applause. But after he had passed his fourteenth lap and was soaring far up on the banked turn to enter the home stretch, the accident occurred which brought a chill to the hearts of the spectators and even caused the steel-nerved drivers to ease their pace until the average dropped below the hundred mark.

Resta Takes the Lead

With Limberg no longer in the race the burden of leadership passed to Resta, who held it in the teeth of the worrying pack of steel hounds who pursued him with unrelenting energy through many a weary mile between the fifteenth and thirty-fifth laps. All this time Rickenbacher in the Maxwell was in second place. A struggle for third and fourth was going on between Devigne and Devlin with Devigne holding third position in the twenty-fourth and twenty-fifth laps, Devlin holding it from the twenty-sixth to the thirty-seventh and then with third honors pass-

Whirlwind finish in the fight for second place in the 20-mile Coney Island Cup race. Christiaens crossed the line just ahead of Limberg and Rickenbacher

The new scoreboard, which is much more legible than the one used last Fall

ing to Devigne again until the fifty-eighth lap when he crawled into second place when Resta was forced to drop out and Rickenbacher took the lead.

Vail in his Hudson climbed into third place, beating out Devlin's Duesenberg in the seventy-first lap. Up to this time he had been running fourth with Devlin third. Fifth place was taken by Adams in the Adams Special which had run a consistent race throughout. Both the Hudson and the Adams while not so fast as Resta's Peugeot and the other speed creations had proved the value of the great increased factor of safety due to maintaining a steady but not excessive speed. Standing before the pits were the line of cars which had suffered in the grind and each one has meant a lesson which is far broader than the loss of a prize and which should be interpreted into invaluable stepping stones in the advancement of the art. Each broken car should prove a foundation for greater reliability and the lessons learned in this race will not only have their effects on the speed paths throughout the country this year but should also leave their imprint on the family stock car.

Handicap Race Postponed

A 10-mile handicap consolation race was scheduled to take place after the 150-mile Metropolitan trophy event. This was postponed indefinitely, however, out of respect for the death of Limberg and Pallotti. It is doubtful if it could have been run anyway, as darkness was beginning to spread over the track and the crowd was already leaving.

One of the features of the opening of the track for the 1916 season which was a great improvement over last fall is the new electrically-operated scoreboard. This was four or five times larger than the one used last year and could be read from the grandstand. It was a double-faced design so that the people in the bleachers on the back stretch could also read it. The scoreboard used during the 1915 season was blown down by the heavy gales during the winter. The new one has been placed in the center of the great ellipse.

It was only due to the skillful handling of their cars by some of the other drivers that other accidents did not follow that in which Limberg lost his life. The ambulance surgeon who reached Limberg's car which was then in flames at the bottom of the incline surmised that the occupants had been thrown over the edge when he saw that the burning car was empty. One of those who had reached the scene with the ambulance made a dash up the side of the track and reached the top, but the ambulance surgeon failed to acquire enough momentum to carry himself to the top and started to slip backward in the path of the oncoming cars. He was rescued from his precarious position by being pulled up by the man who had preceded him. Another physician in the meantime had rushed out of the grandstand where he was occupying a place as a spectator, and jumping into his car, had driven around to the outside of the track where the accident had occurred. He was the first to reach the body of Limberg and found the mechanician still breathing. Pallotti died in the ambulance on the way to the hospital.

Devigne was 50 ft. behind Limberg when the accident occurred and swung down the track to avoid the wreck. He spun around three times on the concrete level before he succeeded in regaining control of his car.

Technical Details and Equipment of the Cars Taking Part in the Opening Program at the Sheepshead Bay Motor Speedway, May 13

Car	Driver	Mechanic	Cyl.	Bore	Stroke	Displ.	Carb.	Mag.	Plugs	No.	Pistons	Valve		Oil	Wheels	TIRES		Wheelbase	Shocks	Motometer
																Make	Size			
Delage	Limberg	Palletti	4	94	160	274	Claudel	Mea	KLG	4	Steel	Steel	16	Oilsum	Rudge	Silvert	34x4½	106	Htfd.	Yes
Delage	Lecain	Moera	4	94	160	274	Zenith	Bosch	KLG	4	Magnlum	Steel	16	Oilsum	Rudge	Silvert	34x4½	106	Htfd.	Yes
Delage	Devigne	Bellecchi	4	94	160	274	Claudel	Mea	KLG	4	Steel	Steel	16	Oilsum	Rudge	Silvert	34x4½	106	Htfd.	Yes
Peusun	Franchi	Ambrosee	4	94	160	274	Zenith	Bosch	KLG	4	Steel	Steel	16	Oilsum	Rudge	Silvert	34x4½	106	Htfd.	
Duesenberg	Devlin	Nawgard	4	3¾	6¾	298.2	Miller	Bosch	Rajah	8	Magnlum	Tung	16	Oilsum	Rudge	Silvert	32x4½	106	Htfd.	Yes
Peugeot	Mulford	Stavens	4	3.6	6.6	274	Zenith	Bosch	Rajah	4	Magnlum	Tung	16	Oilsum	Rudge	Silvert	34x4½	106	Htfd.	Yes
Peugeot	Resta	Dahnka	4	3.6	6.6	274	Zenith	Bosch	KLG	4	Magnlum	Tung	16	Oilsum	Rudge	Silvert	34x4½**	106	Htfd.	Yes
Peugeot	Aitken	Becker	4	3.6	6.6	274	Zenith	Bosch	KLG	4	Steel	Steel	16	Oilsum	Rudge	Silvert	34x4½	106	Htfd.	Yes
Maxwell	Rickenbacher	Latta	4	3¾	6¾	298.2	Miller	Bosch	Rajah	4	Magnlum	Tung	16	Oilsum	Houk	Silvert	34x4½	106	Htfd.	Yes
Maxwell	Handersen	Clipping	4	3¾	6¾	298.2	Miller	Bosch	KLG	4	Magnlum	Tung	16	Oilsum	Houk	Silvert	34x4½	106	Htfd.	Yes
J. J. R.	Watson	Kintsch	4	3 15/16	6	299	H. & N.	Bosch	Bosch	8	Magnlum	Tung	8	Mobiloil	Rudge	Silvert	33x4½	101	Htfd.	Yes
Adams Spec	Adams	Edwards	4	3¾	6¾	298.2	Master	Bosch	Rajah	8	Magnlum	Tung	16	Mobiloil	Rudge	Ther	34x4½	100	Htfd.	Yes
Crawford Spec	Chandler	Johnson	4	3¾	6¾	298.8	Zenith	Bosch	Rajah	8	Magnlum	Tung	16	Oilsum	Rudge	Silvert	33x4½	106	Htfd.	Yes
Crawfard Spec.	Lewis	Alaxander	4	3¾	6¾	298.8	Miller	Bosch	Rajah	8	Magnlum	Tung	16	Oilsum	Rudge	Silvert	33x4½	106	Htfd.	Yes
Erwin Forty	G. Bergdoll	H. Muller	4	4	5 15/16	298	Master	Bosch	Rajah	8	Magnlum	Tung	8	Mob-l B.	Rudge	Silvert	32x4½*	108	Htfd.	Yes
Erwin Forty	Stecher	Furray	4	4	5 15/16	298	Master	Bosch	Rajah	8	Magnlum	Tung	8	Mob-l B.	Rudge	Silvert	32x4½*	108	Htfd.	Yes
Sunbeam	Christiaans	Christiaans	6	81½	156	294	Claudel	Bosch	KLG	6	Aluminum	Steel	24	Oilsum	Rudge	Silvert	35x5	113	Htfd.	
Hudson	Vail	Suederman	6	3½	5	288	Hudson	Delco	Rajah	6	Iron	Tung	12	Veedol	Rudge	Silvert	34x4½	104¾	Htfd.	Yes

*33x5 tires rear **35x5 tires rear

Left—J. J. R. Special changing a tire at the pits. Right—Stevens trimming Mulford's tire in the intermission between races

Pit Work Shows Poor Preparation

Nine Tire Stops and Eleven Mechanical—Eight Cars Drop Out at Pits for Permanent Trouble

Tabulation of Stops at Pits

20-Mile Event

Car	Driver	Lap No.	Time of Stop	Cause of Stop
Crawford Sp.	Chandler	1	Out	Piston seized and broken.
Adams Spec.	Adams	6	Out	Stripped driving splines on right axle shaft.
Peugeot	Mulford	7	Out	Connection between carbureter float chamber and mixing chamber broken.

50-Mile Event

Car	Driver	Lap No.	Time of Stop	Cause of Stop
Maxwell	Rickenbacher	7	20 sec.	Change right rear tire.
Maxwell	Rickenbacher	8	Out	Broken oil lead.
Delage	Limberg	12	30 sec.	Changed left rear tire.
Delage	Devigne	17	1:14	Changed right front tire.
Peugeot	Aitken	21	Out	Burned bearing.
Maxwell	Henderson	21	Out	Oil trouble, seized piston.
Delage	Devigne	22	1:	Changed right rear tire.

150-Mile Event

Car	Driver	Lap No.	Time of Stop	Cause of Stop
Peugeot	Mulford		Out	Piston head broken.
Adams Spec	Adams		1:	Changed right rear tire.
Peusuo	Franchi		Out	Broken connecting-rod.
Delage	Devigne		:40	Changed left rear tire.
J.J.R. Sp	Watsoo		1:20	Gasoline and oil.
Peugeot	Resta		1:	Changed right rear tire.
Maxwell	Rickenhacher		1:55	No. 4 ignition cable broken.
Peugeot	Resta		Out	Cracked cylinder.
J.J.R. Sp	Watson		:30	Misfiring, inspected ignition.
Delage	Devigoc		2:	Right front tire, engine on fire.
J.J.R. Sp	Watson		1:31	Right rear tire, inspected ignition.

IF short races give more excitement to the spectators, they certainly make a pit stop strike a very stirring chord on the heartstrings of the drivers and mechanics. In the 20- and 50-mile events a stop at the pit was a sacrifice of place. Three stops were made during the 20-mile event and as the drivers glanced around they saw that this meant withdrawal and none of them re-entered.

During the course of the afternoon there were twenty stops altogether, and eight of these were permanent. Nine stops were made for tires, four in the 50-mile event and five in the 150-mile. The remainder were mechanical troubles and of these only three were of a sufficiently trifling nature to allow the contestant to go on with the race, the others being so serious that this was impossible.

Looking at the pit work from the standpoint of efficiency, it was far below par. The importance of well-drilled pit crews seemed to be but little realized and the result was that in many instances there was considerable bungling of important jobs and consequent loss of time. An example of this was shown in an instance of a tire change. It seems almost foolish to say that a pit crew should be well drilled in making tire changes and yet an instance where considerable time was lost because one of the pit hands endeavored to take a wheel off by turning the retaining nut in the wrong direction is only one of the cases where time was lost. After he had thoroughly jammed the threads it was only with the greatest difficulty that the nut was spun off at all.

Resta's Cylinder Cracked

Another instance was when Resta stopped to change his spark plugs. It happened that the real cause of this trouble was a cracked cylinder and eventually he found that he could not go on. But at any rate after the plugs had been changed and he was again in his seat he found that although he had signalled for water the pit attendants had waited until he was all through changing plugs before they removed the radiator cap.

Going over the list of troubles as indicated by pit stops, it appears that lubricating difficulties are still too numerous. The light pistons and high speeds have rendered the oil film a very important part of the car's bill of health. The very first car out which was on the first lap of the first event was troubled with a seized piston. A broken oil lead put Rickenbacher's car out in the 50-mile event and Henderson's Maxwell went out with a seized piston due to oil trouble in the same race. In all probability Mulford's Peugeot which went out in the ninth lap in the 150-mile event after having won the previous race was troubled with this identical weakness.

Chandler Out at Start

In the first race Bill Chandler after making one lap had to withdraw his Crawford Special on account of a seized and broken piston. The Adams special went out in the sixth lap on account of stripping the driving splines in the right rear axle shaft and Mulford had to stop because a screw entering the nozzle passage of the carbureter became loose.

In the second, or 50-mile event, the first pit stop came when Rickenbacher brought his car in for the quickest tire change of the day. He was off in 20 sec. with a new right rear wheel. In his next lap, however, a broken oil lead forced him to stop until the next race.

Devigne's Delage took fire at the pits while changing a tire but the extinguisher brigade made short work of the blaze

In the twelfth lap Limberg changed a left rear tire in 30 sec. Devigne changed a right front in the seventeenth in 1 min. Henderson's Maxwell went out with oil trouble in the twenty-first lap and Devigne again changed the tire, this time a right rear in the twenty-second lap. The change occupied 1 min.

Mulford's Peugeot Breaks Piston

In the 150-mile race nine laps were covered before the first car stopped at the pits. Mulford's Peugeot then came limping in with a broken piston head which ended his participation for the day. In the twelfth lap the Adams special changed a right rear tire in 1 min. and no further stops were made until the twenty-fifth when the Peusun car, a combination of Peugeot chassis and Sunbeam motor, went out with a broken rod. In the twenty-sixth lap Devigne's Delage made a tire change in 40 sec. and in the twenty-eighth the J. J. R., with Watson driving, had to stop for gasoline and oil. This was the only stop of the day in which more fuel or lubricant was taken aboard.

A steady grind ensued after the twenty-eighth lap until the fifty-sixth was reached. Here Resta in the Peugeot changed a right rear tire, the shift of wheels occupying an interval of 1 min. A broken ignition cable connecting the distributor with the No. 4 spark plug held out Rickenbacher in the Maxwell for 1 min. and 55 sec. in his fifty-eighth lap. In Resta's fifty-eighth lap the broken cylinder occurred. When he first stopped he thought only a change of plugs was necessary, but after starting, a gush of water down the exterior of the motor showed that he was out for good.

The J. J. R. special paused for 30 sec. to inspect the ignition in the sixtieth lap and seven laps later a tire change was made on the right rear and another inspection of the ignition. In the sixty-sixth lap Devigne's Delage took fire but this was extinguished without lifting the hood by the busy Pyrene squad, whose energy on this occasion boded ill for any conflagration within reach of their streams.

Limberg Killed in Metropolitan Event

THE accident during the Metropolitan Trophy race to Carl Limberg was the first that has occurred during a contest at the Sheepshead Bay track, although Harry Grant was burned and fatally injured in his car last year. Carl Limberg was born in the West but came East in 1907, when he was very active as a bicycle rider. He attained prominence in the bicycle world while riding in six-day events and was paired in Madison Square Garden in 1904 with Hardy Downing.

Carl Limberg and his mechanician, Roxie A. Pallotti, just before the start of the 150-mile race

With Downing as partner and also with Burton Downing, a brother of Hardy's, Limberg took part in many of the bicycle races. As a member of the Chalmers team he won the American road championship and his knowledge of track work as picked up in the bicycle field stood him in good stead.

Limberg was married and since his wedding has lived in this city. His last place of residence was at the Woodstock Hotel on Forty-third Street. Although quite young in appearance he was about thirty-two years old, and it was quite difficult to believe from his youthful countenance that he had been in the cycling and automobile fields for nearly a score of years.

For several years Limberg was a team mate of Harry Grant, who, as stated, was fatally burned on the same track. He drove a Haupt-Rockwell in the 1910 Vanderbilt and an Abbott in the 1911 Vanderbilt and Grand Prix races. He raced with Grant in the 1915 Indianapolis and Chicago races, and in the Astor cup race last fall he finished in sixth place. After this event he was sent to France by H. S. Harkness, by whom he was employed, and who holds the office of president of the Sheepshead Bay Speedway Corp. At this time Limberg brought back three new cars, in one of which he was killed.

Roxie A. Pallotti, Limberg's mechanician, who was also killed in the fatal accident, was a native of Italy. He received his early training in the automobile business in that country and had been employed in various automobile factories in Europe and America.

Italian Car Factories Speeding Up

Plant Extensions Are the Order of the Day—Aeroplanes Increase Car and Truck Makers' Work—All Workers Placed Under Military Discipline

TURIN, ITALY, April 2.—Extensions are the rule among Italian automobile factories, and in every shop speeding up is being attempted. The factories are supplying all their own army's requirements and are shipping considerably to France. No foreign trucks or touring cars are being imported into Italy. Shipments to England appear to have fallen off, the best Italian customer now being France. In taking as many Italian trucks as possible, in preference to American, the French authorities avoid freight difficulties and the attendant high cost, and also have the advantage of a favorable monetary rate of exchange. The exchange between France and Italy is about 10 per cent in favor of the former country, while between France and America it is 20 per cent in favor of the latter country. It is claimed that practically all the trucks attached to the Verdun army have been supplied by Fiat. This army of 250,000 men is entirely dependent on automobile traction for its food, ammunition and general transportation. The position here is such that the Germans have been able to bombard all the railroad lines a considerable distance in the rear of the French, making it necessary for everything to be brought up by road. This appears to be the only case along the whole battle front of France in which complete dependence has had to be placed on automobiles. The manner in which the French have been able to hold in check the most formidable attempts of the German army to break through is proof that automobile traction has been equal to the task imposed upon it.

Aeroplanes Increase Work

Increased work has been thrown on the Italian automobile factories by the extension of the aeroplane service. After hesitating a long time between the airship and the aeroplane, and being the victims of interested partisans, the Italian authorities, like those of France and England, have decided definitely in favor of the heavier than air type. A well defined program is in course of execution, and its completion will place Italy in the front rank. In aeroplane design the Italians are receiving all their inspiration from France, every leading French army type of machine being built under license in Italy. The Italians are more independent as regards motors, and although the same general lines are being followed as in France, the design is entirely Italian. All the Italian automobile factories are actively producing aeroplane engines, and in addition the Italian Gnome and Rhone Company is producing rotaries. As in France, the Rhone motor appears to be preferred to the Gnome. This company was established in 1912 with less than a score of workpeople, and now has several hundreds and is still extending. Quite recently the Gnome people of Paris sold out the greater portion of their holdings in the Italian branch to a French group in which the Darracq automobile company predominates. The Seguin Brothers who founded the Gnome company in France, retain all their interests in the parent company, and in the Rhone concern which has been incorporated with it. There is a decided move toward motors of 200 to 300 hp., these of course all being of the fixed-cylinder water-cooled type. This same tendency is observable in other European armies.

Despite the war, experimental work is being carried out in most of the factories and new models are being prepared, although the number of cars built for private use is decidedly small. The small high-speed twelve-cylinder motor—a motor of not more than 2½ in. bore and running at 3000 r.p.m.—is receiving attention; also work is being done on small four-cylinder models, corresponding roughly to the cheaper American types but having a more elaborate finish than is usually found on cars of the less than $1,000 class.

Italy Independent of Outside Supplies

Italy appears to be fairly independent of outside supplies except of magnetos and tires, both of which are being imported from America. The result of the war has been to make the factories more independent. Fiat for instance, is now producing all electric equipment for its own cars—lighting and starting sets—and will, it is declared, build magnetos also within a very short time. As this factory is doubtless the largest in Europe, the move is of no small importance.

Italian, French and English automobile manufacturers intend to be independent of Germany for magneto supplies, and also, if possible, to be self-supplying in this matter. This independence has not yet been reached, for American magnetos are still selling freely. Recently a French commission agent received intimation from New York that 1000 magnetos could be shipped immediately. A communication was sent to the five leading French automobile factories, and in a few hours the lot of 1000 had been sold and application made for 3000 more.

Italy is very little disturbed by England's decision to forbid the importation of touring cars for private use. The volume of this business has been small, there are considerable difficulties in shipping, and the home army can absorb all that the factories can produce. France appears to be equally indifferent, for it is freely admitted that the production of private cars is not as profitable as the manufacture of shells and other war material. The net result will be that a number of Italian and French agents in London will close their showrooms.

All Under Military Discipline

All workers in Italian factories are now under military discipline. This applies not only to men who are eligible for active service in the field and who have been placed in the factories instead, but to those whose classes have not yet been called up for active service. The former are identified by a tricolor armlet, which must always be worn, and the latter have a special army badge in their buttonholes. Failure to report at work, or even late arrival, is punished immediately, and a second or third offence is liable to entail imprisonment. All strangers are kept away from the factories.

The normal working day is 10 hr., but most men do 2 hr. a day overtime, making a working day of 12 hr. All factories are running two shifts. On Sundays factories run half days. Some time ago the workers in the automobile and general engineering factories secured Saturday afternoon half holiday, as in England, but this has been abolished by order of the military authorities. One of the leading factories is endeavoring to enforce more stringent laws than are stipulated by the military authorities, and has given instructions that work must be carried on all day Sunday and on all holidays. From the standpoint of the manufacturer this is a move of very doubtful intelligence, it having been clearly proved elsewhere that if exerted beyond a certain degree labor goes stale and production falls off.

This attempt to enforce 360 working days a year is arousing the opposition of the working classes. In the socialistic press vigorous attacks are being made on the individuals directly responsible for the new conditions. There is no reason to believe that this move will become serious, for the spirit of the people is right; nevertheless there is plenty of material for the agitators, and when protesting against the attempt to speed up they do not forget to mention that last year the Fiat company earned more than $3,000,000, after paying big fees to the directors.

Gasoline now costs three times more than before the war. Italy is, of course, shut off from European supplies and must import exclusively from America, paying high freights and insurance. The army authorities get all the gas they require for automobile and aeroplane services, but it is not always an easy matter for the private owner to get enough to keep a car in commission. There are no restrictions on the use of cars outside the army zone, and no attempts to artificially control the gasoline supply. Within the interior of Italy motorists can move about as freely as in peace times, provided they can get supplies of gas; but toward the frontiers very stringent regulations are in force. This applies not only to the Austrian frontier, where fighting is in progress, but to the French frontier and particularly to that of Switzerland. Unless a special pass has been obtained, these zones cannot be approached in an automobile, the military restrictions being rigidly enforced in every particular.

New Scripps-Booth Four-Passenger Eight Has Sociability Seating

New Scripps-Booth four-passenger eight-cylinder model, showing seating arrangements

ALTHOUGH description and details of the new Scripps-Booth four-passenger, eight-cylinder model were given in a recent issue, actual photographs of the new car are just available, and reveal the fact that the latest creation lives up to the body standard already set by the earlier Scripps-Booth design.

The seating arrangement is what might be termed the sociability type, in which entrance to the rear compartment is effected through a 7-in. passage between the individual front seats, there being only two doors to the body. The same general curve and sloping lines which are given the roadster are carried out in the four-passenger car, with the windshield tilted backward at a slight angle, in conformity with the curve of the cowl at this point. Back of either front seat a semi-deck idea has been carried out which adds materially to the general appearance. At the rear the body is curved outward and the spare wire wheel lends a finishing touch. The fenders are crowned and follow closely the curve of the wheels, with nothing whatever on either running board to disturb the sloping effect of the whole.

The extreme body width is 46 in., while the rear seat has a width of 34 in., with a depth of 22 in. Front seats are each 16 in. wide and 21 in. deep. There is a surprising amount of leg room in either compartment.

Some of the mechanical details of this new Scripps-Booth include the 2⅝ by 2¾ in. overhead valve, eight-cylinder motor, which develops 35 hp.; Wagner starting and lighting by a two-unit system; thermo-syphon cooling system; Zenith carbureter; Remy ignition; multiple-disk clutch; three-speed gearset; three-quarter floating rear axle; cantilever rear springs, and 34 by 4 tires. The wheelbase is 120 in.

One of the features of the motor is the provision for easy adjustment of the inclosed overhead valves in that adjustment of the clearance between the end of the valve rod and the rocker which actuates the the valve stem is afforded by the adjusting nut protruding through the top of the cover plate. By means of these facilities it is possible to adjust the valve clearance while the engine is running, if desired. First the cap which goes over the adjustment proper is removed and then a screwdriver may be used to turn the slotted head of the adjusting nut, the locking nut having to be loosened first. An experienced person can tell by the feeling of the valve rod just how much clearance there is.

The Remy distributer is vertically mounted, so as to be driven by a worm gear off the front end of the camshaft. The coil is mounted in close proximity to the distributer and both are adjacent to the generator. Centralization of the electric apparatus is the result and it tends to shorter wiring.

Side view of the four-passenger Scripps-Booth eight, showing semi-deck behind front seat. Note rounded rear carrying spare wheel

Paragraphs on Current Topics

By Marius C. Krarup

Motto: Radical Thought, Conservative Action.

Many hopes were centered once in acetylene gas as a motor fuel. Absorption in acetone finally made it safe enough for illumination purposes. But its extremely wide range of explosiveness in admixture with atmospheric air operated against its use in any other form and still restricts its employment for autogenous welding and metal-cutting. The lessons in caution were taught mainly through accidents, and it was only at a comparatively late date that the figures were ascertained which explained them. Anywhere from 2½ to 65 per cent of acetylene gas mixed with air forms an explosive mixture. That is too dangerous. In these days of gasoline substitutes—formed in part by the decomposition of water, it seems, like acetylene—it might be well to reverse the order of proceedings and start with an examination of the fluids and their vapors rather than with accidents. Should it be found that the vapors form an explosive at almost any rate of admixture with air, it would be safe to insist on a suitable modification before employing the fluid in automobile motors. On the other hand, if a fluid such as that discovered by Enricht is found to be safe and may be produced from a relatively small quantity of solids, by their action on water—stating the case roughly—what a remarkable effect in military transportation affairs we would at once be called upon to consider. An expedition such as that which went into Mexico recently could then carry sufficient fuel to warrant the extensive use of automobiles for the transportation of soldiers, ammunition and other supplies. The rapidity of a raid could be trebled and therewith the chances for success. The anomaly of forced and exhausting marches for men and horses in this age of motor vehicles could then be avoided, and much of the laborious organization of the rear guard which is now necessary could be dispensed with.

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The Preparedness parade in New York now being over and a receptive mood engendered, engineers ask with their usual professional frankness for complete specifications. We want an efficient Preparedness, if not necessarily the cheapest; plain preparedness, with a small p, in defense of PROSPERITY, in caps.

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What is the difference between new construction and invention? The question has been asked and the S. A. E. committee on nomenclature has not yet supplied the answer. "Construct more, invent less" (*Mehr construieren, weniger erfinden*), was Guldner's advice to engineers, meaning about the same as the Roman: *Natura non saltat*, applied to industrial progress, or "Avoid leaps in the development." But there is a financial side also, and American investors will have none of construction, as a rule, while invention often appeals to their fancy, even though it usually has to be reconstructed afterward. Can it be that you "construct" for your own business and "invent" for somebody-else's? That no other distinction is possible?

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Though a taste for hard work is now considered a virtue of the first order only in unskilled men and horses, it is noticed that a large majority of the air pumps used for compressing air, either in tanks or in tires, are of the hard working variety and are lacking in efficiency by reason of high piston friction and slow operation. If worked by hand they usually involve a large reciprocating movement of a human body. Probably the net efficiency does not exceed 5 per cent, and the rest is mortification of the flesh. Rotary motion by foot pressure is almost as uncommon as the employment of a liquid (glycerine) piston working perfectly without tight packings. There must be room for better average methods and a more widespread appreciation of what they should be. On another page an air pump construction is illustrated which may suggest ideas on this subject, although it is not directly applicable to any other automobile uses than that of keeping air tanks in garages supplied with pressure.

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A New York daily insists repeatedly, and with some editorial chagrin, on the rule that pedestrians should cross at the crossings under the supervision of the traffic squad officer, as recommended by the Safety First Federation of America, and believes that strict enforcement of this regulation would reduce the number of accidents. That one person should be able and constantly willing to do better for thousands than each is able to do for himself, remains, however, a theory anything but plausible to those who have confidence in their own faculties, and many find it safer and far more comfortable to pick their own way, preferably at the middle of a block, where the periodic stoppage of the traffic at the intersections leaves a perfectly free passage at almost regular intervals. The rule is a good one to follow for the majority and to break for the few. It works best when not enforced.

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Had a case ever come to notice in which a driver of a car operated one set of brakes to avert an accident and, after finding it out of order, operated the second set in time to accomplish his purpose, the belief that two sets of brakes are worth less than one might be hard to defend. As everybody knows, however, the emergency brakes are used in practice only to hold a car at a standstill on an incline, and the service brakes could easily be connected with a notched quadrant or bar for that purpose, still leaving the ordinary operation as free as it is now. This being the situation, it is obviously suggested that the equipment of cars with two sets probably is little more or better than a needless survival from the days in 1897 and 1898, when officials all over were nervous about the control of automobiles and imposed restrictions upon design and construction somewhat as their inexperienced fancy dictated. Brakes, particularly, became an official hobby for legislators, not here only, but in even higher degree in France. An imperative precedent was created. But at this more advanced stage it should be possible to reason on the subject. And it is well understood that one perfectly reliable set of brakes will do all the retarding required; that it is more easily and safely kept in good order than two; and that the use of two on the rear wheels interferes with the best construction and dimensions for each of them, the contracting band brake, for example, hindering the cooling of the expansion brake. It is also understood that, if one of the two sets were abandoned, there would be a better chance for getting perfected the sort of brake which could be used constantly on long declivities without overheating, or perhaps for getting adopted a system acting on both front and rear wheels in the most approved manner. At all events, the question of two sets or one should probably be a current topic, even though in reality it has not yet impressed either the industry or the public very seriously.

* * *

In Major Lawton's list of requirements for army trucks one of the most impressive is to the effect that all vehicles to be operated together should be of the same make, in order to have the repair department efficient. Among the lessons he draws from the present war he places in the first line that "ordinary commercial trucks are best; the special body types not necessary." But among the problems to be solved by American truck manufacturers, he mentions as the fourth: "Determination of the best body for use." A lightly built two-ton stake truck with large platform and storage for tarpaulins and rope in the platform was found the most useful type of all, according to another source of information, being especially valuable for the rapid shifting of troops over poor roads. It holds more men than any other type, and they can get on and off most quickly.

* * *

The buying public is the final judge of construction it is commonly said, even among engineers. The public's verdict is not based on technical argument, but on practical performance, they add. Against the trend of these statements let a few other ones be registered. For example: The public's verdict varies from day to day as well as geographically. Good technical argument gives full consideration to practical performance. Every smart salesman influences the public verdict. Every captivating advertisement does likewise. And does the public buy practical performance in anything else, aside from automobiles—in literature, stage productions, food, drinks, homes—or does it buy something which appears at the moment sentimentally satisfying? If there is a schism between technical conclusions and practical results, there remains the explanation that the technical argument is not quite strong enough or is not sufficiently fortified with human shrewdness.

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WAR CORRESPONDENCE:—M. Krayn, Berlin—*Konstruktionsberechnungen* etc., by A. G. von Loewe, which you posted us in December, according to your letter of advisement which reached us in February, has not yet arrived. The censors at Falmouth or Kirkwall may suspect a code in the formulas and equations, or the information contained in the book may be too valuable to be passed along. Hoping that they will soon get through studying it, we remain——

Failing to reach the German publisher by letter, we are trying this method, as THE AUTOMOBILE still reaches Germany, at least occasionally, this being evident from the articles which are found translated in German automobile publications, some of the latter continuing to arrive, though at very irregular intervals. Von Loewe's book deals largely with formulas for design and methods of manufacture, and is said to be very interesting.

Rotary Valveless Air Pump Suitable for Garages

AMONG new constructions of British design there appeared last year in the market a rotary and valveless air pump well suited to be driven from a small electric motor, as the resistance to its operation is never concentrated at any one point and high pressures must be produced through high speed of the machine. It is made by Globe Pneumatic Engineering Company of London, but during war conditions is probably mainly of interest to Americans as a subject for study. The illustrations and description given herewith are taken from *Engineering* of July 23, 1915.

A photograph of the rotor is reproduced in Fig. 1, while Fig. 2 shows a longitudinal section of the pump together with a centrifugal device at its left for separating water from the air. and Fig. 3 shows an end view and cross-section. The essential parts of the pump are the rotor, Fig. 1, which is shown at *A* in Figs. 2 and 3, and the drum shown at *B* in Figs. 2 and 3. The casing *C* protects the pump from dirt and shields the rotating drum but takes no part in the action.

The rotor is built up of a cast central spider carrying an outer ring which has a deep double screwthread on its circumference. This thread is right-handed over half the width of the rotor surface and left-handed over the other half. Crosswise of these very deep threads there run partitions of half the depth, as shown in Fig. 2, and fairly close together all around, as can be seen in Fig. 1. The rotor is coupled rigidly to a shaft which is made in two parts with facing couplings bolted together through the center of the rotor. The part of the shaft to the left is hollow and the bore forms part of the suction pipe.

The pump is here described as a vacuum pump, but by reversing the operation it becomes a compressor and the hollow portion of the shaft becomes the discharge pipe for the compressed air. When used for high compression the speed of the pump must be proportionately higher than for exhaust work.

The rotor is carried on SKF ball bearings which are mounted on bosses forming parts of the frame *C*. Drum *B* is practically a plain cylinder with closed ends and is also mounted on ball bearings mounted on the same bosses that carry those for the rotor. But the relations of the drum to the rotor and of the two sets of bearings are eccentric, the drum being lower.

When the pump is to be operated, water is run into the drum through pipe *D*, Fig. 2, until it stands at the level of the bottom of the hole in the guard-ring *E*. If more water were run in, it would run out into the bottom of the casing *C*. The rotor is then driven around by an electric motor or any other convenient and suitable means. In rotating, the rotor tends to carry the water with it, partly owing to surface friction and partly to the trapping of the water by the cross-partitions between the helical circumferential grooves. The drum, being quite free to rotate on its bearings, is carried along with the rotor by the skin friction of the water, and 15 to 30 sec. after the movement is started the rotor and the drum therefore rotate together, and the water which is carried around between them distributes itself by centrifugal force at a uniform depth all around the inside of the drum.

Pumping now takes place owing to the action of the screw-thread grooves on the rotor and the eccentric position of the drum. The water being evenly distributed, any part of the partitioned circumference of the rotor

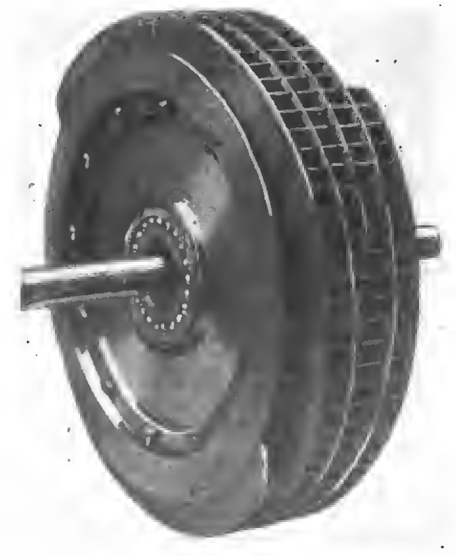


Fig. 1—Rotor of Globe-Johnston rotary valveless air pump

continually dips deeper into the cylinder of water surrounding it as that part approaches the top position, and it lifts partly out of the water as it approaches the bottom. This tide of water between the threads causes the pumping, as follows. Air passes from the hollow shaft through a space in the center of the rotor spider to the circumference of the rotor between the right-handed and left-handed threads. At the bottom of the rotor the tide is low, and, as a consequence, communication is established around the end of the inner thread—when this is at the bottom—between the suction channel and the unfilled space between the threads. As the rotor moves further around, however, it dips more deeply into the water and consequently the connection of the air spaces is very shortly severed, the rising water in the groove interrupting it. A bulk of air is thus isolated in the passage, and, as the rotor continues to move around, this air is driven forward through the passage between the threads, because the passage continually decreases in cubic capacity through the rise of the tide in it. The trapped air is thus driven along between two threads and is discharged when it reaches the end. It begins to leave the rotor at the point where the outer edge of the ring *F* leaves the water. At this point communication is established from the passage between the threads to the inside of the drum, and from there the air escapes into the casing through the holes *G* shown in Fig. 2. The discharge action can be clearly understood from the photographic view of the rotor, Fig. 1. The ring *F* is there well shown. Toward the top of the rotor this ring dips into the water, so that there is no connection from the passage between the threads to the inside of the drum. Toward the bottom of the rotor, however, where this ring leaves the water, the air escapes around the end of the last thread and passes to exhaust. As the rotor is double-threaded there are two discharges per revolution. The use of right and left-handed threads eliminates end thrust. Air enters at the center of the rotor, passes in both axial directions and is discharged at both sides.

It will be clear that in this interesting mechanical arrangement the rotation of the drum and of the water have nothing directly to do with the pumping action. The pump would work equally well if the water were standing still around it, provided such a thing were possible, but the rotation of the drum is of course necessary to maintain the water ring. It also has the advantage of eliminating friction, neither the rotor nor the drum having any motion relative to the water in the direction of rotation, and the drum no motion radially, either. Only some slip of the drum may occur, owing to the slight resistance in its ball bearings and external air friction within the casing.

The pump has no rubbing parts, except the bearings, and there is apparently nothing which is liable either to wear or to get out of order. No water is consumed except what is carried off by evaporation with the pumped air. The water is merely a seal. The drum may be filled to the correct height and left alone for a long time. But, if the level of the water falls seriously below this height, the capacity of the pump will decrease, and to avoid this a continuous water circulation may be arranged for.

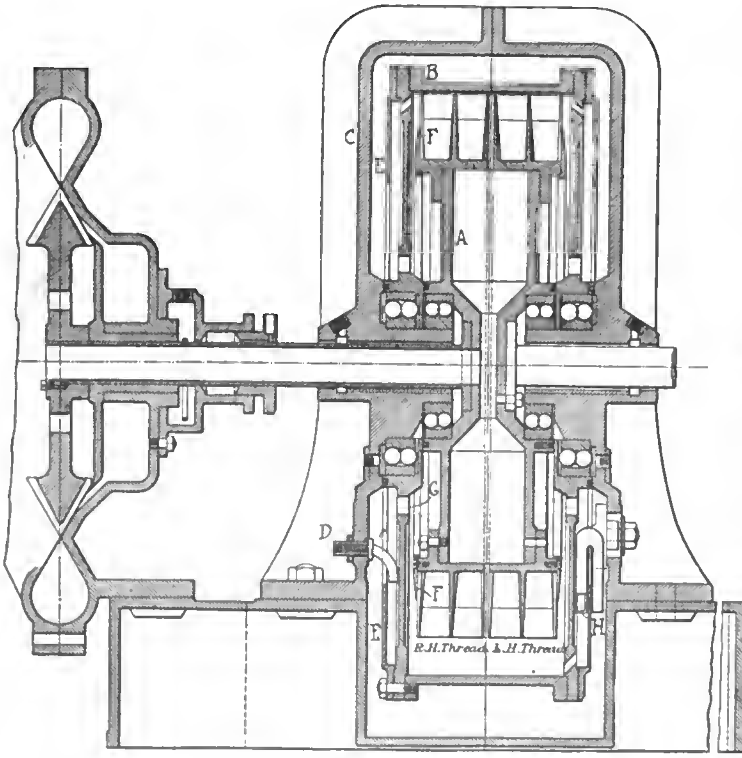
When the pump is used as a compressor the water ring has to maintain the pressure of the receiver tank. If it could not do this, the water would be forced out of the drum over the guard-ring *E* and into the casing. It must maintain this back pressure by its centrifugal force, and consequently the higher the pressure the greater must be the speed of revolution.

[A loose estimate would indicate that for the purpose of compressing air in a garage tank a speed of 6000 to 8000 revolutions per minute might be required.—M. C. K.]

Adaptation to Fire-Engine Pumps

As the wide adoption of motorized fire-fighting apparatus for American municipalities bids fair to be continued and greatly extended, many designers are undoubtedly working on improvements for the type of fire engine in which the use of centrifugal pumps is the main characteristic. Were it not for the necessity—existing in those locations where the water supply is not under pressure—of priming these pumps with water in order to start the stream, they would oust the more cumbersome reciprocating pumps, and the apparatus on the whole would be cheapened and improved. In this connection, too, the Globe-Johnston air pump seems to suggest ideas which might be turned to excellent account in capable hands.

The subject is too large and specific to be dealt with in detail in this place, but to make the suggestion which the Globe-Johnston pump mechanism conveys a little clearer, it may be mentioned that the small water supply—sometimes 100 gallons—which is usually carried for starting the centrifugal pump occasionally fails to accomplish the starting, due to leaks in the suction hose or hasty coupling, and then delay is caused which may prove costly. A simple and positive rotary suction pump would overcome this defect and permit dispensing with the auxiliary water tank.—M. C. K.



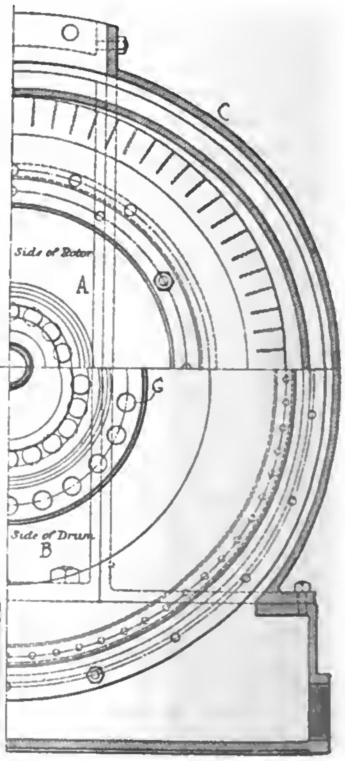


Fig. 2—Longitudinal section of Globe-Johnston air pump and compressor, with air drier and cleaner at extreme left. Fig. 3—End elevation and cross-section

Panorama showing the interior of the first floor of the Perfection service building with passenger cars and trucks on the bays

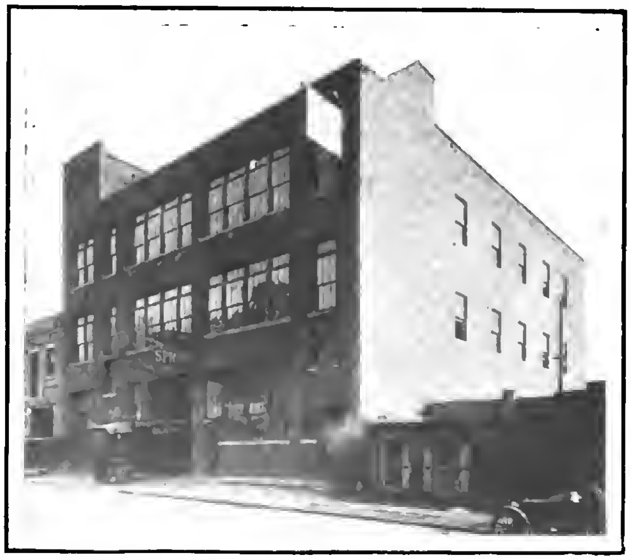
Perfection Spring Erects Service Building

Self-Supporting Plant in New York Manufactures Its Own Stock in Accordance with Home Factory Standards

A NEW standard in service for automobile spring users has been set by the Perfection Spring Co. in opening what may be called the first complete spring service plant in New York City. Housed in a three-story building which will eventually be increased to five, designed especially to meet the requirements of an ideal spring service station, the new plant of the Perfection company is of particular interest.

The service work is designed to not only take care of individual owners but also to lend a helping hand as far as springs are concerned to the automobile repair and service shops in the vicinity. There is nothing in the way of automobile springs which cannot be handled quickly and efficiently in this shop because it is not only supplied with a large amount of stock springs for standard models but is also in a position to manufacture springs for obsolete models or for special cars.

An interesting feature of the plant is that it is entirely self-supporting. It is equipped with its own heat-treating plant, pyrometer, testing machinery, etc., and in the hands of men who are familiar with the methods and standards of workmanship of the home plant in Cleveland. Hence, the work done in the main factory can be duplicated in this combination service and manufacturing plant. Primarily, however, the building has been laid out for service with manufacturing as a secondary consideration, although nothing has been neglected to make equipment for the latter complete.



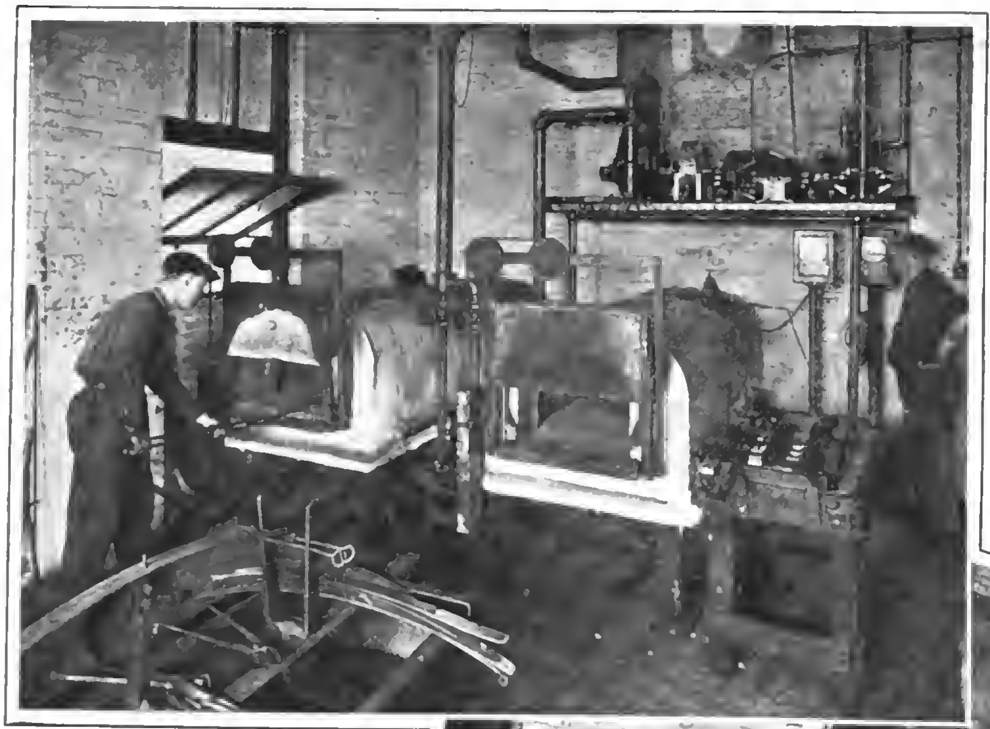
The three-story building which will eventually be made a five-story structure

There is no truck too large nor roadster too small to be taken care of in the shops; and, owing to the fact that the building has been laid out particularly for spring work there are a number of facilities which permit the workmen to operate at a great advantage and hence reduce to a minimum the length of time spent on any job. Perhaps the most noteworthy feature in this respect is the use of bays in which the cars are run over a long deep pit on tracks formed of built-up H-beams. There are twelve of these bays, nine being designed for touring cars of any size and three for trucks of any capacity. The width of the track of some of these bays is adjustable and cars other than of standard tread can be handled just as readily as those with the 56-in. span.

The area of each floor is 75 by 100 ft. with a wide aisle down the center of the first floor and the bays arranged six on a side. As a car enters the door, which is in the center of the first floor, it is stopped opposite the office and the necessary job tickets, etc., arranged. The car is immediately swung around on a combination truck and jack and pushed on to the H-beam tracks over the pits. The men are then free to work on it and if the car has been built any year after 1909 the stock spring will probably be found in the stock storage room of the plant. In case of an odd spring or an odd leaf it can be made in quick time in the shop.

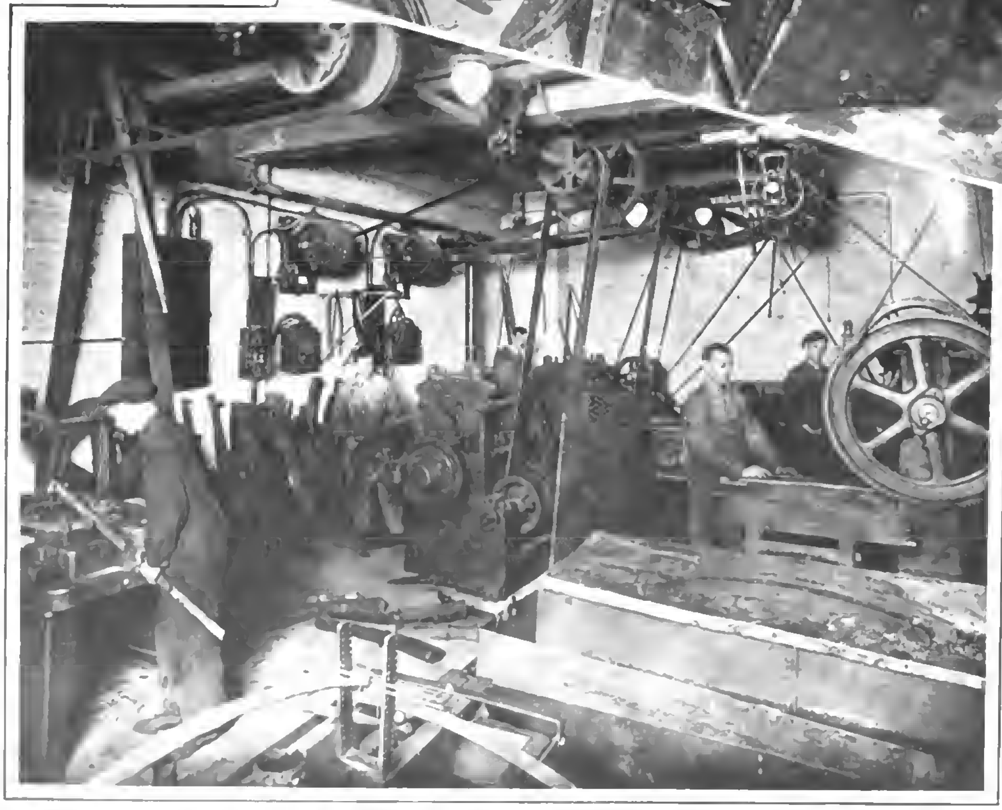
With the cars on the bay the workman has the spring at about shoulder height and is therefore able to accomplish the work in much handier style than if he were compelled to labor in a stooping position or lying on his back. This arrangement for the convenience of the workmen has its reflection in the time on a given job and also permits of much greater care in setting up bolts on spring clips and other

Perfection Spring Service Factory



Top, left—Heat treating furnaces and pyrometers used in the Perfection Co.'s New York plant. These furnaces are equipped and arranged to give the same heat treatments as are afforded the springs in the home plant of the company

Center—Heat treating baths employed in tempering the spring leaves made in the New York plant. An economical arrangement is secured by having the workmen between the furnaces and the heat-treating baths



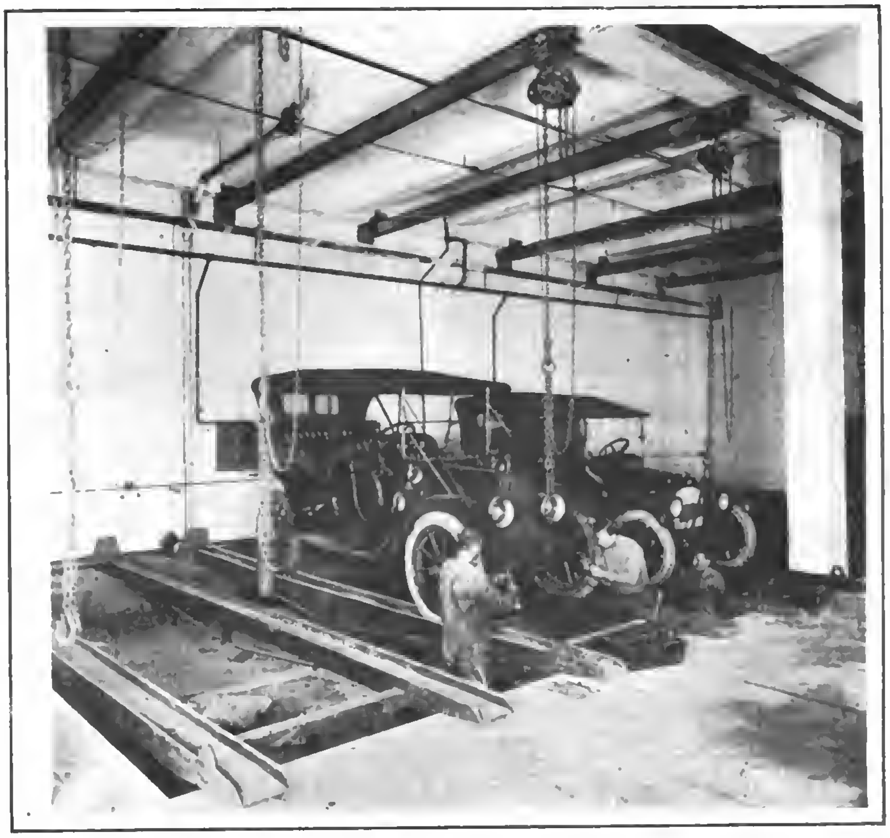
Bottom—Machine shop for turning out the finished springs. Note the individual motor drive to each machine. This machine shop is located in the same room with the heat-treating plants and the dipping baths, giving a full spring factory in one room, so that all kinds of spring work can be done parts which are very often located so inaccessibly that it is difficult to properly adjust them.

Chain Hoists Used

Above each of the bays supported by overhead I-beams are chain hoists. These are capable of lifting any of the cars which enter the shop and are graduated according to the size of the bay. The smallest bays have H-beam tracks which are 9¼ in. wide. The track beams for the large trucks are 30 in. in width and the overhead hoisting apparatus is graduated in much the same way. The tread distance from center to center on the touring car tracks is 56 in. and for the trucks it is 70 in. normally, although adjustments can be made, as stated, for variation of the tread.

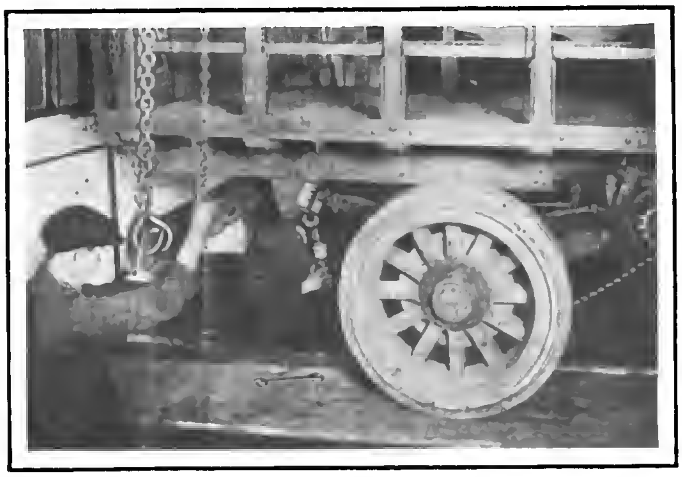
Shop Is 50 by 22

In order to take care of the trucks fitted with very high bodies the ceiling height of the first floor is 16 ft. and as the maximum truck height is close to 14 ft., this leaves 2 ft. for exceptional circumstances. The elevator is also of large size, the dimensions being 12½ by 27 ft. On the second floor the supports have been arranged especially to take care of the heavy loads of spring stock. The capacity of the floor is 250 lb. per square foot. The idea of placing stock on the second floor is that eventually when municipal improvements have been made this will be on a level with the elevated freight lines which have been planned for, making shipping and receiving stock very easy matters.



Passenger cars mounted on the bays awaiting the attention of the Perfection service men

One of the interesting parts of the layout is the shop. This is on the first floor behind the main room containing the bays. It occupies a space 50 ft. across and 22 ft. deep. At one end are two heat-treating furnaces and pyrometers fully equipped to provide the same delicacy of control as is used in the home plant of the Perfection company in Cleveland. The workmen are familiar with the heats used in the Cleveland plant so that a finished spring produced in New York has the same materials and the same heat treatment as it would have had it come from the home plant. Behind the heat-treating furnaces are the dipping baths so that a workman operates between the furnace and the bath, being free to take the materials from the furnace and immerse them immediately in the heat-treating oils. The machine necessary for shearing the spring material, grinding the leaves, wrapping the eyes and doing other necessary machine work in the process of manufacture are all operated by individual motors supplied by current taken from the public service lines. The fuel used in the furnaces is gas which is also piped into the building from the outside lines.



Bay arrangement permits men to work on the springs at eye level, thus improving speed and quality of work

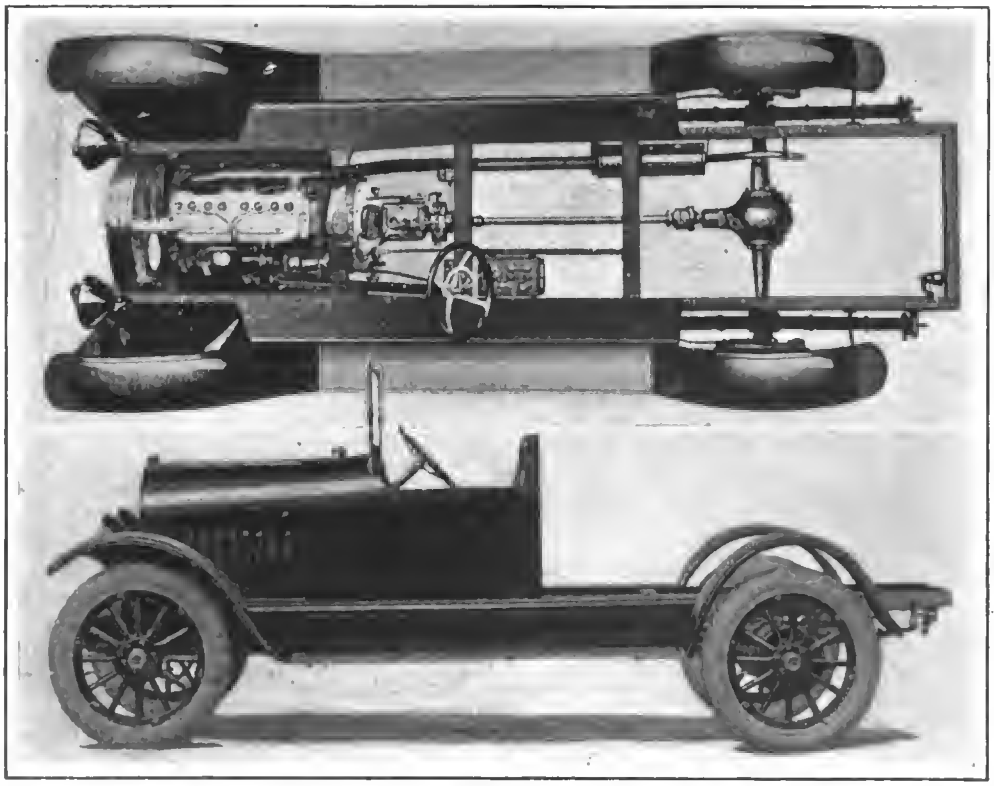
For spring testing there is a Tinius Olsen machine which is capable of handling the heaviest springs. Outside of the individual inspection given to each spring blade the entire spring can be inspected and tested on this machine.

Manufacture Springs

The manufacture of springs in this plant is a part of its economical operation. The men when not engaged in repair work are utilized as manufacturing hands and thus any springs which are running low in the stock room can be manufactured and stored against future demands. This gives an arrangement whereby there is no idleness of the hands while waiting for repair jobs to arrive and the owner or service station which comes in with a repair job does not have to pay for the unoccupied time of men. The New York plant is equipped with a full set of drawings of the springs used on different cars and is capable of making springs to the specifications shown in these drawings.

Educating Car Service Stations

With a plant of this kind it is the aim of the Perfection company to educate the service stations for different makes of cars to utilize its conveniences in their spring service work. It is thought that with the manufacturing and service ability of a large plant the necessity for the individual service station to maintain a large stock of springs is removed. Furthermore, instead of compelling the individual owner to purchase an entire new spring when he has broken but one leaf it will be possible to replace this leaf at a very low cost. In order to take care of the wants of the local car service stations a call-for-and-deliver service is being organized which will still further simplify spring matters for the local service station.



The new Jeffery Rapid-Service Wagon chassis. As illustrated in the side view it sells for $900

Two New Jeffery Trucks

Rapid-Service Wagon Is 1500-Lb. Type and the All-Purpose Truck a 3000-Lb.

TWO new truck chassis of smaller capacity than the Quads have been added to the commercial vehicle program of the Thos. B. Jeffery Co., Kenosha, Wis. Though these retain to a degree the quality of sturdiness that has characterized the four-wheel-drive type, the new designs are more conventional in their transmission layout. That is, they take the drive through the rear wheels only and steer on the forward wheels only, the combination of four-wheel-drive and four-wheel-steer not being considered necessary for the lighter vehicle.

The Rapid-Service Wagon

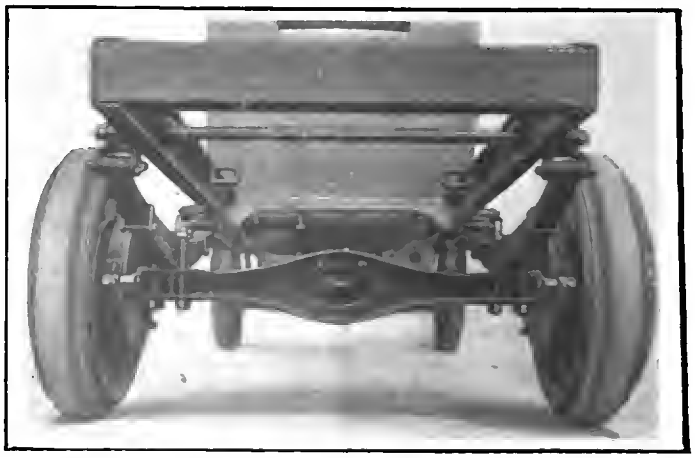
The lighter of the two new designs is known as the Jeffery Rapid-Service Wagon, and has a maximum capacity of 1500 lb. In general design it follows quite closely the four-cylinder passenger vehicle except for certain changes which are adapted to commercial practice. The chassis, which includes driver's seat, foredoors, hood and windshield, and Bijur two-unit starting and lighting, is sold for $900. A wide option of body styles is offered.

The heavier of the new models is called the Jeffery All-Purpose truck, and has a capacity of 3000 lb. This design is similar to that of the lighter one except for heavier and stouter construction. However, the final drive, instead of being of the spiral-bevel type employed in the Rapid-Service Wagon, is an internal gear system, and equipped with the M. & S. locking differential, Duplex speed governor and other features designed to adapt it particularly to its greater carrying capacity. The chassis alone, equipped with the Duplex governor in addition to the equipment mentioned for the lighter vehicle, is sold at $1,400. There is a wide choice of bodies, the flareboard express type adding only $75 to the original list price of the vehicle.

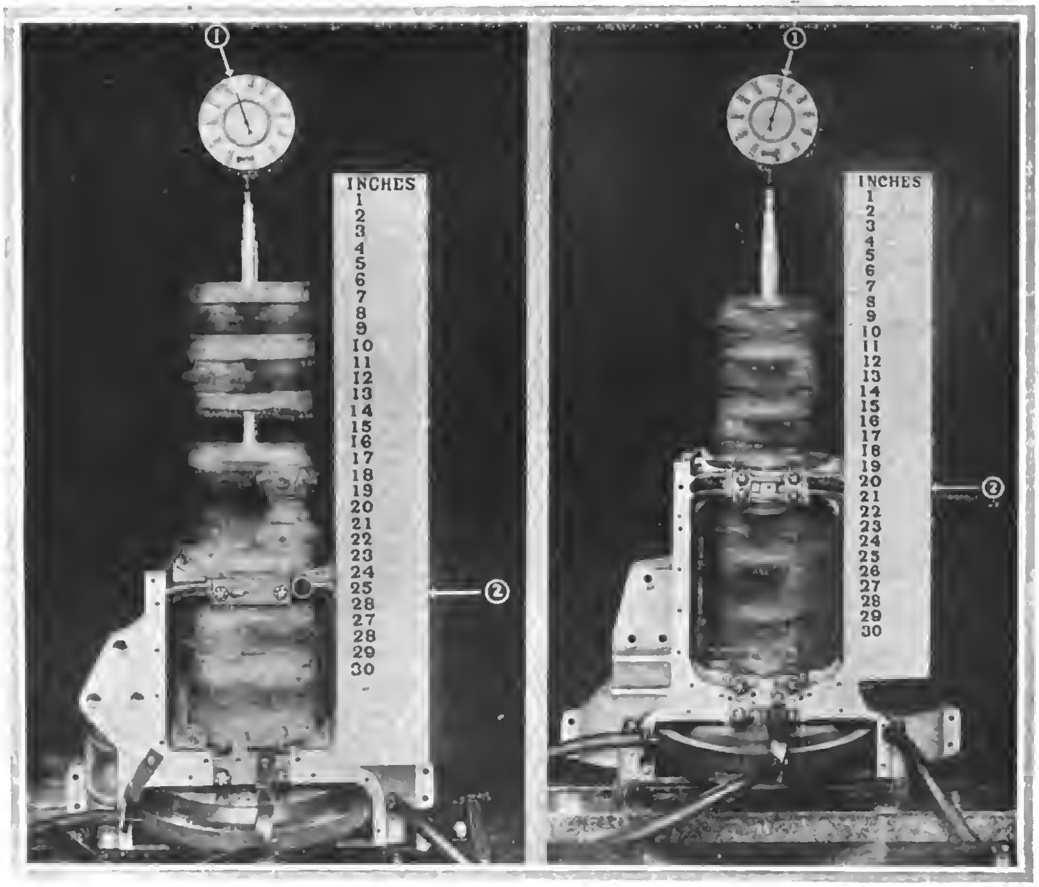
The Rapid-Service Wagon can best be described by noting the points in which it differs from the four-cylinder Jeffery passenger chassis. These differences are in the frame, the springs, and the strengthening of the rear axle, the three points at which the more rigorous demands of commercial vehicle operation necessitated a departure from passenger car Jeffery practice. The frame has been made very much heavier, the springs are semi-elliptic at the rear instead of three-quarter elliptic, and the rear axle housing is strengthened by a truss.

The detailed specifications include the four-cylinder block 3¾ by 5¼ motor, which is already familiar, Raybestos-faced dry plate clutch, roller bearings, three-speed gearset, shaft and spiral bevel with double Universal joint to a semi-floating axle, equipped with adjustable taper roller bearings. Tires are 35 by 4½ in. and the gear-ratio is 4½ to 1 on high.

The All-Purpose truck, which is the 1½-ton model, employs the same power plant as the lighter vehicle, except that the gearset is considerably heavier and stronger. The transmission of power to the rear axle is through a tubular propeller shaft instead of a solid one and the axle itself is the Celfor internal gear drive in which the weight of the load is carried on a dead axle, while the power transmission is through shafts and spur pinion to internal gears on the rear wheels. The axle shafts and the housing of the live axle are free from any suspended load. The frame and springs are very much heavier in this model than in the other, as in addition to the greater load capacity, the wheelbase is increased to 130 in. This makes it possible to give a body length of 110 in., as against the maximum body length of 80 in. in the Rapid-Service type. The rear wheels of the All-Purpose chassis are 34 by 5 with solid tires and 34 by 4½ pneumatics are used in front.



The Jeffery All-Purpose truck uses internal gear drive



Left—Hudson super-six shaft running true at 3500 r.p.m. Not bolted down and supported one-third of its length
Right—Conventional crankshaft revolving at 800 r.p.m. Upper bearings is vibrating so badly as to be indistinct. Shaft rigidly bolted down and supported half its length

Proving Crankshaft Rigidity

An Ingenious Rig Employed to Compare the Old and New Hudson Cranks

SOME interesting experiments recently conducted by the Hudson Motor Car Co. have been brought to our attention by E. V. Rippingille, assistant sales manager. These deal with the rigidity of the Hudson crankshaft resulting from the system of balancing employed.

Ingenious Methods Used

The accompanying illustrations show the ingenious method used for carrying on these experiments. The shaft was supported vertically so as to eliminate the possibility of bending due to overhang, as would be the case if it were supported in any but a vertical plane. Then, in order to eliminate any chance of torsional strain due to an auxiliary driving mechanism, the flywheel, with its face provided with teeth ordinarily used in connection with the starting motor, was converted into a turbine, several air nozzles being arranged to revolve it without actual mechanical connection. The weight of the shaft was taken on a hardened steel ball let into the end of the crankshaft.

Up to 3500 R.P.M.

The shaft was run up to 3500 r.p.m. with perfect safety and could have been run higher had the air pressure been enough to carry it at greater speed. There was practically no vibration, as the illustration shows, although the shaft is unsupported for 66 per cent of its length, as indicated by the scale which is mounted at the side.

In the case of the standard type of crankshaft, which was a unit taken from a standard Hudson 6-40 model, it was supported for 50 per cent of its length as shown. Although driven in the same manner as the super-six shaft, it was not deemed advisable to run it above 1100 r.p.m., the experimenters not daring to stay in its immediate vicinity above that speed, due to the vibration which manifested itself and which can be noticed fairly clearly in the photograph, which was taken at a rotative speed of 800 r.p.m. The case was subjected to considerable strain at 1100 r.p.m., and the upper bearing was vibrating so badly as to render it indistinct. At 800 r.p.m. this shaft swung about 1/16 in. off center.

Balancing Crankshafts

In connection with the balancing of crankshafts, Mr. Rippingille calls attention to the fact that the engineering fraternity has always talked about perfectly balanced shafts and symmetrical design, but no one ever subjected these shafts to a test on a balancing machine with the connecting-rod big ends bolted in place. The connecting-rod big end is a considerable mass of metal, and it is strictly a rotated mass that is a part of the crankshaft, for it must be taken into consideration when calculating the forces and momentum at any point.

Tests of this sort are valuable because they serve to show up a fact which is very little appreciated, namely the inherent possibilities of a crankshaft for vibration. Everyone knows that a reciprocating mass like a piston causes vibration and that the good belance of a six is due to the pistons acting against each other through the medium of the crankshaft. Properly to enable the piston forces to cancel out, however, the shaft itself must be perfectly stiff and true-running, otherwise the vibrations in the shaft will react upon the pistons and the resulting vibration will be far more violent in character than that due to the crankshaft alone.

Avoiding Vibration

In aviation engines even more than in automobile motors the avoidance of vibration is highly important, and the coming of the twelve cylinder for aeroplane work has drawn the attention of engineers all the world over to the troublesome problem of balancing a six-throw crankshaft. Any vibration in an aeroplane motor acts destructively upon the light framework or, putting it the other way about, absence of vibration allows weight in the framework to be saved. Thus it is probable that aviation engine crankshafts will undergo further development before settling down to a standard form and the Hudson type should have much to recommend it.

Convoy of White trucks passing through the shell-torn ruins of a village near Verdun

Joffre Praises Automobiles

Thanks Corps for Efficient Service in Verdun Battle When Railroads Failed

PARIS, April 15—The following communication of General Joffre to the officers and men of the Automobile Transport Corps of the Verdun army, testifies to the value of the work accomplished by this corps in the fighting around Verdun:

"Since the renewal of active operations in the Verdun district the automobile service has furnished a considerable effort in order to assure the transportation of troops and the carriage of ammunition and food. Thanks to the fine organization of the convoys on the one hand and the high sense of duty of the men on the other hand, this transportation has been carried out with the greatest regularity and in a remarkably orderly manner. The General in Chief expresses his highest satisfaction to the officers and men of the automobile service having taken part in these operations.

(Signed) "J. JOFFRE."

East of Verdun the German lines project into France in the form of a huge V, the point of the V being close to St. Mihiel, about 25 miles back of the Verdun fortress. With such a position the German long-range artillery could bombard not only the country parallel to the main French front, but a considerable portion at right-angles to it. From their point near St. Mihiel they could drop shells on the main railroad line from Paris to Nancy, in the neighborhood of Commercy, and in consequence for over a year have obliged the French to make a detour to the south over a single track winding line, where quick service is impossible.

No Railroad Service

These conditions doubtless weighed considerably with the military authorities when the attack on Verdun was decided. The preliminary was a systematic bombardment of all the railroad lines within range of German guns, leaving a French army of not less than 250,000 men entirely dependent on automobiles for movement, food and ammunition. This is the first time in the history of the war that a great army, while fighting desperately, has been deprived entirely of railroad service. In all other cases, and at all other points of the front at the present time, the railroad and the automobile work in conjunction, with a final distribution when necessary by hand or by light horse teams. It is valuable testimony to the efficient organization of the automobile service that it has been able, under the most difficult conditions, to keep the army reinforced and to supply it regularly with food and ammunition, thus making it possible for the troops to arrest the most powerful and determined attacks since the war began.

Alive with Motor Convoys

Members of the automobile corps returned from Verdun describe that district as being alive with motor convoys of every possible kind. Every type of automobile vehicle from powerful four-wheel drive and caterpillar tractors to motor bicycles is to be found on duty in this district. American trucks are very plentiful in the Verdun sector, Whites predominating, with also a large number of Packards. Fiat has supplied a large number and various French makes are represented.

All the rapid movements of troops are carried out by automobile, and it was owing to the rapidity with which the transportation-of-troops sections got to work in bringing up fresh men that the initial success of the Germans was arrested. Although all army trucks are fitted for the transportation of men in case of emergency, there is a special organization known as the T. P.—transport personnel—designed for this work. The vehicles used are either the original Paris buses or the same type of chassis with a special single-deck body. After taking the 1100 buses in service in Paris when war broke out, the De Dion Bouton and Schneider companies were ordered to continue making this type for the army, and all those which could be assembled by the bus company were immediately requisitioned.

Big Body Area of Buses

The great advantage of this type for troop transportation is the big body area in relation to the total area of the vehicle. The driver is over the motor, this being the only type in the army where the motor is not under a hood, and the frame members have lateral and rear extensions to allow of a body flush with the hub caps, and to give a big rear platform. Some of these vehicles have been in service since August, 1914, and are thus approaching the end of their second year of actual warfare. The later ones have the same chassis details but lighter and cheaper bodies. The substantial double roof with ventilating windows, also side and front glass windows, have been abolished; from the plain roof canvas sides with mica windows can be rolled down to attach to the side panels.

In operations such as those at Verdun the army has to undertake the removal of the civilian populations. Contrary to what might generally be supposed, the rural populations do not flee in terror at the sound of battle. Many of them are so unconcerned at the booming of the guns that they pay little attention to the recommendations to move to the rear, preferring to wait until a military order is given to evacuate the district. Then the army trucks have to come into service, for there are neither railroads nor horses; women, children, and invalids, together with such small hand baggage as it has been possible to save, are loaded into the trucks and taken to the nearest railroad station, from which they can be shipped to some point in the interior. This work, of course, is a considerable addition to the trucks' usual tasks.

Zeppelins Carry Four Six-Cylinder Engines

Details of Motor Equipment of Airship Brought Down in France by Automobile Gun

PARIS, April 14—The complete destruction of a German Zeppelin and its crew by the fire from a French automobile anti-aircraft gun has attracted attention to the role played by the automobile in the war against airships. Although the airship was brought down on Feb. 21, all the facts in connection with its destruction have only recently been made public. There had been considerable aerial activity in the Revigny district, north of Bar-le-Duc and south of Verdun, during Feb. 21. French aeroplanes attacked the invaders, and succeeded in bringing down one of the German machines, while two others dropped into their own lines apparently in a damaged condition.

Picked Up by Searchlights

The same evening about 8.30 o'clock the listening posts announced that two Zeppelins had crossed over the lines near St. Menehould and were working toward the south, evidently in the direction of Bar-le-Duc. Immediately the automobile searchlights were put into action, and two converging rays of light picked up the first of the two Zeppelins flying at a height of 6000 ft. The airship was heading directly toward Revigny station. The Zeppelin discovered, two 75 mm. guns mounted on automobile chassis got into action. In the absence of the superior officer, the two guns were commanded by an Adjutant who ordered incendiary shells to be fired. The first shot passed very close to the airship; the four following shots were placed around the Zeppelin; finally the sixth shot, fired by Gunner Pennetier, passed through the center of the airship from bottom to top. In a few minutes the aerial vessel was in flames, but no perceptible explosion took place. Very slowly the burning airship began to settle down, while pieces of the envelope became detached. After a while the rate of descent decreased and the crew could be seen throwing bombs and other heavy articles overboard, without however, any appreciable result. When at a height of 600 ft. from the ground one of the crew, an underofficer, threw himself overboard. Finally the airship reared and plunged to the earth; the carcass telescoped and the flames completed the destruction. Of the fourteen persons who remained aboard only one could be partially recognized by portions of his uniform. It was discovered that the airship was the L.Z. 77, in charge of Major Horn, of Fribourg. The Zeppelin carried four six-cylinder motors built by Maybach, of 7⅛ by 8⅝ in. bore and stroke, each one weighing 990 lb. The L.Z. 77 carried 1½ tons of bombs, varying in weight from 100 to 220 lb. each.

The automobile searchlights which contributed toward the destruction of the Zeppelin are 30 hp. touring car chassis carrying a searchlight of 24 in. diameter. Several types are in use, but the most common practice now is to have two motors, the smaller one at the rear driving the dynamo which supplies current for the searchlight. This simplifies the construction of the chassis and leaves the main motor free for its ordinary duties. The searchlight is mounted on the center of the chassis, the relative positions thus being: main motor in front under bonnet, searchlight behind driver, auxiliary motor and dynamo at rear. There is thus a radiator at each end of the chassis. In most cases the dynamo is driven by the main motor off the gearset; and on another type the searchlight is carried on a pneumatic tired trailer.

The anti-aircraft gun used for this work is the French 75 mm. field piece designed for high-angle fire and, when directed against Zeppelins, firing incendiary shells. The chassis is a modified 3-ton truck type built by both De Dion Bouton and Schneider, the motor in each case being a four-cylinder of 4.7 by 5.5 in bore and stroke. There is nothing special in motor and gearbox, and final drive is by internal gear. The gun is mounted on a revolving platform immediately above the rear axle, but when going into action the weight is all taken off the road wheels by means of six quick-acting hydraulic jacks. The load is not taken off the front wheels. There is a shield around the front of the gun and the motor is protected against rifle and machine gun fire by means of plating. Twin rubber tires are fitted on rear wheels and singles on the front. In all the latest models cast steel wheels are used in place of the original wood artillery wheels.

Studs Wore Off in 1000 Miles

In a communication by C. C. Hancock, published in the Forum May 4, the following statement was made:

"Two years ago I designed a runabout with live axle and without differential. I ran this 2700 miles and found the tire wear to be extremely rapid, the rubber studs being completely worn off the rear tires in less than 100 miles."

The latter figure was a typographical error, the correct number being 1000.

French 75 mm. anti aircraft gun on 3-ton chassis. Latest type has cast-steel wheels in place of wood

The FORVM

Another Hotchkiss Drive Effect

By H. D. Church,

Chief Engineer, Truck Division, Packard Motor Car Co.

THE writer has read with much interest the article by A. L. Clayden in THE AUTOMOBILE for April 20 in reference to brake action on trucks when Hotchkiss drive is used. The points brought up by Mr. Clayden are important ones, which should be called to the attention of truck designers.

The writer has done quite a bit of experimental work with the Hotchkiss drive on heavy trucks and ran into a condition in connection with hand brake operation which was not referred to in Mr. Clayden's article.

If in addition to choosing the proper eye center locations for the hand brake connecting-rod, as outlined in the article referred to, due consideration is not given to the location of the rear eye in reference to rotation of the entire rear axle casing around its center, due to spring deflection when the hand brake is applied, trouble may be experienced.

The writer has had experience with one design of this type where the brake was automatically applied harder, as soon as it took hold, by the bending of the rear springs, permitting the axle housing and, consequently, the hand brake carrier to rotate slightly around the axle center.

The brake would lock the wheels, and the resultant pull from the rotation of the hand brake support would increase the tension in the brake connections to a point where the hand brake could not be released until the brake had come to a standstill. With a foot brake on the rear wheels this condition, of course, would not exist, as the foot brake is not equipped with a ratchet lock.

The particular case referred to was, of course, an extreme one, but the point is one to be looked out for in the design of brake connections on a spring driven truck, as under severe brake application almost any Hotchkiss drive spring will deflect enough to permit a slight rotation of the axle casing or hand brake carrier around the center of the rear axle.

IN HEAVY TRUCKS USING HOTCHKISS DRIVE REAR SPRINGS SOMETIMES BEND WHEN BRAKE IS APPLIED, PERMITTING AXLE HOUSING AND BRAKE CARRIER TO ROTATE AROUND AXLE CENTER

Change Cycle by Fewer Parts and More Impulses

By James McIntosh

I NOTICE in THE AUTOMOBILE for April 20 an article under the caption Are Other Cycles Possible? J. E. Schipper has treated of several phases of the situation, notably the poor means of control in an automobile engine from an efficiency standpoint. The statement that a motor 20 per cent efficient at full throttle drops to 5 per cent at one-third throttle proves the control is defective and Mr. Schipper's question Are Other Cycles Possible? is, I consider, an admission that the present cycle is not a desirable one. In this I agree with him but have other reasons as to why a change may be advisable.

First, the more impulses per revolution the less each has to be controlled to get results, this to some extent is an answer as to the trend toward multiple cylinders. The result is a multiplicity of parts to regulate and adjust. More constant torque and better acceleration seem expensive adjuncts and the results as to efficiency plus complication show the article by Mr. Schipper is timely. While he offers no solution to the problem, there is one other phase that may be interesting, and the logical control is based on a well recognized and sound principle which I will use to furnish evidence for a change. The early steam engine was controlled by a throttle in the steam pipe and acted on the flow of steam from the boiler to the cylinder. Its function was to reduce the initial pressure to suit light loads and that in turn reduced the mean effective pressure.

Variable Cut-Off Control

The next improvement was a decided change in control with a correspondingly higher efficiency. The variable cut-off constant initial pressure method of controlling is an admitted advantage for variable loads and close regulation.

There is still another condition to be found in our largest transportation problems, both of which use the expansive means of control. The locomotive has a throttle to stop and start with, but the valve gear is so arranged that the cut-off is used to regulate the speed whether the train is a heavy freight or fast mail train. The steamship is also stopped and started by a throttle, but the cut-offs and ratio of expansion in the engine once adjusted decides the power with a boiler pressure and constant initial pressure and a vacuum maintained to a point considered most efficient. It is a well established fact a throttle is not used in the sense it is in an automobile except for small units or where intermittent service and simplicity are virtues. High initial pressures are desirable in a steam engine and no one will say the same applies to a gasoline engine to a lesser degree and back up the statement successfully.

I suggest the more impulses per revolution the less each has to be controlled to get results. This is not advice to add to the number of cylinders. We may get the same number of impulses with half the number of cylinders by making each double acting or by a change in the cycle to make each cylinder deliver twice the number of impulses not justified by a fashion.

Suppose I suggest a change in cycle first to reduce parts; and second to increase impulses per revolution or to get the name number of impulses with one-half the number of cylinders. As a means of control let me suggest a constant volume, constant initial pressure compression and a variable cut-off controlled by a volume of pure air in position to precede a charge of constant and correct mixture and delivering both where they can be most effective.

Let someone question the virtue and my ability to furnish the means and we may have a friendly debate of interest.

The History of the Pneumatic Tire—3

Discovery of Vulcanization by Goodyear in 1835—Hancock's English Patent of 1843—Parkes Discovers That Carbon Bisulphide Is a Satisfactory Solvent — Dietz and Tires

The History of the American Automobile Industry—30

By David Beecroft

AFTER many experiments and probably knowing of the use of sulphur for preventing adhesion, Goodyear discovered vulcanization in 1835 and carried it so far that he produced vulcanite as well. He did not, at this time, make any attempt to secure a patent, possibly expecting to rely upon secrecy. In 1842, he began producing rubber shoes and in that same year samples of his products reached England. There, Hancock, already working in rubber, discovered that the effect was produced by sulphur and secured a somewhat similar result by immersing his product in melted sulphur and then heating it to 302 deg. Fahr. His patent on this process bears the date of 1843. In this year, Parkes of England discovered that carbon bisulphide is a satisfactory solvent and he also vulcanized some products by sulphuric chloride.

In 1846, Hancock introduced the use of molds for forming rubber products. Goodyear secured a second patent in the United States in 1854, but infringements became so common that he was involved in constant fights for his rights, with the result that his patent expired in fourteen years, leaving him penniless and his family in want. He died about this time—July 1, 1860—but Congress, recognizing the work he had done, extended his patent for a number of years.

Dietz Makes First Rubber Tires

The first use of rubber for vehicle tires seems to have been that of Dietz, who, in 1835, patented a rubber cushion applied to the ordinary iron tire and covered with an iron ring or tire so as to get the elasticity without subjecting the rubber surface to the rocks of the road. This recognition of its value, following so closely upon the discovery of Goodyear, shows a wonderful perception of the needs for a shock absorbing tire. The next and even more wonderful, of which there is record, is the pneumatic tire patented by R. W. Thompson, an Englishman, Dec. 10, 1845, his patent number being 10,990, and also patented in the United States in 1847. This patent shows a flat iron tire of considerable width, on the wheel in the usual manner, to which a casing of leather is bolted. It describes and shows a single inner tube and also as many as nine inner tubes, which he explained could be inflated to different degrees, and which, it is quite evident, could have one of them punctured or deflated without seriously affecting the supporting ability of the tire, as a whole. His inner tubes were of several thicknesses of canvas covered "with rubber or gutta percha in solution," and vulcanized by exposure to the fumes of sulphur or by immersion in melting sulphur. He also suggested stuffing the tubes with hair, sponge, or elastic materials, so that in case of deflation the tire would still serve.

A Rubber Cushion

A further suggestion was that of a rubber cushion or liner between the leather case and the air tube or tubes, the original puncture strip. His leather casing was arranged to be laced or riveted along the sides, and the tread portion is shown in some cases provided with rivets or studs, substantially as are leather tire covers of the present day. He says a diameter of 4 or 5 in. is recommended for carriages, which were much heavier in those days than we now know them, and recommends inflation to a point that would permit the tire to flatten approximately one-third of its diameter on a smooth road. So thoroughly practical was the information given by him that one is forced to the decision that he had much experience in the use of these tires at that time, and was not a theoretical inventor, as too often proves true. Carriages fitted with his tires were offered for sale by one or more prominent London carriage houses and *The Scientific American* in 1847 mentioned a carriage equipped with rubber tires on the streets of New York in that year. These were quite probably Thompson's. His application to railroad cars, running on the broad, flat wooden rails of that day, which were about a foot wide by 6 in. thick, shows the wheels with tires fitted just as for road carriages, but the cars were equipped with centrally placed guide wheels which ran each side of a third rail between the regular rails. These guide wheels kept the cars on the track just as modern wheel flanges do.

In 1849, several Philadelphia papers mentioned carriage tires that were proposed to be made of gutta percha. These were doubtless to be of India rubber, it being quite common about that time to confuse the two products. No record of actual construction or use is at hand, however.

The Rostrum

Can Purchase Tire Caliper

EDITOR THE AUTOMOBILE:—Concerning tire inflation discussed March 9, and April 13, I would like to have the following information:

1—Is there a caliper made like that G. A. S. of Boston, Mass., mentions and if so, where can I get one?

2—I have a seven-passenger touring car which I drive a great deal riding alone, weight about 3200 lb., Hudson 6-40, keeping the front tires pumped to 70 lb. and rear 75 lb. When Sunday comes I have seven passengers, so if 70 and 75 respectively are right, how much more tire pressure do I need for the increased load?

3—Is there a chart or scale furnished by anyone that gives the air pressure you should carry in your tires according to the number of pounds or load that each wheel carries?

Yuba City, Cal. H. H. W.

—The tire caliper is made by the B. F. Goodrich Co., Akron, Ohio.

2—If you are using the 35 by 4½ tires you should have 85 front and 90 rear with the full passenger load.

3—This can be secured from any of the larger tire companies.

Haynes Six Makes 3460 R.P.M.

Editor THE AUTOMOBILE:—What is the maximum speed of the Haynes Light Six engine?

Oakland City, Ind. C. R.

—The Haynes Motor Car Co. states that on official tests the maximum speed obtained with the light six motor is 3460 r.p.m.

Ammeter in Gray & Davis Ford System

Editor THE AUTOMOBILE:—Kindly describe the proper installation of an ammeter on the Ford Gray & Davis starter system. Undoubtedly this is a very simple accomplishment but the particular ammeter I have in mind does not appear to be able to stand up under the load subjected to.

Earlville, N. Y. L. L. L.

—An ammeter may be connected into a Gray & Davis system for Ford cars by removing the green wire from the starting switch terminal nearest the battery and connecting this wire to one of the ammeter terminals. From the other ammeter terminal connect a No. 12 insulated wire to the same starting switch terminal.

To determine whether the ammeter is properly connected turn the lights on, engine at rest. Ammeter should indicate discharge amount used by the lights. If charge instead of discharge is shown reverse the wires at the ammeter.

Valve Timing of Lyons-Knight

Editor THE AUTOMOBILE:—Kindly give correct valve timing of the motors in the Lyons-Knight cars. Also bore, stroke, power curve and stock gear ratio.

2—Is the model D-3 Stromberg carbureter suitable for a Stutz motor?

Allston, Mass. S. D.

—The port opening and closing of the Lyons-Knight engine is as follows:

Exhaust opens 63 deg. before end of working stroke.
Exhaust closes 5 deg. before end of exhaust stroke.
Admission opens 5 deg. after beginning of suction stroke.
Admission closes 36 deg. after end of suction stroke.

The bore and stroke of this motor is 4½ by 5½, but no power curve is available.

2—It would be inadvisable to use the D-3 Stromberg carbureter with present-day grade of fuel as this is an old model not suitable to the heavy fuels of to-day.

Cast-Iron Pistons in 1915 Reo

Editor THE AUTOMOBILE:—What kind of pistons are used in the Reo 1915 six-cylinder model M 3.562 by 5.125?

2—The Hudson company claims an increase of 34 hp. making its horsepower 76 without increasing the size of cylinders. How do they get more power?

3—What is the difference between a valve-in-head motor and a Knight motor?

4—Does the National company manufacture its own motor?

Akron, Ohio. G. H.

1—The pistons used are cast iron.

2—The Hudson claim of increase in horsepower is due mainly to a reduction in the internal friction of the engine. They are also using an improved carbureter and have increased the efficiency of the valves.

3—The valve-in-head motor has ordinary valves which seat directly in the head of the cylinder with the stems projecting upward. The Knight motor is an entirely different construction, having two sleeves surrounding the piston with slots cut in the sleeves near the upper end. The sleeves are moved up and down over a small range by means of crankcase and the opening for intake and exhaust is obtained when the slots in the sleeves register, which they are arranged to do at the proper positions in the main piston stroke.

4—The National company manufactures its twelve-cylinder motor, but some of its sixes are made for the company by a firm of engine specialists.

Power Curves of Model 75 Overland

Editor THE AUTOMOBILE:—Will you kindly give power curve developed at different speeds on the 1916 Maxwell and also the model 75 Overland?

2—What is the advantage of a belt drive for generator?

3—What are the six leading cars in production at present?

Lincoln, Neb. C. L. H.

—The horsepower curve of the 1916 Maxwell is not available. That of the Overland 75 is given in Fig. 4.

2—Simplicity and cheapness. It is also silent.

3—Since a large number of the concerns keep their manufacturing schedules a secret THE AUTOMOBILE cannot publish information of this nature.

Explanation of Ford Ignition System

Editor THE AUTOMOBILE:—Kindly tell me all you can about the Ford magneto and the entire ignition system, including a Master vibrator; how the spark is made, etc.

2—Is the Ford a magneto as we understand the word?

Kansas City, Mo. J. K.

—It is impossible to give in this space a complete discussion of all the phases of Ford ignition. The Ford magneto which generates the electric current is the invention of Henry

Ford. It is an integral part of the engine consisting of two sections; one attached to and rotating with the flywheel and the other fastened to the cylinder casting. It eliminates a number of complicated parts as it has no brushes, no distributer, no moving wires or any parts to work loose. It revolves at the same speed as the motor. The magnets on the flywheel passing the stationary coil spools create an alternating low-tension electric current in coils of wire which are wound around spools fastened to the stationary part of the magneto. This current is carried from the coils to the magneto connecting wire leading to the coil box on the dash. The current generated by the magneto flows through the primary winding of the coils in the coil box on the dash to the commutator located at the front end of the engine just under the oil breather pipe, back through the frame of the motor to the magneto. This completes the primary surface or path of the magneto current. The high tension current induced into secondary winding of the coils is led to the spark plugs in the cylinders as their respective circuits are completed by the commutator.

2—Yes.

Power Curves of Four Overland Models

Editor THE AUTOMOBILE:—Kindly publish complete power curves of Overland models 75, 83D, 84 and 86.

New York City. J. F. W.

—The power curves of the four Overland models you request are published herewith. Model 86 in Fig. 1, 83-D in Fig. 2, 84 in Fig. 3 and 75 in Fig. 4.

Dash Gage for Rear Tank

Editor THE AUTOMOBILE:—Is there now on the market any mechanical device for indicating on the dash or cowl board just how much gasoline the driver has when the gasoline is carried in a tank in the rear? In other words, is there a dash indicator for rear gasoline tanks?

Flint, Mich. J. E. G.

—Yes, there are a number of cars which are regularly equipped with devices of this nature.

Why Fours Are Not V Types

Editor THE AUTOMOBILE:—Why are not four-cylinder motors built in the V type?

2—Please state disadvantages of this type of motor.

3—Would a motor of this design be more rigid than the regular four in a row?

Syracuse, N. Y. C. A. McV.

—Dividing 360 deg. by four, it is found that the crankshaft throws are 90 deg. apart. With this arrangement the cylinders can be advantageously set on a line and there is no reason for the V.

2—No marked disadvantages have been found except perhaps the added care necessary to have everything accessible.

3—Not necessarily so.

Buick and Chevrolet Not Connected

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for April 27 mention is made by one of your correspondents of the McLaughlin-Buick car. What car is this and what does the name McLaughlin signify when used in connection with Buick?

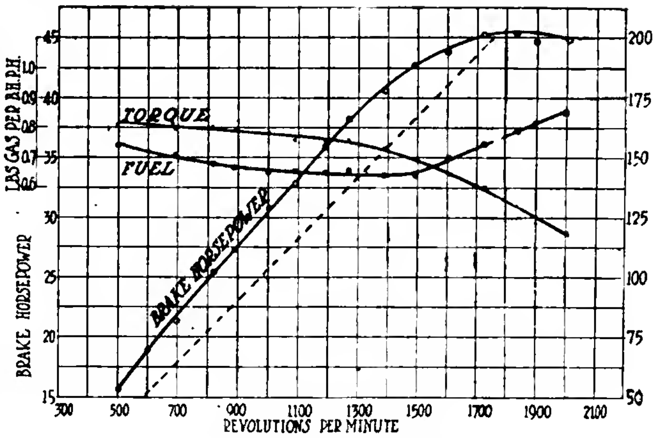
2—How did the name Buick originate?

3—Who designed 1916 Buick cars?

4—What connection if any, exists between the Buick and Chevrolet companies?

5—Were these cars designed by the same engineer?

6—The cylinder capacity and weights of the Buick D45 Six and the 1916 Studebaker Four are approximately the same. Which is the speedier car?



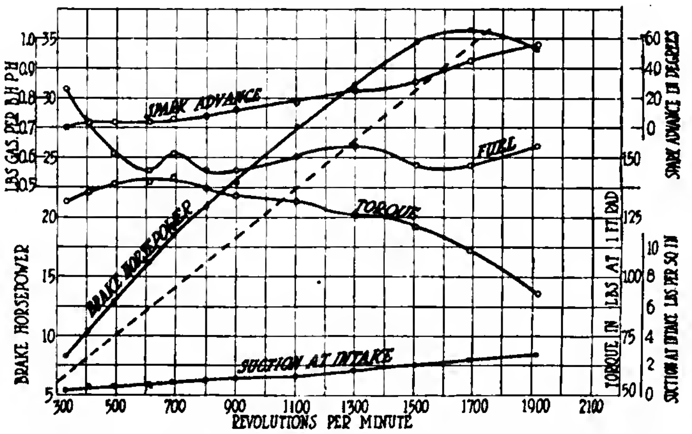
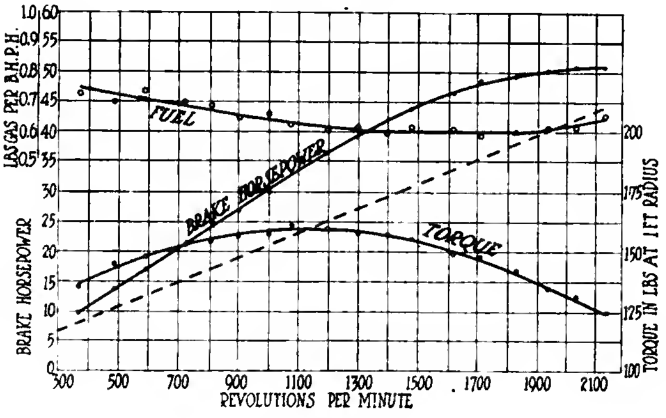


Fig. 1—Top, power, fuel and torque curves of the Overland model 86

Fig. 2—Bottom, power, fuel and torque curves of the Overland model 83 D



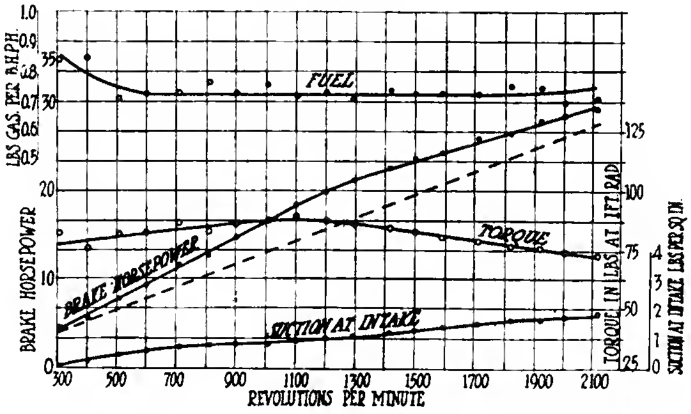


Fig. 3—Top, power, fuel and torque curves of the Overland model 84

Fig. 4—Bottom, power, fuel and torque curves of the Overland model 75

7—Why does running with a late spark tend to overheat a motor?

East Canaan, Conn. D. C. C.

—The McLaughlin-Buick car is the Buick car assembled in Canada by the McLaughlin Motor Car Co., Ltd., Oshawa, Ontario.

2—The Buick car takes its name from D. D. Buick, who was the founder and organizer of the Buick Motor Co., Flint, Mich.

3—The Buick company employs a large corps of engineers, and all of these men have a hand in designing new models, although Mr. Walter L. Marr, who is the chief engineer, assumes the responsibility for this work.

4—There is no connection whatever between the Buick company and the Chevrolet Motor Co.

5—No.

6—THE AUTOMOBILE has no record of any contest of speed between these two makes of car.

7—Overheating is due to a late spark because combustion takes place so late that the gases have not had opportunity to be cooled by expansion before the exhaust opens. The result is that the engine runs much hotter than it would if explosion occurred on upper dead center as it is supposed to do.

Lubricating System of Grant Six

Editor THE AUTOMOBILE:—Please describe and illustrate the oiling system of a 1915 Grant six. Give horsepower curve of this motor.

2—Are the valves of the Franklin motor placed in cages or directly in the cylinder head?

3—What kind of wood is used for the frame of this car?

Tipton, Ind. E. G. D.

—Illustrations of the lubricating system of the Grant six are given in Figs. 5 and 6. The method of oiling is along conventional lines, the oil being drawn through a strainer in the oil sump, forced through a sight feed on the dash and through two discharge pipes from this sight feed. One of the discharge pipes goes to the motor gears and the other to the rear end of the motor from where it is distributed to the oil troughs.

The illustration of the pump in Fig. 5 shows a novel arrangement in the form of an air chamber on the pump which allows a steady flow of oil.

2—The valves are placed in the cylinder head; are inclosed and mechanically operated.

3—The Franklin frame consists of three plies of second growth ash of equal thickness, being glued and screwed together and bound on the top and bottom by a thin strip of the same material to cover the joints. The wood is carefully selected for grain and is kiln dried and seasoned in the open air. A thorough painting treatment is used to protect the wood from moisture.

Austin 77 a Six-Cylinder

Editor THE AUTOMOBILE:—Kindly give me the bore and stroke, number of cylinders, wheelbase and horsepower of the Austin 77. Who is the nearest agent?

New York City. J. E.

—The Austin 77 had six cylinders, bore and stroke 4½ by 7 and a horsepower rating according to the S. A. E. formula of 48.6. The motor was T-head design with the cylinders cast separately. The wheelbase of the Austin 77 was 141 in. and the tire size 37 by 5.

THE AUTOMOBILE has no list of Austin agents. This can be secured from the Austin Automobile Co., Grand Rapids, Mich.

Information on Midland Car

Editor THE AUTOMOBILE:—Where was the Midland car made?

2—How many years did the company manufacture cars and at what price?

3—Where can I purchase parts of the Midland car?

4—What motor did they use and what size bore and stroke?

5—What speed could they make?

Lee, Ill. E. W.

—The Midland car was made by the Midland Motor Car Co., Moline, Ill.

2—This company manufactured at least from the year 1908 to the year 1913. The cars manufactured were in accordance with the following table:

1908-9-F	30-35 hp.	Roadster	$2,000
1908-9-G	30-35 hp.	Touring	2,250
1908-9-G-10	30-35 hp.	Touring	2,500
1908-9-F-9	30-35 hp.	Touring	2,250
1908-9-E	25-30 hp.	Touring	1,958
1910-G-10	40 hu.	Touring	2,250
1910-L	35 hp.	Runabout and touring	1,750
1911-L1-L2	40 hp.	Runabout	1,950
1911		Touring	2,000
1911		Torpedo-touring	2,100
1911-K	50 hp.	Touring	2,250
1912-O-6-60	60 hp.	(6 Cyl.) Roadster	3,000
1912-L-111	40 hp.	Roadster	1,900
1912-R	40 hp.	Touring	2,750
1912		Coupé	3,000
1913-W	40 hp.	Touring	2,100
1913-T-4-40	40 hp.	Roadster and touring	1,685
1913	40 hp.	Coupé	2,350
1913-T-6-50	50-60 hp.	Roadster	2,385
1913	38 hp.	Touring	2,450
1913	38 hp.	Coach	3,250

3—From the Maxwell Motor Co., Newcastle, Ind., or the Midland Motor Co., Moline, Ill.

4 and 5—THE AUTOMOBILE has no complete record of this information.

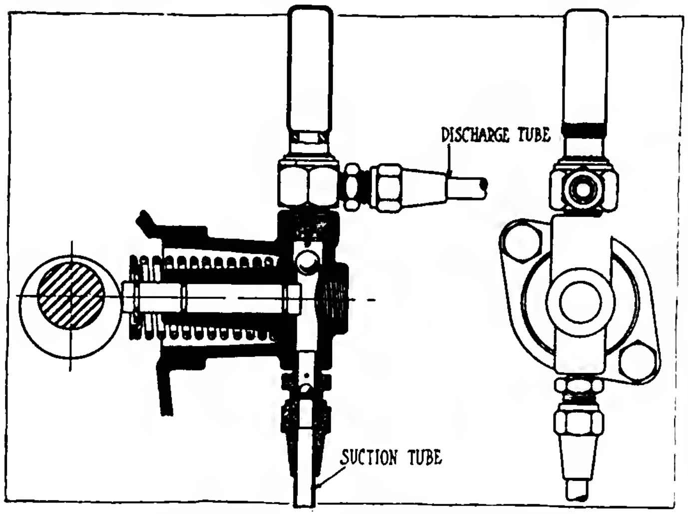


Fig. 5—Oil pump used in the Grant six, showing the air chamber which allows a steady flow of oil

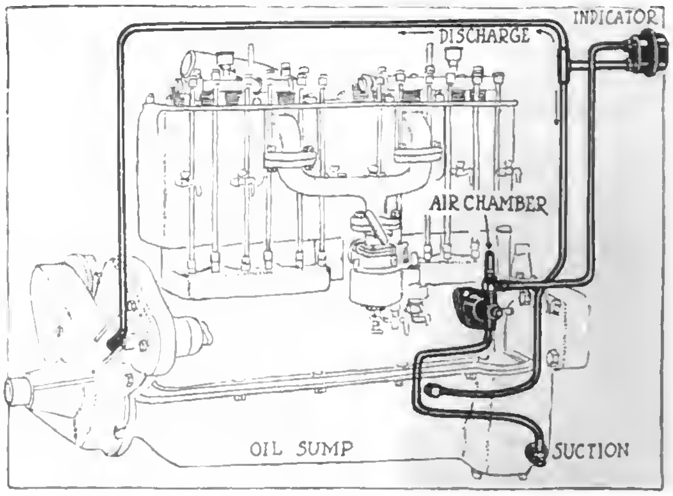


Fig. 6—Diagram of the lubricating system on the Grant six, showing the various leads

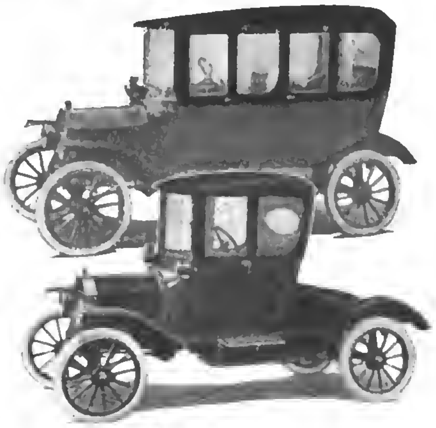
ACCESSORIES

Cassco Tire Pump

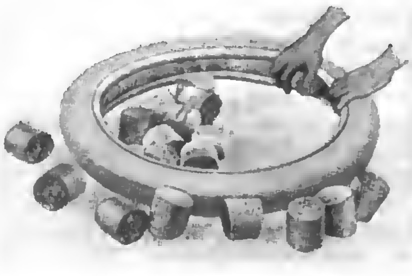
THIS pump, which is just being put on the market, is very compact, and the makers pride themselves upon the materials used and the workmanship employed in its construction. The cylinder and crankcase are of heat-treated cast iron accurately reamed and burnished. Pistons are of special aluminum alloy iron, and the piston guides are two parallel rods inserted in the lower surface of the piston and at right angles to its horizontal plane. These rods slide easily without play in two lugs, the holes being accurately machined. The lugs are integral with the base of the cylinder. This construction makes perfect alignment of the piston and cylinder walls certain, and prevents side play of the piston. This is a distinctive feature of the Cassco pump.

Piston rings are of special soft spring steel pressed and ground to size, each piston having three rings, thus preventing oil leaking into the tire and the consequent deleterious effect on the rubber. The crankshaft is of high-grade steel with a bearing on each side, thus avoiding overhanging loads. The connecting-rod is of special semi-steel and the gear shift is positive in action, automatically locking in both the engaged and disengaged positions. This prevents stripping the gears. Poppet type intake and exhaust valves of the same size are used, the intake being automatic in action, the air entering the cylinder the instant the piston begins its intake stroke. Gears are made with the stub form of tooth, and are accurately cut. The stroke of the pump is 1 in. and the bore 2½ in., giving a piston displacement of 5 cu. in. Lubrication is by splash and a felt lubricator which distributes oil to all working bearings.

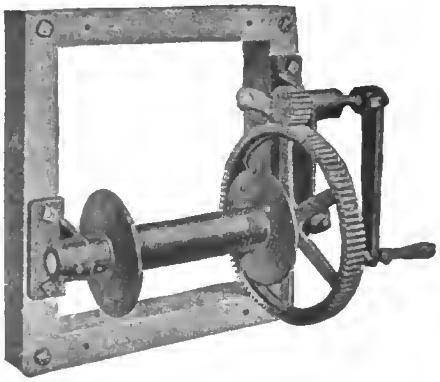
The pump may be easily installed by the car owner using a screwdriver and wrench, as special brackets and fittings are provided for installation. No machine work or shipping is required. Cassco pumps are now ready for Buick, Chandler, Chevrolet, Dodge, Ford, Hudson, Hupmobile, Maxwell, Overland, Reo the Fifth, Saxon and Studebaker cars. Complete with gage, hose and complete instructions for installing, the pump sells for $8.—Edward A. Cassidy Co., Inc., New York City.



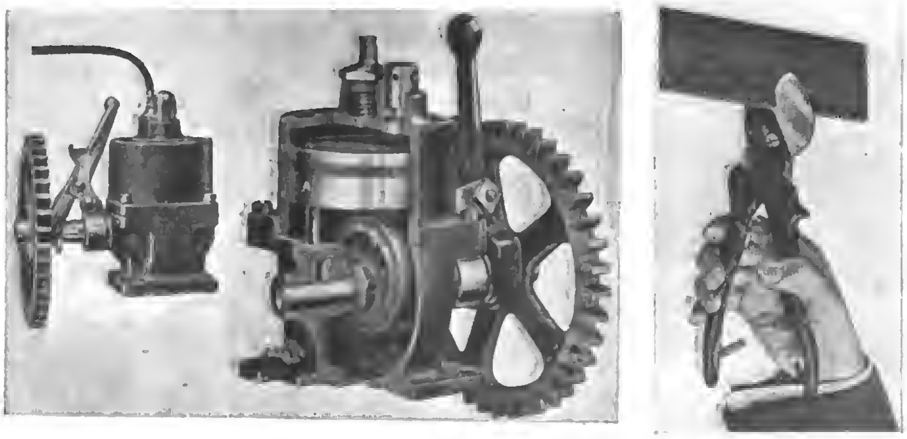
Ames sedan and coupé tops for Fords



National rubber tire filler



Erle single-drum hand hoist



Left—The new Cassco tire pump. Right—Multibestos brake lining cutters

Ames Detachable Bodies

The same general type of construction is used in the Ames sedan and coupé tops. Framing is of hard wood, roofs full slatted, padded and covered with enameled full grain muleskin leather, with blind welts, watershed moulding. The glass is 3/16 plate set in cushioned mouldings. Door lights are fitted with patent lifts, windshield is automatic hinged, rain vision, ventilating. The makers state that these tops make the Ford practically as snug and tight as a built-on top. Lining is of gray whipcord and a dome light is provided. All joints are so made that there is no squeak or rattle. Net weight of sedan top, 150 lb.; of coupé top, 100 lb. The sedan type lists at $97.50.—F. A. Ames Co., Inc., Owensboro, Ky.

Erie Hand Hoist

Two capacities of single-drum hoists are made, one of 900 lb. and one of 1200 lb. The frame is of pine. The former weighs 95 lb. and the latter, 140 lb. Price, type 220, $28; type 221, $36.—Erie Hoist Co., Erie, Pa.

Standard Brake Lining Cutters

This is a special tool of the shear type, designed especially for cutting brake lining, but useful also for cutting cable, wire or light sheet metal. The handles are long, give the requisite leverage and the blade is of hardened steel, easily removable for sharpening.—Standard Woven Fabric Co., Framingham, Mass.

Pedex Extension Pedals

The purpose of these pedals is to make it easier for women drivers to operate a car. They are made to fit any make of car and do not interfere with the operation of the regular pedals. Price, $5 per pair.—American Car Accessories Co., New York City.

National Tire Filler

This is a tire filler made up in short sections. The makers state that high grade rubber is cut into small particles and vulcanized together by a process that results in great resiliency. The sections fit the tires for which they are made accurately when the tires are pressed into

Left — Hood tire, showing the tread and cross sections. Right—International Half-Sole tire

place. Tools for the purpose are furnished free with a set of four fillings. Prices range from $13.50 per tire for 28 by 3 to $39 for 37 by 5½; Ford size, 30 by 3, $14; 30 by 3½, $18; 34 by 4, $25.50; 36 by 4½, $30.—National Rubber Filler Co., Midlothian, Tex.

Shi-Nup Enamel Cleanser

Shi-Nup is not a polish in the ordinary sense of the word, but a cleanser, according to the descriptions furnished by the manufacturer. It does not re-surface the part to which it is applied, nor leave a covering of wax, oil or grease. It contains no acids or combustibles. The manufacturer says it will restore the original luster of the finish. It is adapted to use on fenders, hoods and parts finished under heat treatment. A quart is said to be a large enough supply for a season. It is sold in quart cans at $1, and in pint cans at 50 cents per can.—Shi-Nup Corp., Yonkers, N. Y., manufacturer; Rose & Hibbard, Yonkers, N. Y., wholesale distributor.

Hood Tires

Hood tires are put out with the idea of producing the best possible wearing surface without regard to cost. The result is that, owing to the extra fabric plies, extra rubber quality and extra tread thickness, the cost is higher than that of the standard makes. One tire, however, made by the same concern under the brand name of Puritan is of standard construction throughout as to number of plies, strength of fabric and quality of rubber. It has, in addition, an extra thick tough resilient tread. This tire sells at the standard price. It is made with a gripper non-skid tread, which gives a good surface for slippery roads but is not as skid-proof as the regular Hood treads.

In order to maintain a standard compatible with the slightly higher price, the Hood tires are made with an extra ply of fabric, having on the small sizes one more and on the larger sizes two more plies than the ordinary type of tire. The fabric is of the highest quality of Egyptian staple woven to Hood specifications, and every roll is tested before using. The rubber is selected from the best grades of plantation and para. This is compounded only with sulphur.

The beads are locked in and so constructed that rim cutting is practically eliminated. The cushion and breaker strips are made extra wide, giving the tire extra strength and rendering it difficult to puncture. The tread is tough and extra thick, with a depressed arrow type tread made with arrow-shaped insertions having very sharp edges which hold the road by suction.

Although the first cost of these tires is higher than the standard tire because of the extra construction, the makers claim that the first cost is justified by the extra mileage and they state that during 1915 the adjustments made on tires which came back to the factory on the basis of 5000 miles was less than one-half of 1 per cent.—Hood Rubber Co., Watertown, Mass.

International Half-Sole Tires

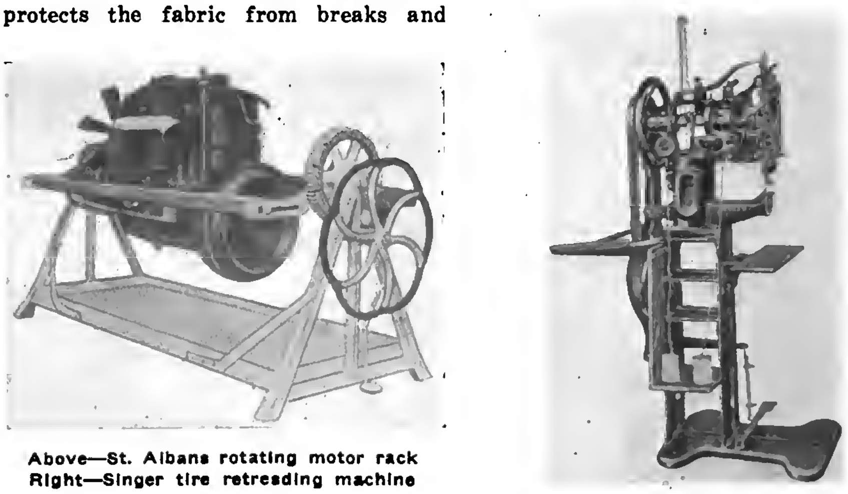
These Half-Sole tires are a trademarked product, the manufacturer stating that they are built like the highest grade tires, with the exception of the bead, being really outer tires to go over worn tires. There are three to six plies of tire fabric solidly vulcanized together, a thick cushion of elastic rubber which protects the fabric from breaks and ruptures and the outside tread which is made of ½-in. or more of very tough live rubber. The use of these Half-Sole tires on worn shoes is said to double or treble the mileage obtained. They are made to fit any kind of tire, and the rim can be of any type. The Half-Soles carry a guarantee against puncture and the price is about half that of a new tire.—International Rubber Co., Denver, Col.

Singer Tire Retreading Machine

This machine is for stitching two old casings together to make one good casing. The outer one has the bead removed and then it is sewed in place with two rows of lock stitches. Price, $275 cash, or $100 down and $25 per month for eight months.—Singer Sewing Machine Co., New York City.

St. Albans Motor Rack

A motor may be clamped or bolted and in this rack turned to any position from right side up to upside down. The motor is secured to longitudinal rails which are adjustable as tc their distance apart. The frame holding the motor is rotated, through gearing, by a handwheel. There are twelve positions in which the motor may be held, and a stop, actuated by a pedal, is provided. The gearing is 6 to 1, so that even a heavy motor is easily handled. A removable drip pan at the bottom catches all oil and dirt. The stand is built of heavy angle steel and is so strong that a motor may be driven by belt from an overhead shaft while bolted in the frame. The side rails are so heavy that they can be drilled for bolts without unduly weakening them; the holes will be drilled by the makers if exact measurements or templets are suplied. In the absence of bolt holes the motor may be held by hand clamps. The largest size, model 400, will take any size of motor; the smallest is 30 in. long and the side rails are adjustable from 10 to 24 in. apart. Prices, model 100, $32.50; model 200, $35; model 300, $38.50; model 400, $42.50.—Foundry Motor Car & Mfg. Co., Inc., St. Albans, Vt.



Above—St. Albans rotating motor rack
Right—Singer tire retreading machine

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Stock Car Performance

THERE are many in the industry who remember with pleasant recollection the days of stock car racing, just as there are a few whose remembrances are less inspiring, but one and all will join in admiring the perfomance of the Hudson in the Metropolitan Trophy 150-mile race. Of course, this chassis was carefully prepared; it was treated just as the amateur drivers in England treat the stock cars they use for the monthly afternoon of racing on Brooklands, but this did not alter the fact that the chassis was designed and built without any regard to its use in this way. Ira Vail's performance shows what splendid racing a field of good stock chassis could provide, and it will be interesting to observe whether the modern stock car is not capable of beating regularly the type of hybrid vehicle which commonly makes up the tail in the big speedway events. A good stock car gone over carefully to see that all the fits are correct is better as a speed machine than an old racing car which is wearing out. The maximum speed may not be quite so high, but the reliability is far greater and in modern automobile racing, on board, cement, brick and asphalt-surfaced speedways, it is reliability rather than sensational speed which most frequently figures as the determining factor in the order of finish of the participants. It is the old fable of the hare and the tortoise over again; the race is not always to the fleetest.

Oil and Metal

FROM an engineering viewpoint the racing at Sheepshead Bay last week proves two things. The first is that design has reached a point where it is restrained by strength of materials. The second is that the efficiency of lubrication required by racing engines on such speedways is far above any other need of the kind.

Simultaneously we see that ignition trouble, so prevalent last year, has been overcome completely. In all the racing on May 13 not a single spark plug was changed, except as a precaution, between races.

Toward the close of the 1916 season of racing it was noticed that broken connecting-rods were common. Fatigue of the metal was suggested as a possibility, as also was the notion that perhaps sections had been reduced too far in the effort to cut down reciprocating weight. Here, obviously, the metal available limits the lightness of the design.

Pistons Also Affected

We have, however, seen several piston failures which may not be explicable on the same supposition, and it is even possible that some of the connecting-rod failures are traceable to lubrication failure, rather than to anything else. If the frictional resistance of the piston increases suddenly in a motor running at 3000 r.p.m. the stresses on the piston itself, and on the connecting-rod may increase enormously. If, for example, the lubrication fails partially, so that the piston grows only a trifle tighter than normal, the pull on the connecting-rod at the instant of reversal of motion at the top of a stroke can be made much larger. It does not require a frozen piston to do damage in a very high speed engine; one that is merely rather tight is quite enough to put it out of the running.

Similarly with bearings. With the ball bearing crankshaft and with shafts on plain bearings there is rarely any trouble in the main bearings, but the lower ends of the connecting-rods are in a very different case. With a ball-bearing crank pressure lubrication for the lower ends is impossible. With a plain bearing crank the pressure and amount of oil supplied to the lower ends cannot be as great as in the main bearings. At the same time, it is the lower end bearings that have the most severe stresses to bear. Racing engines to-day are destroyed if the efficiency of the lubrication falls off, even for an instant. The avoidance of trouble is as much a matter of extreme care in preparing the car as it is a question of design. In an ordinary engine the lubrication provides a large factor of safety, whereas in a racing engine it has scarcely any factor of safety whatever. Of the leading cars on the speedways this season there is little difference in the power obtained, there is little difference in the weights, and the design in each case ranks very high indeed. Thus the success of one car or another is more than ever bound up in the treatment it receives. It is the supremely careful overhaul before the race compared with the hasty one that is going to make the difference between first place and collapse when the test comes.

France Bars Cars and Parts

Prohibits Importation of Chassis, Bodies, etc., from England and United States

Paris, May 15—*Special Cable*—Without the slightest warning, the French Government has prohibited the importation from the United States and England of automobile chassis, with or without motor or body, automobile coach work and other automobile parts.

The decree contains a clause authorizing the Ministers of Commerce and Agriculture to make exceptions and permit, under conditions to be determined by the Minister of Finance, the importation of particular articles. No official explanation has been made, but it was said that the new ruling undoubtedly had been put into effect with a view to procuring more space in vessels coming to French ports for supplies the Government needs.

N. A. C. C. to Conduct Educational Campaign on Credit Plan

New York City, May 17—In view of certain advertisements which have appeared relative to buying automobiles on the deferred payment plan and the use of the names of certain cars without authorization from the manufacturers, the National Automobile Chamber of Commerce at its directors' meeting on May 3, voted to institute a broad and vigorous campaign of education, not alone among publishers, but among members of the N. A. C. C., calling attention to the fact that widespread advertising of credit plans is detrimental to the industry; that members be encouraged to avoid adopting policies which may undermine the business and that they be encouraged to pursue those policies which can alone maintain and continue permanent success. The resolution is:

"Whereas, Certain influences are working and certain efforts are being made for the organization of plans which will have a disastrous undermining effect on the stability of the automobile industry, and

"Whereas, It is the opinion of this committee that injurious results will follow the adoption of these methods by any considerable number of automobile manufacturers, and

"Whereas, The methods of deferred payments under consideration are very objectionable from the factory standpoint, and are objectionable to a large degree from the dealers' standpoint, and have a disastrous effect on the purchasing public, which will unavoidably react injuriously, now therefore be it

"Resolved, That a broad and vigorous campaign of education be conducted by the National Automobile Chamber of Commerce, instructing and enlightening its membership along these lines and calling their attention to the fact that methods which on superficial consideration, seem to have merit, are in reality potent forces for destroying the foundation on which our industry has been builded, and that every effort be made to encourage the membership to avoid adopting policies which will undermine the stability of the industry and to encourage them to pursue and develop those policies which can alone maintain and continue permanent success."

Two Velie Worm-Drive Trucks

Moline, Ill., May 14—Two worm-drive trucks are now marketed by the Velie Motor Vehicle Co., this city. They are known as the models 25 and 26 and are rated respectively at 1½ to 2 tons and 3½ tons. In design both trucks are similar except in point of size. The motors are 4⅛ by 5¼ and 4½ by 5½ of Continental manufacture controlled positively by a gear-driven centrifugal governor. The radiator tubes are removable and the whole radiator assembly is mounted on springs to absorb the shocks.

Velie Biltwel trucks are completely equipped with top over driver's seat, seat and cushion, gas headlights and Prest-O-Lite tank, oil lamps and full set of tools. Later in the summer an additional model will be added.

$1,100,000 Miller Rubber Preferred Subscribed in 1 Hour

Cleveland, Ohio, May 16—A syndicate headed by Borton & Borton and including Hayden, Miller & Co., of this city, and Field, Richards & Co., for the Cincinnati market, yesterday offered $1,100,000 of the new Miller Rubber Co. preferred stock at 105. The offering was more than covered within an hour.

Of this issue there is to be authorized a total of $10,000,000, of which $2,000,000 is for immediate issue. Of the latter $600,000 is to be used in exchange to retire the present issue of $500,000 and the balance was reserved for subscription by shareholders and by officials of the company.

This offering, together with the recent Goodyear financing, makes a total of close to $20,000,000 of new rubber preferreds taken by the markets within the past week or so. Eliminating the stock taken in exchange for existing issues, there has been marketed approximately $12,000,000 of these securities. The spontaneous response of the investment public shows the high standing they have attained in the investment markets, both in Ohio and throughout the country.

80% Stock Dividend for Paige?

Increase of Capital to $2,000,000 Also Proposed—Meeting May 24

Detroit, Mich., May 11—At a meeting of the directors of the Paige-Detroit Motor Car Co., held here to-day, recommendations were made that a stock dividend of 80 per cent be declared, that the capital stock be increased from $1,000,000 to $2,000,000, and that the par value of the stock be reduced from $100 to $10. These recommendations will be submitted to the stockholders at a special meeting that has been called for May 24, and it is practically certain that they will be adopted.

May 30 Is Proposed Date

According to the plan formulated by the directors at this meeting, the 80 per cent stock dividend will be issued from $500,000 of the present authorized capital stock that has been held in the treasury. At the present time the outstanding capital stock is $500,000, and the stock dividend on this will represent stock of a par value of $400,000. It is proposed to pay for the additional stock to be issued by transferring from the surplus account to the capital account $400,000. Even after doing this, it is said that the accumulated surplus will still be in excess of $250,000. The Detroit Trust Co. is transfer agent, and it is proposed to issue the stock dividend to stockholders of record at the close of business May 30.

Second Dividend

The Paige company has enjoyed a rapid growth and has been a big earner for its stockholders for some time. It was originally formed in 1909, with a capital of $100,000, all subscribed. The present stock dividend is the second distribution within a year. On Aug. 2, 1915, a stock dividend of 100 per cent was distributed, the outstanding capital at that time being $250,000. For some time past the concern has paid regular monthly dividends of 5 per cent cash. The year following its formation, the Paige concern increased its authorized capital to $250,000, of which $136,000 was paid in, and in October, 1914, the balance of $114,000 par value of stock, which had been held in the treasury, was issued to the stockholders at par, raising the outstanding stock to $250,000. In June, 1915, the capital was increased to $1,000,000, half of which was left in the treasury.

To-day the stock was selling on the Detroit Stock Exchange with bid quotations at $860.

A Transcontinental Record

Baker Drives Cadillac 8 from Los Angeles to New York in 7½ Days

New York City, May 17—Shattering all previous automobile records by dashing across the continent in seven days, eleven hours and fifty-two minutes, E. G. Baker, accompanied by W. F. Sturm in a standard Cadillac eight, arrived here May 15.

The car left Los Angeles, Cal., at 12.01 on May 8, and, covering the distance of 3380.7 miles to this city, arrived at Broadway and Forty-second Street at 2.53 p. m. The original mileage, 3471, as given out by the Cadillac company, was an error.

The former record was eleven days, seven hours and fifteen minutes, made by Baker and Sturm in a Stutz last May. On that trip the distance covered was 3728.4 miles.

On both trips Baker was the only driver, getting only nineteen hours' sleep on the last trip.

Deplorable road conditions were encountered and much difficulty in getting through mud holes was also experienced. Baker states that he could have negotiated the distance in one day less but for the poor weather conditions and bad roads. Rain at Kansas City held him up practically one day. The hardest riding was through Missouri, where at one time the car was only able to make 10 miles in two hours.

567.2 Miles In 1 Day

The longest distance covered was 567.2 miles on the third day's run into Dodge City on May 11. The total for the three days was 1655.9 miles. This was an average of over 551 miles daily and an average of 20.9 miles for every hour of the twenty-four. In 1915 Baker went by way of Phoenix, Ariz., and El Paso, Tex., before heading northward through Texas into Kansas. Baker's mileage the first three days of last year's run was 1245.5, as compared to 1655.9 miles for the first three days this year.

Comparing this time with that of a railroad train, it is shown that the latter takes ninety hours between Los Angeles and New York City to cover a distance of 3240 miles and uses over twenty locomotives.

The roads in Arizona were so bad that most of the running was done in intermediate gear. A great deal of the running was also through mountains, where an altitude of 6500 ft. was reached at one time.

The only trouble which happened to the car was a leaky oil pipe which cost the transcontinentalists 2½ hr. This trouble occurred between Barstow and Needles. The hood of the car was not lifted during the trip.

On the last stretch homeward Baker determined to make up for lost time. His last dash of 1028 miles from St. Louis to New York City took him 37 hr. and 17 min.

Notwithstanding the low gear work through Missouri and Arizona, the car managed to make from 9 to 10 miles per gallon of gasoline and from 320 to 350 miles per gallon of oil.

Last night a testimonial dinner was given Baker and Sturm at the Hotel Astor, where they spoke of their experiences on the run. Baker stated at one time he drove 84 miles without going out of intermediate gear. Only thirteen tire changes were made. The worst was through the Mojave Desert, where the thermometer stood at 120 deg. There, five tire changes were made. The usual pressure of the tires had to be reduced 15 lb. on account of the heat.

The car was equipped with U. S. tires, Delco starting and lighting system, Stewart-Warner speedometer, A-C spark plugs and Kelsey wheels.

The following gives the runs between evening stopping stations:

Williams, Ariz.	553.5
Santa Fé	555.0
Dodge City	567.2
Kansas City	401.0
High Hill	216.0
Greenup, Ill.	210.0
Pittsburgh	493.0
New York City	385.0

The mileage of the route which Baker and Sturm followed is as follows:

Los Angeles to San Bernardino	63
To Barstow	79
To Needles	165.8
To Kingman, Ariz.	72
To Williams	138.5
To Flagstaff	34.8
To Albuquerque, N. M	381
To Santa Fe	66
To Las Vegas	72.9
To Raton	136.6
To Trinidad, Col.	25
To La Junta	94.2
To Syracuse, Kan.	114
To Dodge City	104.8
To Hutchison	153
To Florence	121.7
To Kansas City, Mo	134.5
To Columbia	159
To St. Louis	140.7
To Greenville, Ill	52
To Columbus, Ohio, via Indianapolis	322.1
To Greensburg, Pa	303
To Philadelphia	275.8
To New York	103
Total	3,380.7

Hudson Raises Prices $100

Detroit, Mich., May 13—On May 9 the Hudson Motor Car Co. advanced the price of its various models fitted to the Super-Six chassis by $100, but public announcement of this change was not made until to-day. The new price on the phaeton model and the two-passenger roadster is $1,475, while the four-passenger roadster type now sells for $1,525; the cabriolet at $1,775 and the sedan at $2,000. Greatly increased materials costs are responsible for the change.

$60,000,000 Merger Formed

Perlman Rim, Delco, Remy, Hyatt and New Departure Companies Included

New York City, May 12—A giant merger of five leading parts and accessory making concerns has been consummated in the name of the United Motors Corp., with 1,200,000 shares of stock of no par value. The capital involved is nearly $60,000,000 and the concerns merged are the newly organized Perlman Rim Corp., New York and Jackson, Mich.; Dayton Engineering Laboratories Co., Dayton, Ohio, maker of the Delco electric apparatus; Remy Electric Co., Anderson, Ind., and Detroit, maker of electric apparatus; Hyatt Roller Bearing Co., Newark, N. J., and Detroit, manufacturer of roller bearings, and the New Departure Mfg. Co., Bristol, Conn., maker of ball bearings. The new concern will be the holding company.

The company is incorporated under the laws of New York State. Each company in the merger will retain its identity and the management of each will remain in the same hands as heretofore. The board of directors of the parent company will consist of representatives of the management of the subsidiary concerns, as follows:

Directors Elected

For the first year the directorate will be composed of A. P. Sloane, Jr., Hyatt Roller Bearing Co.; E. A. Deeds, Dayton Engineering Laboratories Co.; DeWitt Page, New Departure Mfg. Co.; S. A. Fletcher, Remy Electric Co., and L. G. Kaufman, president of the Chatham & Phenix National Bank, with the following officers: A. P. Sloane, Jr., president; A. E. Deeds, vice-president; DeWitt Page, secretary and treasurer, and L. G. Kaufman, chairman of the finance committee.

W. C. Durant, president of the Chevrolet Motor Co. and a big factor in the General Motors interests, is one of the principal figures in the new accessory combine as well as the newly organized Perlman rim concern. It is understood that the Perlman concern enters the merger on the basis of two shares of the new stock for each share of Perlman rim stock.

The stock of the United Motors Corp. has been oversubscribed by the syndicate in the neighborhood of three times. The banking houses of issue are Dominick & Dominick, J. S. Bache & Co. and W. W. Laird of Wilmington, Del. Dominick & Dominick are managers of the syndicate of bankers underwriting the stock of the corporation.

Noronic Is Oversold to S. A. E.

All Cabins Full—Forty Names on Waiting List—Program of Papers

NEW YORK CITY, May 17—Advice has been received from Detroit that the steamship Noronic, on which the Society of Automobile Engineers will take its summer cruise June 12 to June 16, is oversold, there being already forty more applications than there are berths available. The papers committee is nearly ready to announce its program which includes a wide variety of subjects and promises to be the best the society has ever had.

An endeavor is being made to find accommodation on the boat for two simultaneous meetings so that papers on widely different subjects can be read at the same time. This will allow a much larger number of papers to be read and is expected to be much appreciated.

S. A. E. Standards Program

During the coming week there will be a number of meetings of divisions of the standards committee commencing May 22. On May 24 at 10 a. m. at the society's headquarters in New York the sub-committee on lamp standards appointed by the electrical equipment division will hold its first meeting under the chairmanship of W. E. McKechnie of the Cadillac Motor Car Co. On the same date the other sub-division dealing with starting motors and generators will meet in Detroit. The nomenclature division has a meeting in Detroit on May 25, when it is hoped to practically complete the work of its division so that a complete report can be presented to the summer meeting.

Other Meetings

The miscellaneous division meets in Detroit May 26, and the engine and transmission division in Detroit May 27, while the research division has a meeting at Indianapolis on May 29.

With respect to the meeting of the subcommittee on starting motors and generators, which is composed partly of members of the electrical equipment division; invitations have been issued to other engine makers and to manufacturers of starters and generators to attend this meeting and join in the discussion of the general possibilities.

Tire Division Appointed

The council of the S. A. E., by a mail vote, has decided to establish a tire and rim standards division to handle all matters concerning solid or pneumatic tires and rims. The membership will include representatives of all the solid tire and rim makers, and it is hoped to complete the personnel in time for a meeting to be held previous to the general meeting on the Noronic. This division will take over the truck standards division, a certain amount of work in the nearly complete state and expects also to proceed actively with the standardization of felloe-bands of pleasure car wheels, thus taking over the work of the pleasure car wheels division, which was discontinued some time ago.

Electric Vehicle Section of N. E. L. A. Meets May 22-26

CHICAGO, ILL., May 17—On Monday, May 22, the National Electric Light Assn. will commence its annual meeting, which lasts till May 26. It will be remembered that the Electric Vehicle Assn. recently amalgamated with the N. E. L. A., becoming the Electric Vehicle Section of that body, and this section will present to the meeting a number of interesting papers and reports.

The Papers

Prominent among the readers of papers are well-known S. A. E. members. William P. Kennedy, chairman of the S. A. E. truck standards division, will read a paper dealing with the ability of central stations in the promotion of the use of electric vehicles. E. P. Chalfant, another member of the S. A. E. standards committee, has a very interesting paper on the problems concerning electric passenger vehicles. He analyzes the respective fields of gas and electric cars in detail. F. E. Whitney has a paper analyzing truck troubles and their elimination. S. V. Norton of the B. F. Goodrich Co. is contributing a long paper on tires in relation to electric vehicle efficiency. P. D. Wagoner of the General Vehicle Co. submits some valuable data regarding the battery service system. Industrial truck application, drawing attention to the very wide field of this modern machine, is the subject of the paper by C. W. Squires, and Harry Salvat in a short paper calls attention to the opportunities which the electric car offers to garage owners.

Federal Use of Trucks

The largest document to be presented to the meeting is the report of the committee on Federal and municipal transportation. This discusses the public service uses of electric vehicles and illustrates a large number of trucks in municipal service of all kinds.

The report of the standards committee refers to the fact that the work of standardizing is being left, to a great extent, on the hands of the S. A. E., whose committee on electric vehicle standards consists mainly of members of the E. V. A.

Steel Standards for England

Automobile Engineers Establish Ten Standard Specifications As Official

LONDON, May 4—In December, 1914, a meeting was held by the Institution of Automobile Engineers and an invitation was issued to all those interested in the manufacture of steel as far as it concerns automobile engineering. At this meeting a paper was read by L. H. Pomeroy emphasizing, among other things, the need for a reduction in the number of steels then in use in automobile construction and also for a better understanding between automobile engineers and steel makers.

A good deal of interest was aroused among the steel manufacturers and stampers, and the outcome of the meeting was the appointment of a committee consisting of steel manufacturers, drop forgers and automobile engineers. As a result of less than twelve months' labor this committee has suggested a series of ten standard steel specifications for use in automobile construction, and these specifications have now been finally approved by the engineering standards committee of Great Britain and are being issued by that body.

A Paper Read

At the meeting of the Institution of Automobile Engineers held May 10, L. H. Pomeroy, who has acted as chairman of the committee mentioned above, read a paper dealing with these specifications, setting forth the reasons which led to the adoption of the particular steels chosen and specifying the uses to which each of the steels may be put. The British steel specifications will be published in THE AUTOMOBILE as soon as details are available.

Armored Trucks N. Y. S. A. E. Subject

NEW YORK CITY, May 17—The Armored Motor Truck will be the subject of the evening at a meeting of the Metropolitan Section of the Society of Automobile Engineers to-morrow night in the plant of the International Motor Co., West End Avenue and Sixty-fourth Street, this city. In connection with the meeting several armored cars will be shown and General Wood has appointed Captain Kilbourne of the general staff to represent the army.

S. A. E. in N. Y. Preparedness Parade

NEW YORY CITY, May 13—The Society of Automobile Engineers in this city was represented in to-day's Preparedness parade, in which over sixty trades and professions took part. The automobile engineers marched in section 8 of the engineering division of the parade together with the chemical, municipal and aeronautical engineers. The automobile engineers marched in two platoons led respectively by Herbert Chase and Leonard Kebler. This contingent was preceded, as were other contingents, by suitable standards bearing the words "Automobile Engineers." Among those who marched were: J. A. Anglada, A. C. Bergmann, J. R. Cautley, Herbert Chase, C. F. Clarkson, Ferdinand Jehle, Leonard Kebler, N. B. Pope and E. H. Stickles. Other automobile engineers who were assigned to other divisions in the parade were Howard Coffin, Prof. F. R. Hutton, H. M. Swetland, H. C. Wilson, Azel Ames and W. A. Roberts.

Mid-West Section Meets June 2

NEW YORK CITY, May 15—The second quarterly meeting of the Mid-West Section of the Society of Automobile Engineers will be held June 2 at the Chicago Automobile Club, Chicago, the meeting starting at 8 p. m. W. B. Stout of the Scripps-Booth Co. will present a chalk talk dealing with the relation of art to the automobile, and Henry Farrington of the Jeffery company will give data on motor trucks.

E. B. Blakeley, a mechanical engineer who has been experimenting with small stationary engines which are operated by combustion from compression only, will give a demonstration on how to develop power from any fuel.

Jewett To Address Detroit S. A. E.

DETROIT, MICH., May 13—D. McCall White, chairman of the Detroit section of the Society of Automobile Engineers, announces that the principal speaker at the next meeting of the section, which is to be held on May 17, will be H. M. Jewett, president of the Paige-Detroit Motor Car Co. Mr. Jewett's topic will be, "What Proportion of His Parts Should the Car Manufacturer Make?" Dealing with a most important phase of modern production, it is expected that a record attendance will be on hand.

Hambach Is Shakespeare Engineer

KALAMAZOO, MICH., May 12—Ernest Von Hambach, formerly with the Sunderman Safety Carburetor Corp., Newburgh, N. Y., is now in charge of the engineering department of the William Shakespeare Co., manufacturer of carbureters.

Brown Scripps-Booth Asst. Sales Mgr.

DETROIT, MICH., May 11—W. I. Brown, former supervisor of districts for Dodge Bros., has been appointed assistant sales manager of the Scripps-Booth Co., of which W. B. Stout was recently made sales manager.

Webber a Maxwell Vice-Pres.

6500 Cars a Month Being Built —Year's Output Is Estimated at Over 65,000

DETROIT, MICH., May 10—Orlando F. Webber, assistant general manager of the Maxwell Motor Co., has been elected a vice-president of the company in addition to retaining his previous connection. Mr. Webber has been a figure in the automobile industry since its inception and joined the Maxwell organization in April of last year.

The Maxwell company has declared its regular dividend of 1¾ per cent on the first preferred stock, but no action has been taken on the second preferred. Manufacture of Maxwells is running at the rate of about 6500 cars per month at the present time, and it is estimated that the production for the current fiscal year will be between 65,000 and 75,000 cars, as compared with 32,000 last year. About 300 cars per day are being turned out. Some $250,000 worth of improvements have been completed at the Detroit plants and an equal amount of money is to be spent at Newcastle, Ind., this fall. Sales are said to be running ahead of expectations, with dealers demanding about 15,000 more machines than they thought they would require when the schedules were made up last July. It is stated that about $5,000,000 will be earned this fiscal year, which closes July 31. This is sufficient for regular dividends upon the two preferred stock issues and about 27 per cent on the common.

30 per Cent of Military Cars in France Always Under Repair

PARIS, April 28—More than 30 per cent of the touring cars employed on military work are always under repair, according to a statement made by the Military Governor of Paris. This percentage, which is considerably higher than in any civilian service, is accounted for by the strenuous nature of military service, unnecessarily hard driving, and lack of attention. As a remedy, the authorities have ordered that all drivers shall be allowed a minimum of half a day each week to thoroughly clean, examine and execute minor repairs to their cars. In addition, officers must insist on cars being washed every day, and allow time for this work. It is forbidden for cars to operate away from macadamized or paved roads. When officers have to reach posts situated across country, they must go by car to the limit of the made roads and complete the journey on foot. The average speed on made roads must be kept down to 18 miles an hour. It is difficult to believe that this speed restriction will be observed on long trips over well made and uncongested roads. At suitable intervals all cars must be sent to the workshop to be examined and put in order. This must be done even if no other car is available as a replacement: it is better that the officers should be without a car for half a day rather than allow defects to accumulate until the vehicle is irreparable.

A Service Book Used

When cars are on detached service the officers using them are given a service book, on presentation of which at any army depot they are able to get supplies and repairs. This book constitutes a record of all work done on the car and enables cases of neglect to be traced to the responsible party. Officers on isolated service having the use of an automobile are under an obligation to keep the captain of the group to which the car belongs constantly informed as to the place in which it is garaged, thus allowing him to inspect it at intervals. This will prevent any officer using a car until it is ruined and then returning it to the group for a new machine.

Taylor with Allen Pressure Co.

NEW YORK CITY, May 16—H. W. Taylor, former general manager of the General Motors Co., has become general manager of the Allen Pressure System Co., this city. His headquarters will be at the offices of the company at 1926 Broadway.

McCutchen President Ross Co.

DETROIT, MICH., May 13—C. G. McCutchen, formerly president of the American Gear & Mfg. Co., Jackson, has been elected president of the Ross & Young Machine Co. Mr. Ross, who has been identified with the automobile industry for the last twelve years, will devote his efforts to the furtherance of the business of the Ross Automobile Co.

Skiles, Ohio Tube Co. Head, Dies

SHELBY, OHIO, May 11—G. M. Skiles, president of the Ohio Seamless Tube Co., this city, died in this city on May 4. He was one of the original owners and incorporators of the tube works. In 1908, when the plant was purchased from the United States Steel Corp., Mr. Skiles was instrumental in forming a new company, and selling the stock in the institution.

He was born at Stowstown, Pa., Feb. 25, 1852.

Individual Tractor Tests Tabooed

NEW YORK CITY, May 18—The National Tractor Manufacturers' Assn., of which J. B. Bartholomew of the Avery Co., Peoria, Ill., is president, has decided that individual non-competitive plowing demonstrations do not come within the province of its committee for demonstrations. This information is imparted in a resolution which was adopted late last month. The resolution follows:

Resolved: That the association approve and ratify the action of the committee on tractor demonstrations in the selection of places, dates and circuit, and its refusal to sanction or attend other demonstrations;

That the association holds that individual non-competitive plowing demonstrations do not come within the province of the committee;

That we will make no tractor plowing demonstrations at any County, District or State Fair in the United States, except each manufacturer may exhibit in the County Fair in the county where its factory is located;

That where competitive demonstrations are not under the auspices of the committee and made by individual purchasers, no member of the association will bear any part of the expense of, or have any salesman or expert at, any such demonstration.

Morehouse with Redden Truck

DETROIT, MICH., May 13—Jay E. Morehouse, who was special sales representative of the Maxwell Motor Co., and formerly general sales manager of the H. A. L. company, Cleveland, has been appointed sales manager of the Redden Motor Truck Co., with headquarters at 676 Woodward Avenue. The Redden company builds the Redden Truck-Maker, an attachment for the Ford chassis.

Two Assistants for Hawley

DETROIT, MICH., May 11—The Puritan Machine Co. recently appointed G. Jacob and R. V. Burrell as assistants to E. W. Hawley, service manager. These appointments were necessitated on account of the extraordinary growth in the service department of the company, due to the acquisition of orphan car companies.

Mendel Is Rex Ignition Manager

NEW YORK CITY, May 16—E. H. Mendel, formerly on the staff of the Splitdorf Electrical Co., has joined the Rex Ignition Mfg. Co. in the capacity of general manager. Mr. Mendel's headquarters will be in the New York office at Fifty-eighth Street and Eighth Avenue.

Fox Joins Wetmore-Quinn Co.

DETROIT, MICH., May 13—C. S. Fox, formerly director of service for the old Lozier Motor Co., has formed a connection with the Wetmore-Quinn Co., Detroit distributors for Paige-Detroit and Saxon cars.

Studebaker Boosts Production

16,952 Cars Sold in Quarter Ending March 31—5700 Dealers

DETROIT, MICH., May 13—Although the Studebaker Corp. established a new production record for the first quarter of this year, it is said that the present three months are certain to far surpass the previous period from the standpoint of production and sale of cars.

Sales of Studebaker cars for the first quarter ending March 31 were 16,952 machines, as compared with 9400 for the same period the previous year, an increase of 75 per cent, and this will be greatly outdone this quarter. The completion of the new $1,000,000 factory extensions will be a considerable factor in enabling the Studebaker concern to increase its output for the present quarter, and the easing up of the freight situation is expected to make it possible to ship all the cars that can be built.

With the largest selling organization in its history, numbering 5700 dealers, the problem of distributing this year's output will not assume any great difficulty.

Studebaker Corp. of Canada Formed

OTTAWA, ONT., May 16—The Studebaker Corp. of Canada has been incorporated here with a capital of $400,000.

Standard Steel Car Starts Building

PITTSBURGH, PA., May 15—The Standard Steel Car Co., this city, has broken ground for a new plant which will be over ½ mile long and 60 ft. wide. This is to be the assembly department and is to be without a single inside post or pillar through its whole length.

One of the buildings, heretofore used in another line of manufacture, has been transferred to the automobile department for the manufacture of axles. Contracts have also been let for two additional buildings, one of which is 280 ft. long and 60 ft. wide and four stories high, while the other is 320 ft. long, 60 ft. wide and two stories high.

Jeffery to Add Two Buildings

KENOSHA, WIS., May 13—The Thomas B. Jeffery Co., this city, will add two shop buildings to its plant at Kenosha, Wis., this summer. Plans for the new structures are being rushed to completion by a firm of Chicago architects. Work will be started first on a new foundry. This building will measure 125 by 600 ft., will be one story high and of reinforced concrete. The roof of the building will be so constructed as to make smoke and gases a negligible quantity inside. It will be built saw-tooth style, with the windows so arranged as to open automatically at intervals.

The other building planned by the Jeffery company will be five stories high and of concrete. It will be devoted exclusively to the manufacture of car bodies and will contain modern kilns for seasoning the lumber used. Jeffery manufactures its own bodies. The Jeffery company has 3080 men on its payroll, and this force will be increased soon. At present the Jeffery plant occupies 101 acres, of which 26 acres are under roof.

Grant Awards Plant Contract

CLEVELAND, OHIO, May 16—The general contract for the first factory unit of the new plant of the Grant Motor Car Co. to be erected in this city on a tract purchased last week was awarded yesterday to the Walther Engineering Co. The site, which is located at Colt and Kirby roads, is seven acres in area. The plans for the new factory structure, which were filled at the city hall yesterday, are by the W. S. Ferguson Co. Its estimated cost is $135,000.

Packard Acquires Krit Plant

DETROIT, MICH., May 12—The Packard Motor Car Co. has acquired the plant formerly occupied by the Krit Motor Car Co., which adjoins the Packard property on East Grand Boulevard. This plant has been vacant since the Krit concern failed some time ago, and the ground has a frontage of 300 ft. with a depth of 600 ft. The factory buildings are three- and two-story structures of brick. Packard has made no decision as to what it will do with the property,·but will probably be used for future expansion.

Standard Tube on Eight-Hour Schedule

TOLEDO, OHIO, May 12—The Standard Steel Tube Co. has reduced its working hours to eight per day, and has raised the wages of its 400 employees 20 per cent over what they are now receiving, this to take effect to-day. During the summer months the men will work forty-five hours per week, and beginning Sept. 1 and continuing through the fall and winter months, the total week's work will consist of forty-eight hours.

U. S. L. Make Additions to Plant

NEW YORK CITY, May 15—The United States Light & Heat Corp. will produce in the next twelve months considerably over 300,000 U. S. L. batteries. Additions are now being made to its plant at Niagara Falls to take care of this increased demand.

A Body Plant for Detroit

Springfield Body Co. Buys 29 Acres and Will Erect a Factory

Detroit, Mich., May 12—The Springfield Body Corp., at present located at Springfield, Mass., and manufacturer of convertible bodies, is soon to have a factory here. To-day a 29-acre tract of land was secured on Michigan Avenue, in the Springwells district of the city, and convenient to railroad lines. A modern fireproof factory is to be begun immediately, although details of the structure are not yet available.

Reo Buys 7 Acres More

Lansing, Mich., May 13—As an indication of the buildings and extension activities which the Reo Motor Car Co. has in contemplation, additional property has been acquired along the Grand Trunk railroad tracks adjacent to the Reo concern's main plants here. The tract is 7 acres in extent, and will provide room for greatly enlarged facilities, although no announcement as to what disposition will be made of the new property has yet been given out. This is the second large block of land that Reo has acquired within the last few months here.

8-Hr. Day for Garford Employees

Elyria, Ohio, May 13—Eight hundred employees of the Garford Mfg. Co., this city, went on an 8-hr. day schedule May 11, instead of the previous 10-hr. schedule. It is announced that time and a quarter will be paid for the ninth hour, time and a half for the tenth hour and double time over the former regular day's schedule. Employees working on piece work will receive a raise equivalent to 7½ per cent.

To Reopen Republic Rubber Plant

Youngstown, Ohio, May 11—T. L. Robinson, president of the Republic Rubber Co., Youngstown, makes the announcement that the plant will be reopened in a few days. The plant was closed down about two weeks ago by labor troubles. He claims that many of the employees are anxious to return to work. State mediators are trying to settle the differences.

Monroe Buys Land in Pontiac

Pontiac, Mich., May 13—In line with its proposed expansion, the Monroe Motor Co., at present located in Flint, but which will soon move to this city and occupy the factory buildings formerly used by the old Welch company, has purchased a plot of land having a 596-ft. frontage on Saginaw Street adjoining the former Welch plant property. This purchase will enable the Monroe company to put in sidetracks to its property from the D. G. H. & M. tracks at Foote Street and will provide for any later additions to plant.

Continental Buys 7 Acres

Muskegon, Mich., May 12—With a view to future expansion, the Continental Motors Co. has increased its real estate holdings here by buying a 7-acre tract on the lake front, which land is at present occupied by a lumber and fuel firm. This new land will give Continental plenty of room to spread out for some years to come.

Fisk Grants 8-Hr. Day

Chicopee Falls, Mass., May 13—The employees of the Fisk Rubber Co. have been granted an eight-hour day with five hours on Saturday. Time and a half will be given for overtime work. This comes as a result of a strike, started in March. The strikers will meet in the near future to decide on the company's proposition.

Hupp Joins Emerson Motors

Detroit, Mich., May 12—R. C. Hupp, who organized the original Hupp Motor Car Co., and later left it to head the R-C-H-Corp., and after the latter's failure organized the Monarch Motor Car Co., has become identified with the Emerson Motors Co., a Delaware corporation which proposes to manufacture a five-passenger car to sell at about $395. This concern will be located in the East.

Komp Elected Lansden President

New York City, May 15—F. S. Komp, formerly secretary and purchasing agent of the Lansden Co., this city, has been elected president and treasurer of the company, succeeding A. G. McLaughlin. W. R. Garton becomes vice-president and general sales manager and N. A. Burgess, secretary. Mr. Garton is also sales engineer, with offices at 299 Broadway, this city.

Somerville with Republic Truck

Alma, Mich., May 16—W. A. Somerville, who for some years was advertising manager of the Rapid Motor Truck Co., Pontiac, Mich., and who later held a like position with the Stromberg Motor Devices Co., Chicago, Ill., has been appointed advertising manager of the Republic Motor Truck Co.

M. & W. Co. Plans Concentration

Buys Tract of Land 500x400 Ft. Adjoining Present Plant

Detroit, Mich., May 12—Morgan & Wright, subsidiary of the United States Rubber Co., and large manufacturer of automobile tires, has taken a step looking to the concentration of the tire making operations of the concern here by the acquisition of a block of land on Jefferson Avenue with a frontage of 500 ft. and depth of 400 ft. This adjoins the present large factories of Morgan & Wright and was bought from the Michigan Steel Boat Co., whose factory buildings now occupy the site. The purchase price is not known, but real estate men here state that it has a value of $350,000. The tire manufacturing concern does not take possession of the property until January, 1917, by which time the boat manufacturer will have completed another plant.

Leather Firms in $1,500,000 Merger

Newark, N. J., May 11—Two of the oldest patent leather companies in this city have merged into the General Leather Co., with a capital of $1,500,000, to manufacture automobile and carriage leather. The concerns merged are E. S. Ward & Co., and the Hugh Smith Co. A large plant will be erected, starting next week, adjoining the Ward plant, and when finished, will employ 500 persons.

To Split Up Overland Shares

Toledo, Ohio, May 16—The Willys-Overland Co., this city, will shortly split up the common stock into shares of $25 par value, as reported in a previous issue of The Automobile. This will mean that instead of 210,000 shares of $100 par value, there will be outstanding 840,000 shares. According to information given out, the Secretary of State of Ohio has granted the company's application for the procedure, and the change will be made before July 1. The chief purpose of the quadrupling of the number of shares, without disturbing the amount of capital, will be to bring about a greater elasticity in the market for Overland stock.

Moreland Double Shift a Success

Los Angeles, Cal., May 12—The double shift system recently inaugurated at the Moreland Motor Truck Co. of this city in the machine and service departments is proving a great success, and the system is soon to be adopted throughout the entire factory.

7417 Cars and Trucks Exported in March—Valued at $8,636,118

Value of 1878 Trucks Totaled $4,909,179, While the 5539 Passenger Cars Were Worth $3,726,939—Gain of 539 Trucks and 3110 Passenger Cars

WASHINGTON, D. C., May 12—The popularity of American-built cars and trucks is growing all the time in foreign climes, as the latest government statistics vividly show. During the month of March last, according to figures compiled by the Bureau of Statistics, 1878 commercial cars, valued at $4,909,179, were shipped abroad, as against 1339 commercial cars, valued at $4,725,563, exported during the corresponding month of last year. The exports of passenger cars increased from 2429 cars, valued at $1,958,302, in March, 1915, to 5539 cars, valued at $3,726,939, in March last, while the exports of parts, not including engines and tires, increased from $762,386 to $1,858,247 during the same periods.

The figures for the nine months' period ended March show astounding increases in exports. It will amaze many to learn that during the nine months ended March, 1916, there were 38,795 passenger cars, valued at $29,261,446, exported to all parts of the globe, while during the same period of last year the exports totaled 11,563 cars, valued at $9,551,731. Exports of commercial cars also show a remarkable gain from 6313 cars, valued at $18,737,487, during the nine months ended March, 1915, to 16,345 cars, valued at $43,638,900, during the corresponding period of 1916. During these periods the exports of parts, not including engines and tires, rose in value from $4,116,608 to $16,823,607.

It is interesting to trace the different parts of the world to which these tremendous shipments of automobiles went during the periods under consideration. Of course, the warring nations in Europe are importing thousands of cars, but other sections of the world are also beginning to buy American-built cars at a rate that must be pleasing to every manufacturer who is looking into the foreign field.

Looking over the statistics, one finds that France imported 948 cars, valued at $2,405,437, from this country in March last, as against 460 cars, valued at $1,918,053, imported during the same month of last year. During the nine months' period these exports increased from 2896 cars, valued at $8,325,140, in 1915 to 5147 cars, valued at $13,203,663, in 1916.

The exports of cars to the United Kingdom fell off in March last as compared with the exports for the same month of last year, but during the nine months' period there was a big gain. In March a year ago 1566 cars, valued at $2,468,014, were exported to King George's islands, while in March last the number was 1367 and the value $1,711,672. During the nine months of 1916 no less than 16,107 cars, valued at $22,089,418, were shipped there, as against 6197 cars, valued at $8,915,029, exported during the same period of 1915.

Russia Buys More Cars

Russia, which is just beginning to figure in the export returns, bought twenty-eight cars, valued at $95,753, from this country in March last, while during the nine months ended March last the Czar's realm's purchases totaled 4596 cars, valued at $14,434,529. There are no figures for the comparative periods.

There were no exports of cars to Germany during any of the periods under consideration.

Denmark, in March last, came to the front with purchases of fifty-five cars, valued at $41,351, while during the nine months of 1916 the number was 524 and the value $356,256.

Forty-five cars, valued at $23,514, was the extent of Italy's importations from this country in March last, which is a considerable gain over the figures for the same month of last year, when the importations were twenty-three cars, valued at $13,273. A much larger gain is indicated in the nine months' figures, the exportations of cars increasing from sixty-five cars, valued at $48,385, in 1915 to 252 cars, valued at $169,658, in 1916.

The exportations of cars to countries designated as "other Europe" amounted to 410 cars, valued at $361,144, in March last, as compared with 431 cars, valued at $1,293,577, in March a year ago. During the nine months' period these exports fell from 1263 cars, valued at $3,594,223, in 1915 to 1350 cars, valued at $1,336,154, in 1916.

Canada's Big Gain

Canada bought 1016 American cars, valued at $751,457, in March last, while during the nine months' period of 1916 the purchases amounted to 5303 machines, the value of which was $3,785,265. This is a big increase over the figures for the same periods of last year, which were 345 cars, valued at $317,516, and 2072 cars, valued at $2,553,942.

South America continues to loom up strong as a buyer of American-built cars.

Exports of Automobiles, Trucks and Parts for March and 9 Previous Months

	March				Nine Months Ending March			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	2,429	$1,958,302	5,539	$3,726,939	11,563	$9,551,731	38,795	$29,261,446
Commercial cars	1,339	4,725,563	1,878	4,909,179	6,313	18,737,487	16,345	43,638,900
Parts, not including engines and tires	.....	762,386	.....	1,858,247	......	4,116,608	......	16,823,607
	3,768	$7,446,251	7,417	$10,494,365	17,876	$32,405,826	55,140	$89,723,953
By Countries								
Denmark	.....	....	55	$41,351	......	....	524	$356,256
France	460	$1,918,053	948	2,405,437	2,896	$8,325,140	5,147	13,203,663
Germany	4	2,800	.....	....	20	20,164	......	....
Italy	23	13,273	45	23,514	65	48,385	252	169,658
Russia	.....	....	28	95,753	......	....	4,596	14,434,529
United Kingdom	1,566	2,468,014	1,367	1,711,672	6,197	8,915,029	16,107	22,089,418
Other Europe	431	1,293,577	410	361,144	1,263	3,594,223	1,350	1,336,154
Canada	345	317,516	1,016	751,457	2,072	2,553,942	5,303	3,785,265
Mexico	9	4,861	65	45,895	58	59,635	291	284,421
West Indies and Bermuda	223	136,675	654	360,835	874	576,317	3,362	2,072,919
South America	205	96,599	.....	....	808	434,051	......	....
Argentina	.....	....	357	185,099	......	....	2,992	1,384,959
Brazil	.....	....	40	25,408	......	....	184	114,929
Chile	.....	....	39	27,352	......	....	579	400,741
Venezuela	.....	....	68	41,567	......	....	369	239,752
Other South America	.....	....	81	44,799	......	....	413	234,869
British East Indies	.....	....	267	205,795	......	....	2,126	1,606,196
British Oceania	284	252,212	785	648,529	2,164	1,788,803	4,790	4,052,446
Asia and other Oceania	132	115,366	706	1,313,160	946	1,559,043	3,997	5,180,887
Other countries	86	64,919	486	347,351	513	414,486	2,758	1,953,284
	3,768	$6,683,865	7,417	$8,636,118	17,876	$28,289,218	55,140	$72,900,346

Here are some of the telling figures: Argentina bought 357 cars, valued at $185,099, in March last, and during the nine months' period of 1916 the purchases amounted to 2992 cars, valued at $1,384,959. Brazil imported forty cars in March, the value of which was $25,408; during the nine months the importations amounted to 184 cars, valued at $114,929. Chile took thirty-nine cars in March, valued at $27,352, and 579 cars, valued at $400,741, during the nine months, while Venezuela bought sixty-eight cars, valued at $41,567, in March and 369 cars, valued at $239,752, during the nine months. "Other South America" imported eighty-one cars, valued at $44,799, in March last, as against 205 cars, valued at $96,599, for all of South America in March a year ago. Under this same heading 413 cars, valued at $234,869, were shipped during the nine months of 1916, as against 808 cars, valued at $434,051, for the whole of South America during this period last year.

Tremendous gains have also been made in the exports of cars to British East Indies, British Oceania, West Indies and Bermuda, and "other Asia and Oceania."

The accompanying table shows the detailed figures for the periods under consideration.

Pennsylvania Vacuum Cup and Ebony Tread Prices Reduced

NEW YORK CITY, May 13—The Pennsylvania Rubber Co., Jeannette, Pa., has made public a reduced list on its Vacuum Cup and Ebony Tread tires effective May 15, stating that this is made possible by improved manufacturing methods available in its new plant and by increased production. The reduction, however, is not general with other tire companies, none of them expecting a reduction. To the contrary, several of them predict a rise in the near future in view of the higher cost of raw material. This is offset in part by the statement from another large concern that changes of any nature are not likely until Sept. 1.

The old and new prices of the Pennsylvania company follow:

Size	Vacuum Cup Old	Vacuum Cup New	Ebony Tread Old	Ebony Tread New
30 x 3	$16.60	$14.20	$12.45	$12.05
30 x 3½	21.05	18.75	17.65	15.65
32 x 3½	24.05	20.75	19.15	17.65
33 x 4	33.75	29.25	25.45	24.80
34 x 4	34.85	30.30	26.30	25.75
36 x 4½	48.95	43.40	36.95	36.90
37 x 5	58.30	52.75	46.95	44.80

The Vacuum Cup style is guaranteed for 6000 miles and the Ebony Tread style for 5000 miles. Prices of tubes remain unchanged.

Overland's Wage Schedule in Effect

TOLEDO, OHIO, May 13—The 20 per cent increase in wages and the 8-hr. day schedule at the plant of the Willys-Overland Co. became effective May 11. Nearly 18,000 factory employees are affected and $25,000 is added to the weekly payroll.

Abandon Gasoline Tax Idea

Munitions, Inheritance and Heavier Income Taxes Proposed

WASHINGTON, D. C., May 13—Following a conference between Secretary of the Treasury McAdoo, financial adviser of President Wilson, and Congressman Claude Kitchin, Democratic floor leader of the House, it was learned that a complete abandonment of the President's proposal to tax gasoline and other articles used in industry to raise money for preparedness was decided upon. The President himself has changed on this portion of his message to Congress and favors instead a munitions, inheritance and heavier income tax. Kitchin is reported to have told Secretary McAdoo he was pleased the President had decided to abandon the gasoline tax, as rural congressmen in particular are opposed to it.

It is reliably reported that the Federal Trade Commission will on June 1 make its report in connection with the investigation it has been making into the boosts in the price of gasoline. It is stated that the report will fix the responsibility for the increases.

Acme Wagon Builds Trucks

EMIGSVILLE, PA., May 12—A new commercial car has been placed on the market by the Acme Wagon Co., this city. At present the Emigsville plant is turning out the trucks in two sizes, ¾- and 1-ton capacities. The ¾-ton truck is equipped with a Wisconsin motor, Timken roller bearings, worm drive axle and heavy pneumatic tires. The 1-ton truck has a Continental motor, heavy-duty internal gear drive axle and solid rubber tires.

Both trucks have wide frames which bring the springs close to the wheels on the axle, reducing side sway and vibration and at the same time making it strong and durable. The bodies for the trucks will be made up special as to size and style to suit the purchaser and for the purposes intended. E. K. Emig is the president of the company.

Packard Gets Big Truck Order

DETROIT, MICH., May 15—The Packard Motor Car Co. made a record in filling an order for fifty-six 3-ton army trucks, received from the War Department at 3 p. m. Sunday. Immediately all available men were pressed into service, and by 7 p. m. the trucks were loaded on cars and only awaited final shipping instructions in order to be on their way to Fort Sam Houston at San Antonio, Tex. The order called for the fitting of the regulation army transfer bodies and painting them the standard olive drab that characterizes all army equipment of the kind. The Packard company had anticipated the order to the extent of having made a number of the bodies in advance, so that the trucks left Detroit with only the paint wet.

The Government pays Packard $186,425 for these trucks, and this is the third order received. Included in the order was a requirement that eighty-two able-bodied men be furnished. The trucks required two special trains, and on each train there must be one truckmaster, three assistants, one expert mechanic, one assistant mechanic, thirty-three drivers and two cooks. On reaching Fort Sam Houston all will be enlisted in the army.

Manufacturers Plan Employers' Union

NEW YORK CITY, May 17—One of the points brought out at the convention of the National Assn. of Manufacturers in session yesterday at the Hotel Astor, was the need of an association of all American employers of labor to represent capital and dealings with the American Federation of Labor. The great idea in this project is to reach a solution of the ever-recurring quarrels between capital and labor interests. The plan is at present only vaguely outlined, but includes a central bureau in which statistics and data on strikes and similar industrial matters will be maintained and which will employ experts in the study of industrial legislation.

The association also considered means of credit for foreign business and went on record in favor of the draft acceptance system as opposed to the open account.

Packard Prepares Aviation Field

DETROIT, MICH., May 16—Following the recent tests on the Sheepshead Bay track of the smaller of the new aeroplane motors developed by the Packard Motor Car Co., it is of interest to note that before long Packard will be able to test its aircraft motors on its own aviation field near Mt. Clemens, Mich. Work of removing trees, filling in low places, in general, grading and smoothing the field, is well under way. Practical tests of the first large aircraft motor manufactured by Packard, which, by the way, is considerably larger and more powerful than the one which was tested in a car at Sheepshead Bay, will take place early in July. These tests will be made with a Sloane aeroplane of the tractor type. The larger motor is said to develop 300 hp., has approximately 900 cu. in. piston displacement and is built exactly like the smaller motor, except on a larger scale.

Overland Sales Gain 174% for Year

Willys Re-Elected President—Other Officers Re-elected —900 Cars a Day

TOLEDO, OHIO, May 12—The regular annual meeting of the stockholders of the Willys-Overland Co. was held here recently, in conformity with the new by-laws adopted last fall which changed the fiscal year from closing June 30 to Dec. 31. Hereafter the annual meeting will be held the second Tuesday in May.

At this meeting all of the old officers were re-elected. John N. Willys was re-elected as president; H. T. Dunn, vice-president; H. L. Shepler, vice-president; Isaac Kinsey, vice-president; C. A. Earl, vice-president; Walter Stewart, treasurer, Royal R. Scott, secretary. The board of directors consists of these officials and James Kepperly and Rathbun Fuller.

One of the interesting features of the meeting was the report that Overland shipments for the twelve months ending April 30, this year, were 137,665 cars, as compared with 50,258 cars for the preceding year, an increase of 174 per cent. The largest single month of the twelve prior to April 30, 1916, was that in which 19,781 cars were shipped, as against 7005 for the largest month of the previous year.

But even with this striking increase, the Willys-Overland Co. had on hand May 1 orders for 11,301 cars, as compared with 4527 on order on May 1, 1915. The foreign business, in spite of the war, also has shown a great jump over a year ago. Total exports, all models, for the 1915 season were 2331 cars, whereas, up to May 1 this year, export sales totaled 9867 cars, with unfilled orders for 977 more. Had it not been for a lack of ocean shipping facilities, it is thought that this total could readily have been increased approximately 2000 more.

It is said that shipments are now averaging close to 900 cars a day, and that when the last of the new buildings now under construction is completed the output will be raised to 1000 cars daily.

The latest unit of the Overland group is a 500,000 sq. ft. structure that has just been completed. The building, known as No. 49, is five stories high and built of reinforced concrete throughout, and is one of the largest of the many Overland structures. The entire amount of space will be given over to the manufacture of closed cars, a branch of the business that has surprised the officials by its growth. The first and second floors will be used for final testing, the third for parts assembly, the fourth for painting and trimming of closed cars and the fifth for the making of tops and trimming. Seven hundred power sewing machines are installed here, and this is the only department, outside of the administration offices, where women will be employed. Some 800 will be at work in this department.

L. O. Gordon Mfg. Co. Formed

MUSKEGON, MICH., May 13—The L. O. Gordon Mfg. Co. has been organized here by J. V. Whitbeck, chief engineer of the Chandler Motor Car Co., Cleveland; C. A. Carey, purchasing agent of the same company, and L. O. Gordon, formerly engineer for the Muskegon Motor Specialties Co. The new concern intends to make camshafts and other motor specialties, and will have an employed force of 100. The city of Muskegon is to erect a $10,000 plant, 46 by 177 ft., for the new concern, and it is expected that deliveries will start on Sept. 1.

Thelma Motor Co. Reorganized

ECORSE, MICH., May 10—The Thelma Motor Co. has been reorganized, the capital increased, and the name of the firm changed to the Robinson Machine Co., which company will engage in the manufacture of motor parts. Al. Robinson will remain as president and manager of the new company. The manufacture of Thelma marine motors has practically been discontinued.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum	.58	.58	.58	.58	.58	.58	...
Antimony	.36½	.36½	.35½	.34½	.34½	.34½	—.02
Beams and Channels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.29½	.30	.30	.30	.30	.30	+.00½
Copper, Lake, lb.	.29½	.30	.30	.30	.30	.30	+.00½
Cottonseed Oil, bbl.	10.95	10.90	10.86	10.75	10.85	10.83	—.12
Fish Oil, Menhaden, Brown	.54	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime	1.10	1.10	1.10	1.10	1.10	1.10	...
Lead, 100 lb.	7.40	7.40	7.30	7.50	7.50	7.50	+ .10
Linseed Oil	.74	.74	.74	.73	.73	.73	— .01
Open-Hearth Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Petroleum, bbl., Kan., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined	1.10	1.10	1.10	1.10	1.10	1.10	...
Rubber, Fine Up-River, Para	.69	.70	.71½	.71½	.71½	.71	+ .02
Rubber, Ceylon, First Latex	.73	.72½	.75	.75	.75	.71	— .02
Sulphuric Acid, 60 Baume	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	49.88	49.38	49.00	49.13	49.13	49.00	— .88
Tire Scrap	.05¼	.05¼	.05¼	.05¼	.05¼	.05¼	...

Corcoran-Victor Co. Formed

Cincinnati Lamp Cos., Merger Completed—Capital To Be $2,250,000

CINCINNATI, OHIO, May 13—The Corcoran-Victor Co., has been formed with a capital of $2,250,000, thus completing the merger outlined in THE AUTOMOBILE for April 16.

The merged companies will be under a single management and the new company will include the Corcoran Lamp Co., the Victor Lamp Co., and the Victor Auto Parts Co., all of this city. The stock of the new company consists of $750,000 preferred, of which $200,000 is retained in the treasury, and $1,500,000 common, some of which will be offered to the public. The five Corcoran brothers, T. J., who owned the Corcoran Lamp Co.; W. J. and E. B., who owned the Victor Lamp Co.; and J. L. and H. R., who owned the Victor Auto Parts Co., were paid in cash and stock in the new company.

Copper Prices Half Cent Higher

NEW YORK CITY, May 16—Electrolytic and lake copper went up ½ cent a pound to 30 cents last Wednesday. This market holds very firm, with an active domestic and foreign demand. Lead reached $7.50 per 100 lb., a 10-cent gain, while antimony dropped 2 cents to 34½ cents a pound. Rubber is still being maintained at a low level, both Para and Ceylon grades quoting at 71 cents a pound yesterday. Tin fluctuated this week, closing yesterday at $49 per 100 lb., a loss of 88 cents for the week.

Cottonseed oil dropped to $10.83 per barrel, at a loss of 12 cents, and linseed oil closed with a loss of 1 cent, the quotation being 73. The rest of the oils and lubricants and metals remained constant and steady.

Gasoline Prices Remain Unchanged—Another Fuel Substitute Announced

NEW YORK CITY, May 15—Gasoline prices along the Atlantic Coast remained unchanged last week. It is expected that the present quotations will stay at this level for some time. Sentiment in the trade indicates that crude oil quotations have about reached their highest level, although the belief that a decline is due has not gained any wide support. Oil interests expressed the opinion that the new production should prevent any further advances for some time to come, as they believe that the rise has been sufficient to cover growing consumption in large measure. It is recognized that the price of gasoline may rise, although crude quotations remain stationary, but it is said that until the price of crude goes up, the advance in gasoline will not be of large proportions.

Last month saw a decrease in new oil producing wells, the record for that month showing 94,938 barrels as against 152,020 in March. Wells to the number of 1580 were brought in as compared with 1383 in March.

One more fuel substitute has been announced, this one coming from Bloomfield, N. J. This is a white liquid and F. R. Blamey, a grain merchant, is the inventor. Mr. Blamey states that a teaspoonful of this liquid in 5 gal. of mixed kerosene and gasoline will form a practical fuel costing less than gasoline.

Out in Detroit the Reichenbach Laboratories Corp. has been formed with Lee Olwell, G. W. Durham, H. M. Reichenbach, Paul Weadock and H. D. Van Norman as directors. This corporation controls the Reichenbach patents for an automobile fuel system by reatomizing liquid fuel so that none reaches the cylinders in that form. It is said that a saving of some 50 per cent has been effected under test.

Demurrage of $5 a Car on New Haven

NEW YORK CITY, May 11—The New Haven Railroad has filed a new tariff with the Interstate Commerce Commission to be effective May 25, providing for a demurrage charge of $5 a car a day. This charge will be additional to the usual demurrage. This high fee has been deemed necessary because of the continued delay on the part of recipients of freight in taking their consignments from the cars.

Motor Stocks Show Strength

Overland and Chevrolet Reach New High Records—New Departure Up 27 Points

NEW YORK CITY, May 16—Exceptional strength and new high records featured the automobile and accessory securities on the local stock exchange last week. Expectation of large dividends and the healthy tone of the market were responsible for large gains in which Overland, General Motors, Chevrolet, Studebaker and New Departure figured prominently. New high records were made by Overland and Chevrolet. Overland rose to 270 on Saturday, going up 10 points for the day. The previous record was 268 last November. Overland stock has risen 30 points in three days. Chevrolet on Monday advanced to 228, a new high record. Studebaker common went up 8½ points to 141. Reports have it that Studebaker, during the first quarter of 1916, exclusive of its war order business, showed net income of approximately $2,500,000. New Departure rose to 217, a gain of 27 points, on the announcement that it was to be merged with four other accessory and parts makers into the United Motors Corp.

The United Motors Corp. stock, which was introduced to trading for the first time yesterday, sold at prices ranging from 66 to 74. It closed at 68½. According to Street reports, the stock was underwritten around 55.

General Motors showed considerable strength at 460, a gain of 35 points for the week and 9 points for the day. Apropos of the Studebaker common, sales for the day amounted to 16,000 shares. Maxwell common and first preferred each made good gains for the week, the first going up 3½ points and the latter 3⅛. Some disappointment was expressed in Wall Street circles over the failure of the directors of this company to declare a dividend on the second preferred stock at its meeting last Tuesday. Earnings of the company, it is stated, are running at the rate of approximately $5,000,000 net for the twelve months. On this basis the company is expected to show between 27 and 29 per cent earned on its outstanding common stock for the fiscal period.

On the Detroit Exchange Paige-Detroit, with its 175-point gain, was the feature. This company last week proposed declaring an 80-per cent dividend on its stock and also doubling its stock.

Alliance Tire Supt. Made Director

ALLIANCE, OHIO, May 12—W. H. Christensen, superintendent for the Alliance Rubber Co., this city, has been elected to the board of directors to fill the vacancy caused by the death of the late George C. Russell, who died in California, March 30. J. C. Shively succeeds Mr. Russell as president of the company. Milton Bejach is vice-president and general manager. The statement submitted to the directors and stockholders as of April 1 shows a 1500-per cent increase in business over the corresponding period of 1915. Tires and inner tubes are the chief lines of manufacture.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	66	67½	+1
Aluminum Castings pfd	98	101	..	..	..
J. I. Case pfd	80	88	87	90	..
Chalmers Motor Co. com	91	94	155	160	+5
Chalmers Motor Co. pfd	95	98	98	99½	+9
Chevrolet Motor Co	..	..	216	216½	+11
Electric Storage Battery Co	49½	51	60	63	+2
Firestone Tire & Rubber Co. com	490	..	830	860	+10
Firestone Tire & Rubber Co. pfd	110	112½	113	114	+1
General Motors Co com	128	129	460	480	+35
General Motors Co. pfd	97	98	118	119	—1½
B. F. Goodrich Co. com	40	42	77¾	78¼	+ ¾
B. F. Goodrich Co. pfd	101	102	115	115½	+1
Goodyear Tire & Rubber Co. com	244	248	380	385	—5
Goodyear Tire & Rubber Co. pfd	105	106½	105½	106¼	—3½
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	12½	13½	7	12	—2
International Motor Co. pfd	31	32	21	29	+1
Kelly-Springfield Tire Co. com	131	134	74¼	75	+1¼
Kelly-Springfield Tire Co. 1st pfd	83	86	97	99	+1
Kelly-Springfield Tire Co. 2nd pfd	130	140	..	..	..
Maxwell Motor Co. com	36	38	85½	86	+3½
Maxwell Motor Co. 1st pfd	78½	80	89½	90	+3⅛
Maxwell Motor Co. 2nd pfd	30	32	59	59½	+ ¼
Miller Rubber Co. com	180	188	255	270	..
Miller Rubber Co. pfd	104	105	115	..	..
New Departure Mfg. Co. com	106	..	217	221	+27
New Departure Mfg. Co. pfd	136	141	112	..	..
Packard Motor Car Co. com	103	..	165	170	..
Packard Motor Car Co. pfd	99½	..	100	104	..
Paige-Detroit Motor Car	..	..	750	850	..
Peerless Motor & Truck Corp	..	..	23½	24½	+ ½
Portage Rubber Co. com	35	38	85	88	..
Portage Rubber Co. pfd	85	88	107½	108½	..
Regal Motor Co. pfd	..	..	18	25	..
*Reo Motor Truck Co	14½	15½	29½	30½	+1
*Reo Motor Car Co	31	33	42½	44	+3¼
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	60	63	87	88	+2
Stewart-Warner Speed. Corp. pfd	102	104	109	..	..
Studebaker Corp. com	61	63	141	142	+8½
Studebaker Corp. pfd	97	99	109	112	+2
Swinehart Tire & Rubber Co	80	90	83	84	..
Texas Co.	121	123	192	194	+2
U. S. Rubber Co. com	60	61	55½	56	+2
U. S. Rubber Co. pfd	104	106	107	109	+2¼
Vacuum Oil Company	194	197	237	245	..
White Motor Co. (new)	..	..	49	51	..
Willys-Overland Co. com	109	111	264	270	+36
Willys-Overland Co. pfd	98	100	107	109	+3

*Par value $10.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Net
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	31	..	..
Chalmers Motor Co. com	..	92	158	160¼	—3¼
Chalmers Motor Co. pfd	95	98	..	100½	—1
Continental Motor Co. com	175	185	36½	37½	+ ¼
Continental Motor Co. pfd	83½	85½	..	10¼	..
Ford Motor Co. of Canada	700	..	390	410	+15
General Motors Co. com	128	130	415	..	..
General Motors Co. pfd	98	100	115½	118½	—1½
Maxwell Motor Co. com	35	39	83½	86½	— ¾
Maxwell Motor Co. 1st pfd	76½	78	88¼	91	+2
Maxwell Motor Co. 2nd pfd	31	32½	56	60	—1½
Packard Motor Car Co. com	103	105	185	..	..
Packard Motor Car Co. pfd	98	100½	100	104	..
Paige-Detroit Motor Car Co	..	..	950	1050	+175
*Reo Motor Car Co	32¼	33¼	43	44	+4
*Reo Motor Truck Co	14¾	15½	29¼	30¼	+1¼
Studebaker Corp. pfd	..	100	107	..	..
Studebaker Corp. com	61½	63½	134	137	+2¾

INACTIVE STOCKS

	1915		1916		Net
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	195	..	..	350	—15
*W. K. Prudden Co	19½	21	33¾	35¼	+2¼
Regal Motor Car Co. pfd	..	25	16	..	..

*Par value $10.

N. A. A. A. J. Holds Convention

New Standards of Business Practice Established and Reforms Instituted

HOT SPRINGS, VA., May 12—The National Assn. of Automobile Accessory Jobbers, a year old yesterday, closed its spring convention to-day after having instituted a number of reforms and set up a number of new standards for business practice.

The convention began Tuesday with committee meetings, which lasted Tuesday and Wednesday, and the general sessions were held Thursday and to-day, concluding at 1 o'clock this afternoon.

A number of additions were made to the list of jobbers that the association has prepared and several members were admitted to the organization. In order to carry out the reforms it has in mind, the association plans to employ an investigator, who will devote his time to securing necessary information. In the past Commissioner W. M. Webster has handled practically all of this detail, but with the growth of the association it is becoming too voluminous. The organization is in good financial condition, having $18,378.20 in the treasury.

Unethical Business Practices

The members were of the sentiment that it is not ethical business practice for a manufacturer to duplicate the product of another manufacturer who has spent money and effort in developing the product and building up a business in it. It was recognized that there are exceptional situations and that duplication may, in many cases, be legitimate, but the action of the association was aimed at piracy and guerilla warfare in business. The practice of cashing in on the advertising of the pioneer and doing no legitimate development or advertising was condemned.

The methods of manufacturers who send threatening letters to the trade in advance of any definite situation in patent litigation were condemned, and it was recommended to members that they do not follow this practice.

Advertising Problems

Advertising in the house organs of other manufacturers was considered unwise and injudicious and certain members said that they could see that harm came thereby to even the publisher of the house organ himself.

The sending of collect telegrams has in some quarters become an abuse, and the association recommended that the practice be restricted. Paying for these telegrams was said by one member to be nothing more than a cut in price.

Drawing parallels in advertising was construed as unethical business practice, and it was recommended that members avoid the use of any names in these comparisons. L. C. Reed of the Chamber of Commerce of the United States addressed the convention on the work of the organization he represents, and the jobbers voted to affiliate with the chamber.

Vice-President Joseph Bloch of the Gibson Co., Indianapolis, Ind., delivered an address on business practice.

A Credit Bureau

A credit adjustment bureau is to be established, the object of which will be to disseminate information regarding unsafe accounts.

Greater co-operation between the jobbers and the Motor and Accessory Manufacturers is to result from conferences which have been held and regarding which a report was made to the convention by President Sydney B. Dean, St. Paul.

The next convention is to be held in St. Louis the first week in October, and the dates probably will be Oct. 2, 3, 4 and 5. A committee was appointed to assist the retailing division of the trade in establishing better business methods and deriving greater profits from the retailing business. The chairman is H. R. Williams of the Gibson Co.

The traffic committee recommends a standardization of certain shipping packages, and plans to have parts and accessories entered in some freight classification, after which any rate adjustments will be taken up. At present the majority of accessory merchandise is classified as "Not Otherwise Specified."

Examinations for Special Agents

WASHINGTON, D. C., May 12—The date of examinations for special agents of the government to investigate the markets for motor vehicles in China, India, East Indies, Africa, and Australia has been set for May 19.

K. C. Dealers Find No Need for Used Car Auction Show

KANSAS CITY, MO., May 13—The Kansas City Motor Car Dealers' Assn. has abandoned its plans for holding an auction show for used cars—the committee appointed to investigate reporting that there was little occasion for such an event.

"The committee found that there is a comparatively small number of used cars in the city; that the advance in price and the scarcity of new cars have caused a stiffening of prices on the used cars, and that little could be gained by an auction and show," said Will Brace, president of the association.

Twelve Entries for Chicago

De Palma, Resta, Chandler, Johnson and Lewis on List for Derby

CHICAGO, ILL., May 16—*Special Telegram*—The class of the field for the Chicago Derby, June 10, has been heightened by the entry of DePalma, Resta and Oldfield to-day with DePalma's Mercedes, Resta's Peugeot and Oldfield's Delage. Three Crawfords also came in to be driven by Billy Chandler, Arthur Johnson and Dave Lewis. This brings the entry list up to twelve, and it is expected that before the entries close there will be in the neighborhood of forty cars named for the board track event.

If it is true that Barney Oldfield is to retire this year he will not go back to private life without having made an attempt to capture this race as a crowning glory and a fitting finish to a career which has been one of the most sensational in the annals of racing. Oldfield has announced his intention of accepting the challenge of David F. Reid, president of the Chicago Speedway Assn., who, as announced last week, has offered $1,000 to the driver who will break the world's 2-mile speedway record, with an additional $1,500 if better than 2 miles per minute.

$12,000 for Indianapolis Winner

INDIANAPOLIS, IND., May 15—Prize money totaling $30,000 in cash will be competed for at the coming race meet on the Indianapolis Speedway May 30. There will also be intermediate trophies added. The winner will receive $12,000; second, $6,000; third, $3,000; fourth, $2,000; fifth, $1,700; sixth, $1,400; seventh, $1,200; eighth, $1,000; ninth, $900, and tenth, $800.

Three Trophies

The trophies will be the Remy Grand Trophy and the Remy Grand Brassard, which will be awarded the driver of the car leading at 100 miles; the Prest-O-Lite Trophy, which will be awarded the driver leading at 200 miles, and the Wheeler-Schebler Cup, which will be awarded to the leader at the 250-mile post.

Six Events for Tacoma May 30

TACOMA, WASH., May 15—Six events are scheduled for the Decoration Day Tacoma Speedway race meet. Event No. 1 will be a 20-mile race for cars of 600-cu. in. displacement or under. First prize will be $75; second, $50; and third, $25. Event No. 2 is an outdoor automobile show and parade. Event No. 3 is a 10-mile race for cars of 230-cu. in. displacement or under. First prize is $50; second, $35; third, $15. Event No. 4 is a 30-mile race for cars of 600-cu. in. displacement or under. First prize is $125; second, $75 and third, $50. The other two events are a backing contest for women drivers and a women's exhibition driving contest for three laps of the track, approximately 6 miles.

For July 4 the Tacoma Speedway Assn. is arranging a program which will consist of one event for non-professional drivers, along the lines of the Chicago event on May 20. Besides this, there will be a match race between Ulysses Aubry, in a Tacoma-built car, and James Parsons of Seattle in a Stutz. This race will be put on in three heats, the first two being 35 miles each, and, if a third is necessary, it will be for 30 miles. The prize for this race will be $1,000.

For Aug. 5, there will be a 300-cu. in. race for 300 miles, with a purse of $10,000.

Two Trophy Races Scheduled for Twin City Track

MINNEAPOLIS, MINN., May 13—Entry blanks for the Memorial Day races at the Twin City Motor Speedway, Sanction No. 295, show two trophy races and altogether about $3,000 in purses. Motorcycle races are scheduled and an appearance of Ruth Law, woman aviator. The program is as follows:

No. 1. Class C, Div. V—Non-stock, 161-230 cu. in., 10 miles: $150, $75, $50, $25.

No. 2. Class C, Div. VI—Non-stock, 231-300 cu. in., 20 miles: $150, $75, $50, $25.

No. 3. Class E, Non-stock—Special, 10 miles, roadsters and touring cars, factory equipment, except tops, lamps, mud guards and windshields, for members M. S. A. A., *Daily News* troply, one year.

No. 4. Class D. Non-stock—Free-for-all, 50 miles: $1,000, $500, $200, $150, $100, $50.

No. 5. Class E, Non-stock—Special, Twin City racing cars, drivers and entrants, 10 miles. "Twin City" trophy, permanent when won third time by representative of same city.

No. 6. Non-stock—Free-for-all handicap, open to cars competing in one event of the day, 10 miles: $150, $75, $50, $25.

The management of the speedway is having the joints and rough spots rubbed down, and drivers who contested in the first race last year that have driven over the track this year find the concrete has weathered the winter well and that the course is in much better condition even than last fall.

Prices Are Lower

High prices that worked against a good attendance at the initial race, and which were criticized strongly, have been reduced. Fifty cents is general admission with bleacher seat. Automobiles will be parked free behind the stands with $1 charge for each occupant of cars parked in the circle inclosure and $1 for the car. Seats for the wire grandstand are $1 each, no charge for accompanied children under twelve.

Hupp Has School for Dealers

Most Practical Ways of Taking Care of All Adjustments to Be Taught

DETROIT, MICH., May 13—The Hupp Motor Car Co. has inaugurated a free educational course for Hupmobile dealers, service representatives and repairmen with the aim of informing them of the best and most practical ways of taking care of adjustments which necessarily come up in the use of an automobile. The course is in the nature of a correspondence school idea, and in the preparation of the plan, the Hupp concern has engaged the services of Claude Wadsworth, who originated, prepared and conducted the International Correspondence School Automobile shop course.

Eighteen instruction papers on automobile construction in general and Hupmobile construction in particular have been prepared by Mr. Wadsworth. The subjects to be taught cover every phase of car design, and will be presented in a concise form so they will be clear to the layman. Subjects to be dealt with cover: Automobile troubles; electric starting and lighting systems; ignition; carbureters; repair and adjustments; oxy-acetylene welding; automobile machine shop practice; automobile power plants; cooling and lubricating systems; clutch, control and change-speed mechanisms; tires; driving, assembly; factory work; materials; accessories; salesroom and garage management; data sheets, etc.

Twice during the year a series of questions will be sent to every student who enrolls and suitable prizes will be given those having the highest standing. In addition to the prizes offered, every man who passes the examination with 75 per cent or over will receive a certificate of efficiency from the Hupp company, which will serve as a recommendation for future employment.

Holds New York City Owners' License Bill Discriminatory

ALBANY, N. Y., May 16—Governor Whitman said to-night that he would not sign Assemblyman Kelly's bill, which would require every New York City owner of an automobile who operates his own car to take out an operator's license. Attorney General Woodbury told the Governor that the bill was unconstitutional. Its discrimination between persons, he said, amounted to a denial of the equal protection of the laws guaranteed by the Constitution. In his opinion Mr. Woodbury says:

"No owner of a motor vehicle whose residence is in New York City is permitted to operate or drive it unless he takes out a license. There being no restriction as to the place of operation, it would follow that he could not operate or drive it anywhere in the State without such a license, solely because of his place of residence. Upon the other hand, under the language of the act, any owner of a motor vehicle whose residence is outside of New York City may operate and drive it anywhere in the State, even in New York City, without a license, because no license is required of him.

"The right to operate and drive a car by its owner, with or without a license, is made to depend solely upon the owner's place of residence without regard to the place of operation. Thus people who are residents of New York City are discriminated against in the matter of this license requirement."

Reciprocity for New York and Canada

ALBANY, N. Y., May 13—Automobile license reciprocity between New York State and the Canadian province of Ontario will become effective within a few days as the result of the approval by the Ontario Cabinet to-day of the license exchange plan proposed to the provincial authorities some time ago.

Up to the present, New York automobilists have been obliged to take out an Ontario license before crossing the international boundary, and Ontario motorists were required to obtain a New York permit before they could bring their cars into the State.

Under the plan ratified by the provincial Cabinet to-day reciprocal rights to operate automobiles in each other's territory for a twenty-one-day period will be granted New York and Ontario motorists.

10,112 Cars in Quebec

MONTREAL, QUE., May 12—The returns prepared by the Automobile Bureau of the Provincial revenue for the year ending April 1, show that there were, up to that time 10,112 automobiles registered in the Province of Quebec. In past years nearly 75 per cent of the total number licensed were registered in the district of Montreal, but the figures for the past year indicate that the number of automobiles is much more evenly divided over the whole province than formerly.

Of the total of 10,000 in the province there are 8082 touring cars, 1055 run, abouts, 296 motorcycles, 132 limousines, 528 trucks, and nineteen surries. With the exception of eight propelled by steam and thirteen by electricity, all are driven by gasoline motors. In the districts of Montreal there are 4058 touring cars, six surries, 631 runabouts, 173 motorcycles, 121 limousines, and 425 trucks, most of the heavy commercial vehicles thus being employed in the city and district. Only one steam car and eight electric cars are operated, all the rest being gasoline driven.

Last year in the province there were 6825 passenger cars, 384 commercial cars, 205 motorcycles, and 137 dealers cars licensed, making a total of 7550, an increase of over 2500 motor vehicles in the year. There were over 70,000 cars in all the provinces of the Dominion. Ontario having five times as many cars as any other province. The figures for the last year just ended are not yet completed, but it is believed that the grand total of automobiles and motorcycles in the Dominion is not far short of 100,000 at present.

Expect 115,000 Registrations for Wisconsin This Year

MILWAUKEE, WIS., May 13—When the Secretary of State of Wisconsin issued license No. 79,790 on May 9, the total number of licenses issued during the year 1915 was equalled. Since then more than 4000 licenses have been issued, and by the end of May it is expected that the Wisconsin private owners' registry will have reached the 90,000 mark.

There seems to be no question that the 1916 registration will total 115,000, which would be approximately 35,000 in excess of 1915.

On March 1, the number issued was 21,000; on March 1, 1916, the number was 38,500. The figures for April 1 are: 1915, 30,000; 1916, 50,500. Thus it will be seen that during April alone, more than 25,000 cars were licensed. Dealer's licenses also show a large gain, the number issued on May 1 being 1745. The total revenue from automobile and cycle licenses for the first four months of 1916 was $406,557.

In 1912 the total registration of Wisconsin was 24,578. This number was passed on April 29, 1913. The 1913 total was 34,646, which figure was passed April 26, 1914. The 1914 total of 53,160 was passed April 26, 1915, and the 1915 total of 79,790 was passed May 9, 1916.

161,564 Registrations in Pennsylvania

YORK, PA., May 12—Revenue from automobile registration this year has passed the $1,700,000 mark and officials of the automobile division of the Pennsylvania State Highway Department believe that $2,000,000 will be reached. The total revenue for 1915 amounted to $1,665,276. The number of automobile registrations up to date are 161,564. It is believed that the total number will reach 250,000.

Robbins Pullman District Mgr.

DETROIT, MICH., May 10—P. L. Robbins, for two years connected with the sales department of the Paige-Detroit Motor Car Co., has been appointed district sales manager of the Pullman Motor Car Co., York, Pa., with headquarters in San Francisco.

Des Moines Business $12,000,000

$2,000,000 Average Stocks Carried by Car and Accessory Dealers

DES MOINES, IOWA, May 12—The annual volume of business done by the automobile trades industry of Des Moines is approximately $12,000,000, according to statistics compiled by the Des Moines Chamber of Commerce. The statistics show that the value of the average stocks carried by car and accessory dealers of the Iowa capital city is $2,000,000; the capitalization of the industry in Des Moines is $1,900,000; the number of men employed is 1000, and that the total of wages paid annually is $1,000,000.

The number of Des Moines concerns—corporations, companies, firms or individuals—engaged in the automobile industry is 111, and these are divided as follows: Cars, forty-three; accessories, thirty-seven; garages and repairs, twenty-one; oil, six; manufacturing, eleven. The classifications show some duplications, since some concerns are engaged in more than one line of business connected with the motor industry.

13,352 Cars Registered in California in April—171,755 in State

SAN FRANCISCO, CAL., May 3—The total number of cars registered in April was 13,352 against 8,321 for March. Five thousand and thirty-one more automobiles were registered in California during April than in March and the income to the State was $9,993.10 more.

The total receipts of the department to date are $1,857,492, and the total number of cars registered in California is 171,775.

Driver Liable for Damages

OMAHA, NEB., May 12—By a decision of the Nebraska supreme court, reversing that of the district court, the driver of a car concerned in an accident, who is at the time violating the provisions of the statutes, becomes liable for damages sustained by an innocent victim, even though such liability is not mentioned in the statutes.

The decision came in a case where a sixteen-year-old boy, driving his father's car at a reckless pace, collided with another machine, damaging it and injuring the driver.

Big Mileage by Maxwell Abroad

LONDON, ENGLAND, May 5—The performances of a Maxwell car in a series of mileage tests conducted recently at the Brooklands track near London during experiments with a new motor fuel were so satisfactory as to attract much attention. A mileage as high as 33.6 miles per gallon was obtained. Another test in which fuel of a different mixture was used resulted in a mileage of 32.8 miles. Hill climbing tests were made also. The purpose of the demonstrations was to determine the efficiency of Econo-mee, which is a mixture of a heavy grade vaporizing oil and ordinary gasoline.

Driving Without License Does Not Preclude Damage Claims

MILWAUKEE, WIS., May 14—Operating an automobile without a license does not preclude claims for damages in accident cases, according to the decision of the supreme court of Wisconsin in the suit of Eugene H. Derr against the Milwaukee road. Derr's car was struck by a train on Jan. 30, 1915. He was awarded $900 damages by a circuit court jury. The court in a memorandum found that Derr was illegally operating his car because he carried a 1914 license in 1915. This virtually set aside the verdict and Derr appealed to the supreme court, which says: "We find nothing in the statutes to indicate that the legislature intended to deprive a person who is injured while driving an unregistered car of the protection accorded to other travelers. To bar such an injured person from invoking his rights, it must appear that his violation of the law was a proximate cause of the injury." Judgment is ordered in favor of Mr. Derr as originally ordered by the jury.

4331 Cars in Denmark

COPENHAGEN, DENMARK, May 5—The number of automobiles in Denmark on Sept. 1, 1915, was 4331, with a combined horsepower of 35,229, as against 3430 machines at the corresponding period in 1914, with a total horsepower of 28,122. The first statistical information published by the Kingdom in regard to automobiles was in 1909, when there were only 682 machines in the country. Of the number of machines 3773 are for personal use. This number includes 1291 used for cab or omnibus service. Motor trucks number 558.

There were also on Sept. 1, 1915, 6347 motorcycles in use.

Twenty Pullman Cars Captured

YORK, PA., May 12—Word was received in this city several days ago that twenty touring cars, manufactured by the Pullman Motor Car Co., were on board a ship bound for Sweden which was captured by a man-of-war the other day. The steamer and crew were taken into port as a prize of war.

Track Race for Havana May 20

NEW YORK CITY, May 15—A race meet is scheduled for Havana, Cuba, on May 20 on a one-mile dirt track. Prizes will amount to $15,000.

Factory Miscellany

J and D Tire to Build—The J and D Tire & Rubber Co., Charlotte, N. C., will construct a two-story factory.

Oklahoma Tire Co. to Build—The South Western Tire Mfg. Co., recently incorporated in Oklahoma City, Okla., is planning to construct a plant which will cost about $200,000.

Akron to Build—The Akron Airless Tire Co. will construct a plant at Akron, Ohio, which will cost about $150,000.

To Make Signals—A plant for the manufacture of automatic automobile signaling devices will be equipped at Kansas City, Mo., by the Signalite Mfg. Co., recently incorporated.

Lancaster Tire to Enlarge Plant—The Lancaster Tire & Rubber Co., Lancaster, Ohio, will enlarge its plant. The estimated cost is $60,000.

Pearce Tire Plant Progressing—Work on the new plant of the Pearce Tire & Rubber Co., Ashtabula, Ohio, which is being erected at the foot of Benefit Street, is being rushed to completion. The factory will be two stories, 76 by 180 ft. The building will be absolutely fireproof, modern reinforced concrete, and faced with brick between the floors.

Detroit Crank Builds—The Detroit Auto Crank Co., Detroit, Mich., is to build a factory on Piquette Avenue.

Simplex Adds Foundry—The Simplex Automobile Co., New Brunswick, N. J., has awarded contracts for a new aluminum foundry.

Wis. Factory News—The Gas Traction Foundry Co., Minneapolis, Minn., is installing a 2-ton open-hearth furnace designed by David McLain, Goldsmith Building, Milwaukee, who recently started to make installations. The first is a 2-ton unit in the Sivyer Steel Casting Co., Milwaukee, a large producer of automobile castings for the manufacturing trade. The McLain furnace makes it possible to take five heats, or 10 tons, in 12 hr. The Sivyer company has made more than 200 heats in one month without relining or repairs of any kind.

The Gerlinger Steel Casting Co., West Allis, Milwaukee, a large producer of motor truck castings, is installing a 1½-ton Snyder electric steel furnace to replace a ½-ton unit installed for trial and demonstration purposes early this year. The experiment was so successful that a larger furnace has been found necessary to handle this class of business.

Vacuum Oil to Build—The Vacuum Oil Co. has purchased over 600 acres of ground at Lincoln Park, N. J., just opposite Philadelphia, and will build an oil refining plant, which, with piers, docks and trackage, is estimated to cost $3,000,000. The site was selected because of the large acreage, the condition of which is good, and because the Government is dredging that part of the Delaware River on which it is located. Three large tank ships are being built.

Capital Glass Begins Operations—The Capital Glass Co., Lansing, Mich., has begun operations here and will specialize in automobile glass.

Davis to Build—A. E. Davis, 258 East 138th Street, New York City, has drawn plans for a plant, 72 by 135 ft., to be used for the manufacture of automobile accessories. It will cost about $65,000.

American Trimming Co.'s Plant—Plans are being prepared for a five-story, 94 by 255-ft. factory for the American Auto Trimming Co., Berlin and Meldrum Street, Detroit, Mich. The estimated cost is $125,000.

McLean Tire Production Progressing—Officials of the McLean Tire & Rubber Co., Cleveland, Ohio, who are also officials of the M. & M. Co. of this city, said that the factory in East Liverpool has now been in operation two weeks and that the product is coming through in good shape. It is expected that the factory will be well up to capacity within a short time. W. B. Davis, in charge of the sales, has closed contracts with distributors in Detroit, Pittsburgh and some other important points and the distribution end of the business will soon be well organized.

The Automobile Calendar

ASSOCIATIONS

May 18—S. A. E. New York Section, May Meeting.

May 22-26—Chicago, Ill., N. E. L. A. Convention, Electric Veh. Section, Congress Hotel.

May 26-27—Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.

June 12-16—S. A. E. Summer Trip on Great Lakes.

July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.

Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

May 20—Chicago Non-Professional Speedway Race, Western Interclub Speedway Park.

May 30—Des Moines, Iowa, Iowa Derby, 20 miles; Des Moines Special, 10 miles.

May 30—Tacoma, Wash., 10, 20, and 30-Mile Races, Tacoma Speedway Assn.

May 30—Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn.

May 30—Indianapolis Speedway 300-Mile Rece.

May 30—Minneapolis, Minn., Speedway Race.

June 4—Sheepshead Bay Speedway, 30-mile Race, American Liberty Day Committee.

June 10—Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.

June 16-17—Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.

June 20—Galesburg, Ill., Track Race, 100 miles.

June 28—Des Moines, Iowa, Speedway Free-for-All, 300 Mile Race.

July—LaGrande, Ore., Track Race, LaGrande Motor Club.

July 4—Coeur d'Alene, Idaho, Race Meet, Hillier-Riegel Co.

July 4—Tacoma, Wash, Speedway Race, Tacoma Speedway Assn.

July 4—Minneapolis 300-Mile Speedway Race.

July 4—Sioux City Speedway Race.

July 15—Omaha, Neb., Speedway Race.

July 15—North Yakima, Wash., Track Race, Hillier-Riegel Co.

Aug. 5—Tacoma Speedway Race, Tacoma Speedway Assn.

Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.

Aug. 12—Portland, Ore., Track Race, Hillier-Riegel Co.

Aug. 18-19—Elgin Road Race, Chicago Auto Club.

Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.

Sept. 4—Indianapolis Speedway Race.

Sept. 4-5—Spokane, Wash., Track Race, Inland Auto Assn.

Sept. 16—Providence Speedway Race.

Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.

Sept. 30—New York City, Sheepshead Bay Speedway Race.

Oct. 7—Philadelphia Speedway Race.

Oct. 7—Omaha Speedway Race.

Oct. 14—Chicago Speedway Race.

Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.

Nov.—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

May 14-20—Milwaukee, Wis., Sheridan Road Week to Complete Highway Connecting Milwaukee and Chicago.

May 25—Pennsylvania's Second Good Roads Day.

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

MISCELLANEOUS

June 8—New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphans' Automobile Day Outing Assn.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.

July 24-28—Hutchinson, Kan., Tractor Demonstration.

July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.

Aug. 7-11—Fremont, Neb., Tractor Demonstration.

Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.

Aug. 21-25—Bloomington, Ill., Tractor Demonstration.

Aug. 28-Sept. 1—Indiana Tractor Demonstration.

Sept. 4-8—Madison, Wis., Tractor Demonstration.

Sept. 11-16—Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Iowa News—N. B. Robbins leaves the Double Tread Tire Co., Des Moines, for Fort Sam Houston, Texas, where he is mechanical superintendent of the school of instruction for the government aviation corps which is training flyers for the army work in Mexico.

An Iowa branch of the Studebaker Corp., Detroit, has been established in Des Moines with temporary headquarters on the second floor of the Schee Building, Fifth and Court Avenue. H. A. Haskell is general manager and H. H. Brown is in charge of the office. Repairs to the number of 50,000 are on hand for service to Iowa-owned Studebakers. A five-story building with a floor capacity of 87,120 sq. ft. will be built for permanent headquarters and as an assembling plant in Iowa for Studebaker cars. Site options have been secured.

The Ford Motor Co., Detroit, has bought a site for a branch factory in Des Moines and plans for the construction work are now in progress. It will be located at Nineteenth Street and Grand Avenue, near the center of the city and on trackage. A frontage of 233 ft. on Grand Avenue is afforded. The building is to be six stories high and will have half a million feet of floor space with a show room on the first floor and a front of architectural beauty to face the avenue. A force of between 250 and 300 men will be employed and the $5 a day, profit-sharing wage plan of the mother factory will be in force. The Herring Motor Co., Iowa Ford distributor, will continue to occupy its present location in a fine, large building recently constructed.

California News Items—The Master Carburetor Co. of California, Los Angeles, out of which grew the Master Carburetor Corp. of Michigan, has been merged with the organization of the East. The scope of the Los Angeles house will remain practically unchanged. The local branch acts as Pacific Coast distributer, taking care of the trade as far east as Denver. C. G. Harness, who has been in charge of the affairs of the local house for the past year, remains as manager of the Los Angeles branch.

C. S. Anthony, Los Angeles, one of the pioneers of the automobile industry in California, has been appointed Southern California and Arizona distributer of the Signal truck. The commercial vehicle will be carried in conjunction with the Glide line which has been controlled by Anthony in California for the past year.

Trade Happenings

E. J. Bennett, Los Angeles, has been appointed sales manager of the Empire Motor Sales Co., Los Angeles. Bennett has been in the automobile field in Southern California for more than ten years. In 1905 he had the agency for the Wayne and Peerless and was located on Seventh and Broadway, which is the very heart of the business center of the city to-day.

The Stone-Pierce Dancy Motor Sales Co., 1911-13-15 West Seventh Street, Los Angeles, has taken over the Kelly-Springfield motor truck as distributor in Southern California and Arizona. In addition to the truck agency, the company operates a service station, and a feature of the garage is a set of lock stalls for the storage of privately owned touring cars. The keys to these lock stalls are turned over to the patrons, who know their cars will not be tampered with and that they will not be backed into by other cars in the garage.

New England Trade Items—An agency for the Scripps-Booth line has been placed at Springfield, Mass., with the Springfield Automobile Co.

C. W. Woodbury has been placed in charge of the new Packard annex for trucks and used cars at Providence, R. I.

T. F. Russell has taken the agency for the Inter-State line at Springfield, Mass.

The Gilson Auto Co., agent for the Mitchell at Portland, Me., has just moved into new salesrooms under the Lafayette Hotel, in the heart of the city.

W. C. Goodchild, for some years at the Metz factory, has been promoted to take charge of the Providence (R. I.) branch of the company.

G. Lawrence Ertz, for a long time at New Haven, has accepted a position with the Boston (Mass.) branch of the Locomobile Company, handling Riker trucks.

M. D. Stebbins has taken the Bell line for central Massachusetts, with headquarters at Springfield.

Pugh Brothers have taken the Bessemer truck line for Rhode Island, with headquarters at Providence.

The New England Whip Co., of Westfield, Mass., that has the New England distribution of Munroe cars, has opened salesrooms at Boston at 926 Commonwealth Avenue.

J. J. McCarthy, who looks after Lozier interests at Boston, Mass., has taken on the Ross car for that city.

F. H. Chapman, who has handled the Ford line in central Massachusetts for the past two years, has received word that the factory intends to make Springfield, Mass., a factory distributing center for that territory beginning next November. The company intends to erect a service station to take care of the business in the section for a radius of some miles. With the big Overland service station here it will make Springfield a big motor distributing center for small cars.

Northwest Items—The Chandler line of machines is again established in the State of Oregon; the Gerlinger Motor Car Co. has secured the agency for Portland, the State of Oregon and ten southern counties of State of Washington.

P. A. Berry has been appointed sales manager of the Premier Motor Car Co., Indianapolis, on the Pacific Coast and Hawaii, and will have offices in San Francisco. Mr. Berry was formerly sales manager of Pacific Car Co., Tacoma, Wash.

R. E. Pemberton, manager Northwest Auto Supply Company, Spokane, has secured the agency for the Empire line for the Inland Empire.

Lewiston Hardware Co., Lewiston, Idaho, has secured the agency for the Chevrolet line and opened a garage and service station.

William Gollehon and C. E. Moore of Colfax, Wash., have formed a partnership to handle the Overland and Willys-Knight lines in Whitman County.

Riouth & Johnson, Colville, Wash., have taken the agency for Saxon line.

The Portland Tire Store has opened in Portland, Ore., and will handle Blackstone tires. R. F. Strong is manager.

Marko Establishes N. Y. Branch.—The Marko Storage Battery Co., Bedford Avenue, Brooklyn, has opened a branch at 974 Eighth Avenue, New York, under the name Marko Storage Battery Depot of New York, Inc.

Brown with Scripps-Booth—W. I. Brown, former supervisor of districts for Dodge Bros., has been appointed assistant sales manager of the Scripps-Booth Co.

Takes on Metz in Owensboro—The Ames Motor Car Co., Owensboro, Ky., with A. Reis Meyer as sales manager, has been appointed distributor for the Metz 25 five-passenger touring car and roadster, for Kentucky and Southern Indiana.

Mr. Meyer will also have charge of the sales and distribution of the Ames motor car and motor car accessories.

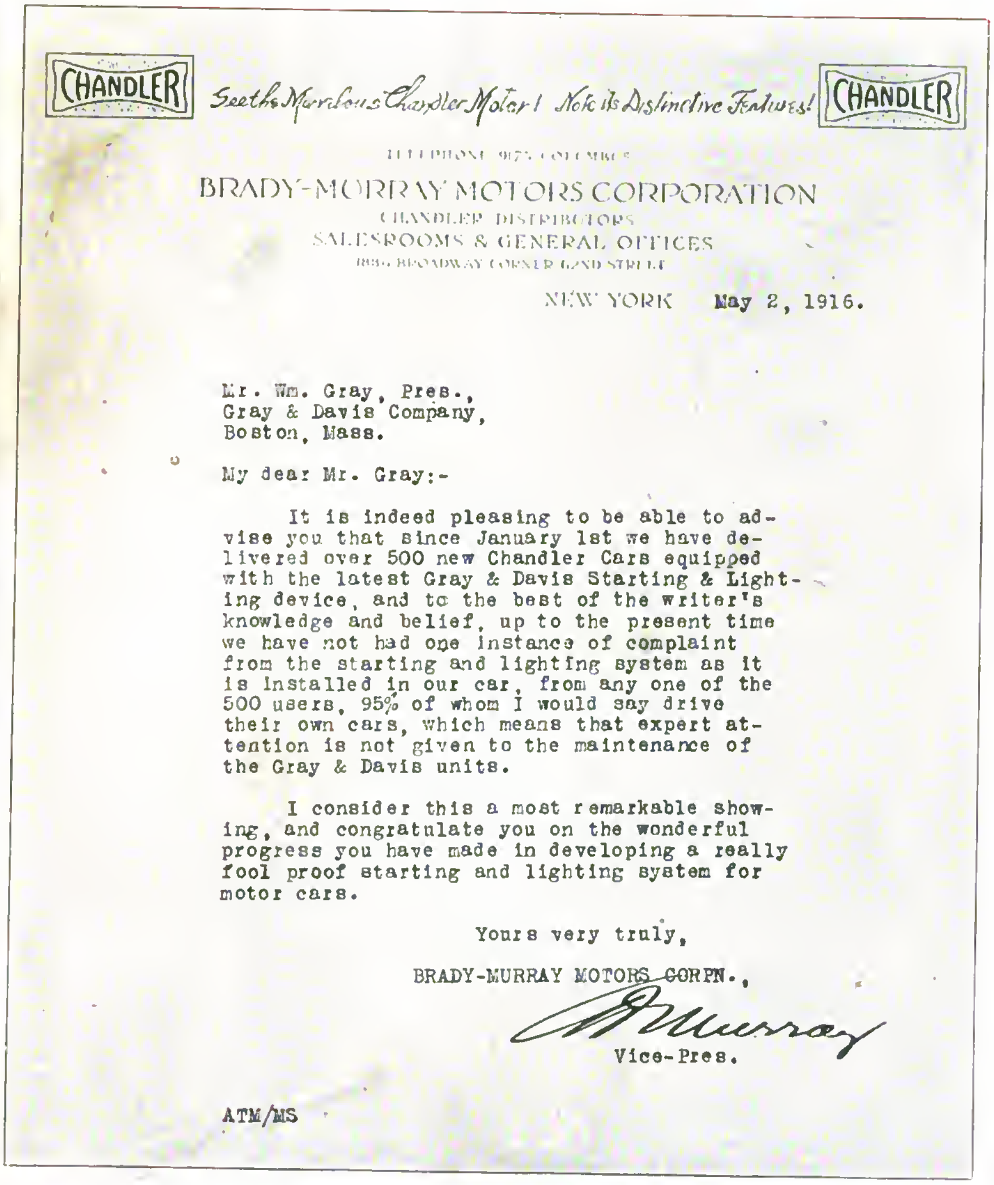
The AUTOMOBILE

Vol. XXXIV
No. 21

NEW YORK, MAY 25, 1916

Ten cents a copy
Three dollars a year

GRAY & DAVIS



CHANDLER See the Marvelous Chandler Motor! Note its Distinctive Features! CHANDLER

TELEPHONE 9175 COLUMBUS
BRADY-MURRAY MOTORS CORPORATION
CHANDLER DISTRIBUTORS
SALESROOMS & GENERAL OFFICES
1886 BROADWAY CORNER 62ND STREET

NEW YORK May 2, 1916.

Mr. Wm. Gray, Pres.,
Gray & Davis Company,
Boston, Mass.

My dear Mr. Gray:-

It is indeed pleasing to be able to advise you that since January 1st we have delivered over 500 new Chandler Cars equipped with the latest Gray & Davis Starting & Lighting device, and to the best of the writer's knowledge and belief, up to the present time we have not had one instance of complaint from the starting and lighting system as it is installed in our car, from any one of the 500 users, 95% of whom I would say drive their own cars, which means that expert attention is not given to the maintenance of the Gray & Davis units.

I consider this a most remarkable showing, and congratulate you on the wonderful progress you have made in developing a really fool proof starting and lighting system for motor cars.

Yours very truly,

BRADY-MURRAY MOTORS CORPN.,

Murray
Vice-Pres.

ATM/MS

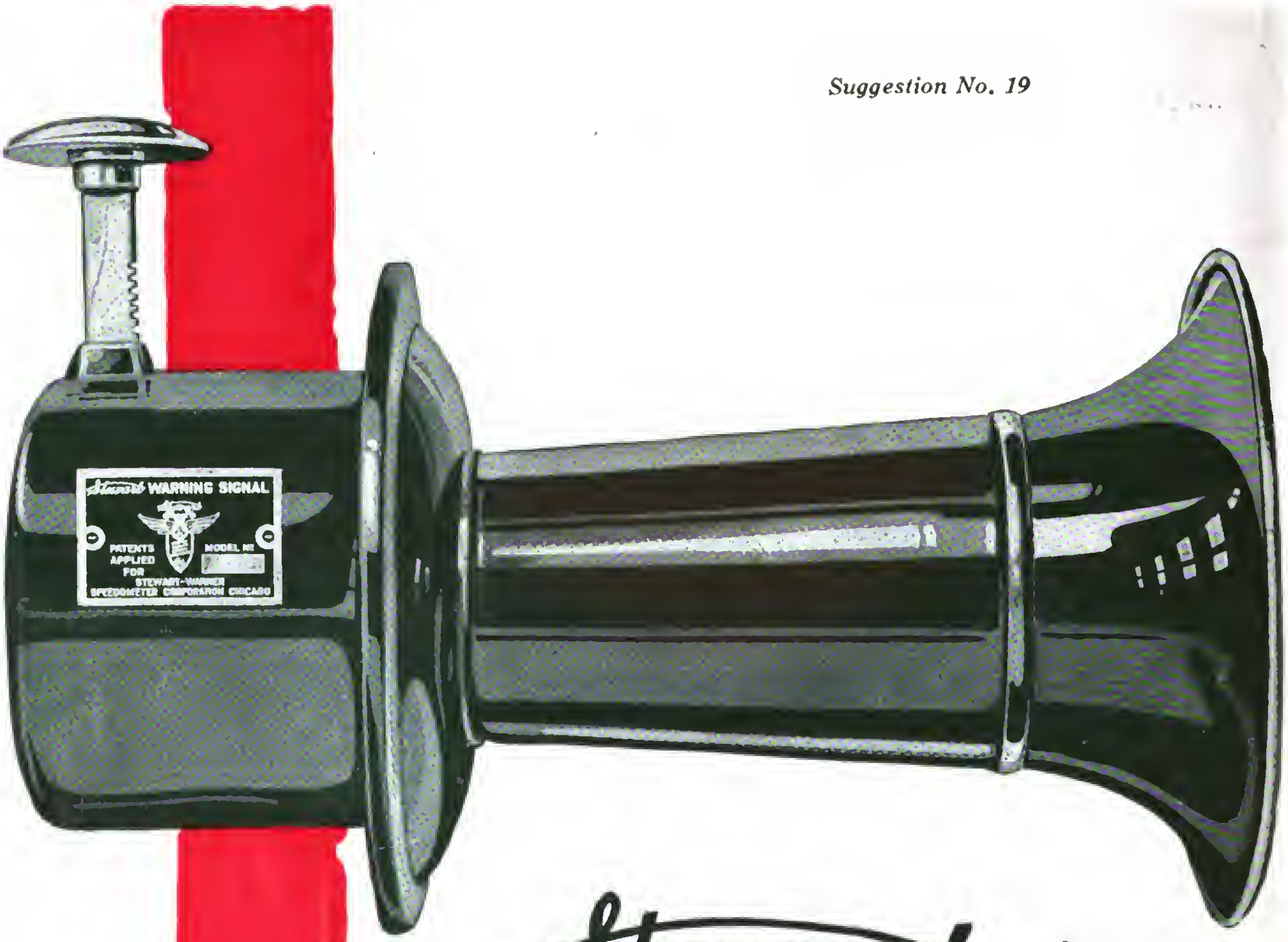
STARTING
LIGHTING
IGNITION

This interesting letter *shows why* dealers have absolute confidence in their cars, when equipped with the Gray & Davis system.

It is gratifying to know that automobile dealers appreciate our efforts to build a quality product.

GRAY & DAVIS
INC.
BOSTON, MASS.

Suggestion No. 19



Stewart

$3.50

Warning Signal

Hand Operated

EVEN a weak little buzzer or an old time bulb horn sounds big and commanding when demonstrated indoors.

Motorists are demanding for their life's sake a signal that sounds sure safety out in the din of traffic.

So many thousands demanded this Stewart Safety last year that our production is doubled and the price lowered to $3.50.

Display this Stewart.

It sells itself.

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Illinois, U. S. A.

Vol. XXXIV New York—Thursday, May 25, 1916—Chicago No. 21

The Automobile

Preparing for Hoosier Classic

Cars Late in Arriving at Track—The Three New Premiers in Detail—Frontenacs Form Featherweight Team with Their Aluminum Construction

By J. Edward Schipper

INDIANAPOLIS, IND., May 22—Ordinarily 8 days before the day of the race the speedway would be crowded with practising cars. This year, however, there is a difference, and it is only now that the cars are beginning to arrive at the scene of the great speed encounter.

Christiaens' Sunbeam and Barney Oldfield's Delage are, so far, the only cars actually on the track, and both of these are torn down while going through the final course of preparation for the 300-mile grind. The Sunbeam is the same car that ran in the Sheepshead Bay, N. Y., events of May 13, but it is now receiving some overhauling in order to remedy the weakness which put it out of the contest in New York. It will be remembered that this car was forced to abandon the race due to damage caused by the tachometer drive.

The tachometer is mounted on the end of the camshaft and the high speed caused a fracture of the aluminum case surrounding the end camshaft bearing, with a result that the oil ran out and a motor bearing seized. Christiaens has overcome this weakness, and prophecies that no little detail like that will again cause him to abandon the race.

Indianapolis Race Entries

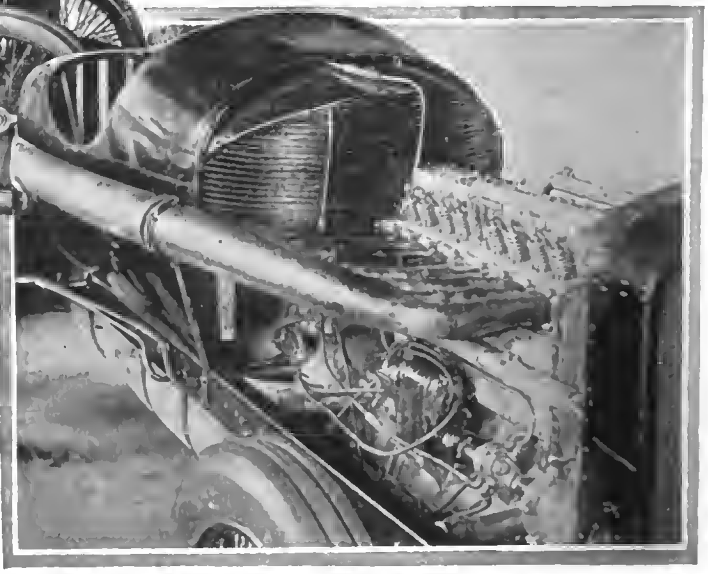
Car	Driver
Maxwell	Richenbacker
Maxwell	Henderson
Frontenac	Louis Chevrolet
Frontenac	Arthur Chevrolet
Frontenac	Gaston Chevrolet
Peugeot	Resta
Peugeot	Aitken
Peugeot	Merz
Peugeot	Mulford
Sunbeam	Christiaens
Sunbeam	Franchi
DuChesneau Special	DuChesneau
Richard	——
Premier	Anderson
Premier	Rooney
Premier	Stillman
Duesenberg	O'Donnell
Duesenberg	D'Alene
Crawford	Chandler
Crawford	Lewis
Crawford	Johnson
Delage	Oldfield
Delage	LeCain
Delage	Devigne
Erwin Forty	Bergdoll
Erwin Forty	Stecher
Ogren	Tom Alley
Duesenberg	Milton
Osteweg Special	Osteweg

Oldfield's Delage is the same car that has been described previously. He is tuning it for the race and making the many little modifications that racing drivers are always sure to do between events. There are no essential details changed.

The Maxwell cars, of which there will be two, are just about due to arrive at the speedway, and these will immediately begin practice. It is felt by all the drivers who contested at New York that the personal element is going to enter this race much more than it did at Sheepshead Bay, and it will be necessary for all those who are going to drive to get out on the track as soon as possible in order to get an exact knowledge of the curves. On the 2-mile board saucer there was no shutting down on the curves. Here the turns will be coasted to a large extent. This means that the accelerative power of the cars is going to mean much to the drivers.

Probably the most interesting feature now in the vicinity of the track is taking place at the other end of town, in the factory of the Mais truck company. Here the new Premiers are being constructed and the Peugeots of Aitken and Merz being

View of the Frontenac showing typical racing stern to reduce wind resistance, the large exhaust pipe along the side and the gasoline tank below the frame



View of the right side of the Frontenac engine in the chassis. The exhaust header has eight individual openings from the valves. The view also shows the position of the main lubricant tank. This has copper fins in front to assist in cooling, and the draught is so arranged that all air going through the radiator must pass this tank

overhauled and fitted with new parts, wherever necessary.

The two Peugeots, as a matter of fact, are being fitted with Premier parts wherever they have been judged to be lacking in strength. The connecting-rods which have proved weak have been renewed and the oiling system completely overhauled. These are the main essentials; but, besides these, there have been a great many other refinements.

The three Frontenac entries for the Indianapolis grind are now completed and ready for their trials. Louis Chevrolet is the designer, and he has built three cars which are constructed more extensively of aluminum than any other motor vehicle yet to come before the public. Every conceivable unit or part of a unit that could be made of the material has a place in these Frontenacs, which as a result tip the scales at the surprisingly low weight of about 1750 lb.

Motor Nearly All Aluminum

The motor is almost all aluminum—cylinders, pistons, crankcase, intake manifold, camshaft cover and gear covers, water pump, oil pumps and other lesser parts are made of the metal—but this is not nearly all. The body, with its cigar-shaped stern, is a sheet aluminum affair; the main parts of the rear axle are cast from this light material, these being principally the gear housing and the brake flanges. Other aluminum parts are the clutch cone, transmission gearcase, pedal brackets, starting crank bracket and, last but not least, the long underpan.

A Real Test

Thus the Frontenacs will have to uphold the contentions of the aluminum exponents as no other cars in this year's speed contests will. On them will rest the proof of the value of the extensive use of the metal for severe service.

Chevrolet will drive one of the cars and Arthur and Gaston Chevrolet will be the pilots of the other two in the Indianapolis meet. Joseph Boyer is relief pilot.

Louis Chevrolet is chiefly responsible for the design. He fixes the horsepower of the new engine he is using at 135 to 140, resulting from a bore of 3.870 in. and a stroke of 6.375 in. He uses a compression of 105 lb. per square inch and has four valves per cylinder, inlets being 2 in. diameter and the exhausts 1¾ in. The camshaft is overhead and actuates the valves through rocker arms, the four for any one cylinder being inclosed by an aluminum plate that is individual for that particular set. Compensating springs are fitted to the valves so as to insure absolute following of the cams, even at very high speeds. Drive for the camshaft is attained by a vertical shaft at the front which is connected to camshaft and crankshaft by bevel gears, both upper and lower sets being completely housed with aluminum. The valve seats are cast in the aluminum cylinder block, and all four for one cylinder are in one piece—a new wrinkle, even for this newest of cylinder and valve constructions.

To insure the best possible cylinder casting the sides and ends of the waterjackets are open and aluminum plates are securely fastened to the openings to form the completed water space. Thus uniformity of the cooling area is attained at the same time and further lightness in the bargain.

Three ball bearings carry the crankshaft, and in order to get the center one in place the shaft is split into two parts securely bolted together by substantial steel bolts. The shaft is of large proportions with very large webs, so that vibration from this source should be almost nil. The pistons are of a special type that might be termed an umbrella form. The piston upper part, carrying two rings, extends down only a little over an inch and joins the portion containing the wristpin bosses through an extension of the inner center, and this part flares below the wristpin to make the lower skirt, which is drilled with holes to lighten it. Thus maximum cooling is attained with minimum weight and bearing surface.

Hollow steel connecting-rods of surprisingly light weight are also a part of these feather-weight cars. These are machined all over and balanced to a nicety that should be conducive of most excellent results. Four bolts hold each machined cap in place, and at the wristpin end there is provision for a steel pin to hold the wristpin in place and cause it to have its bearing in the bosses of the piston.

Special Oil Cooling

Chevrolet has given a great deal of thought to the oiling system and methods of cooling the lubricant. Directly in front of the dash is located a 12-gal. semicircular oil reservoir, the entire front of which is provided with copper cooling fins. The underpan of the engine and a metal shield below this tank completely trap the inrushing air that comes through the radiator and force it to pass over these fins in order to get out. Thus any air that enters the radiator must pass over the front of the oil tank before it can escape. This is really a forced-draft scheme and excellent results are expected from it. In connection with this tank arrangement two independent oil systems are fitted, so that should trouble

come to one the other will adequately take care of the requirements. Two gear pumps are driven by the magneto and water-pump shaft on the left. The oil is forced from the tank directly to the crankshaft bearings and some by-passes to the overhead camshaft at the front end. From the rear end of this unit the oil is led down to the oil sump at the bottom of the motor. From the crankshaft main bearings the oil is led through centrifugal rings on the shaft to the connecting-rod lower bearings, and the spray from these gets to the cylinder walls and wristpin bearings. In addition there is a pump at the mechanician's hand that forces oil directly from the tank to the bearings. One of the gear pumps takes its supply from the sump.

The motor is supported in the frame at four points on steel tubing and is entirely separate from the gearset, which is amidships on three points. This makes a very sturdy layout, allows the flywheel to be completely open, and reduces the weight. Drive is by the Hotchkiss method, using an open propeller shaft with two universals and semi-elliptic rear springs 45 in. long.

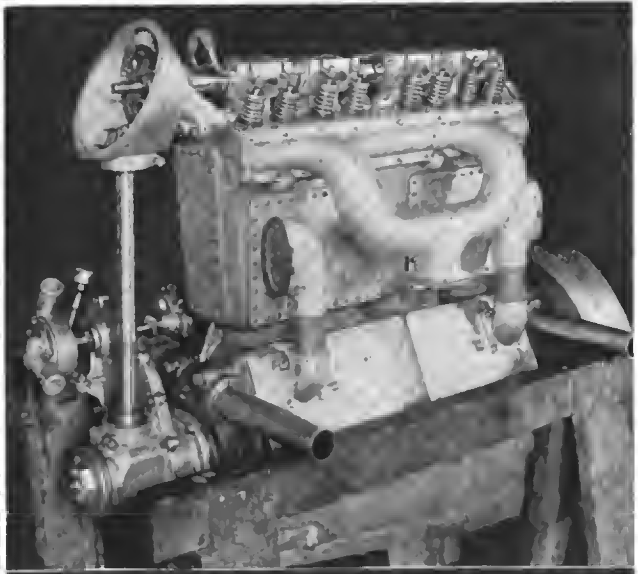
No differential is used in the axle, and Chevrolet has allowed himself some latitude in the matter of gear ratio. He has three sets of gears available for each car, these being 2¼ to 1, 2 1/3 to 1 and 2½ to 1. It depends upon the results obtained with each, when the cars are put on the track, to finally fix which will be employed in the races.

An unusual but very logical location has been given the gasoline tanks. Two long and narrow reservoirs are hung below the frame and alongside of the gearbox and driveshaft on either side. These will serve to distribute the weight and put more of it where it belongs, at the back end of the car, thus making it hold the track better at speed and undoubtedly affecting the pace at which the cars can take the turns. Putting this tank weight low, the center of gravity is brought down considerably. The piping is arranged so that either feeds the carbureter, and there are shut-off cocks from each running close to the mechanician's seat, with filler caps in the floor boards.

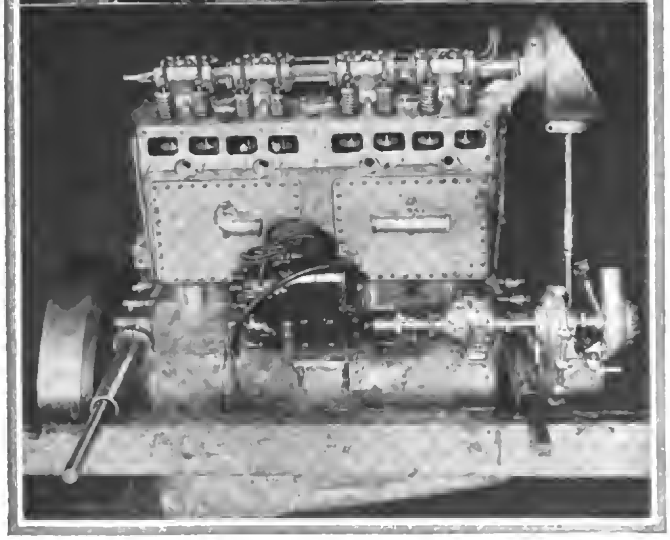
Chevrolet has undoubtedly designed a beautiful body. It has a graceful sweep and is shaped for the minimum of wind resistance, with a pointed tail, narrow radiator, and sloping without external obstructions to set up eddies. The curve of the underpan follows the same lines and makes the whole thing look like a big cigar. The wheelbase is 104 in.

Has Flexible Steering Wheel

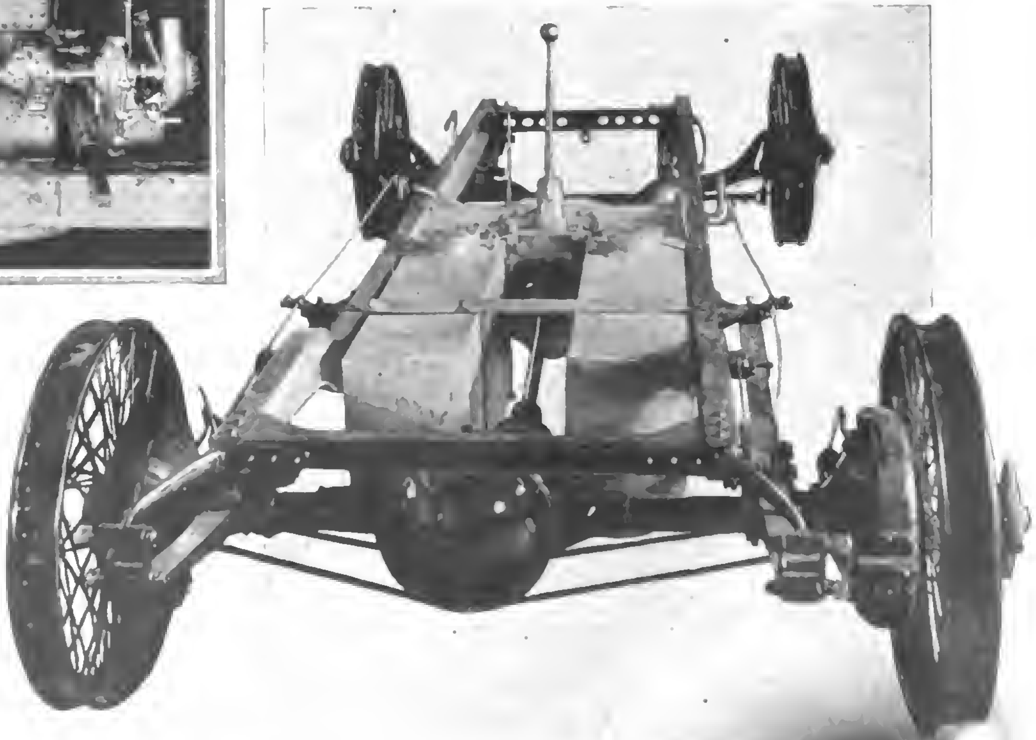
One very clever feature of the cars is the flexible steering wheel, if it might be called such. In racing, the driver gets much of the jarring and vibration of the track, this being transmitted to his hands and wrists through the steering wheel. To absorb this continuous jarring, the arms of the steering wheel spider are made up of three thin plates that have somewhat the same action as a leaf spring. Thus the



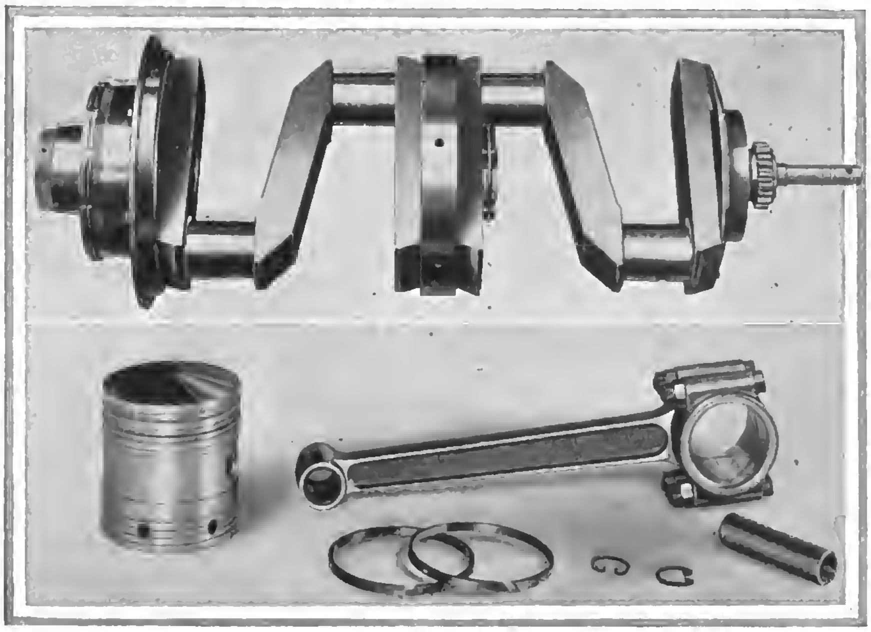
Above—Intake side of the aluminum engine in the Frontenacs. The water-jacket spaces are open, and covered by aluminum plates as seen. Note the aluminum breathers and bevel gear drive of the overhead camshaft by the vertical shaft at the front, the whole being inclosed



Below—Exhaust side of the aluminum Frontenac racing engine, having a bore of 870 by 6.375. There are four valves per cylinder



Right—View of the Frontenac chassis showing the disposition of the gasoline tanks on either side of the driveshaft and gearbox. This location brings the center of gravity down and distributes the weight better, insuring the car's hugging the track



Above—Two-piece crankshaft used in the new Premier racers. It is carried on four ball bearings, the rear bearing being double

Below—Piston and connecting-rod assembly of the new Premier racers. Although 2 lb. lighter than the Peugeot assembly, it is stated to be stronger

wheel can be moved a maximum of 1 in. up or down from its normal plane, and this ability to absorb shocks should result in less tiring of the driver's arms and wrists.

Some of the accessories and parts that have been incorporated in these Frontenacs are Bosch magnetos, Zenith carbureters, Rudge-Whitworth wire wheels, Gemmer steering gears, Goodrich Silvertown cord tires and K. L. G. air-cooled spark plugs.

The new Premier cars, of which there are three, have been built especially for this race. They have never yet been run even on the road, and will not be on the track for 2 or 3 days. The first week in February there was not even a drawing of the new cars in existence and, considering the time and the extraordinarily hard task of getting materials of a special nature through any of the war-order-crowded plants, an extraordinary amount of progress has been made. Two of the cars will be driven by Anderson and Rooney of Stutz fame and are about a day apart in construction, Anderson's car being in the lead in this respect. The third car will be piloted by Stillman.

The cars were designed by James L. Yarian, who has the title of engineer of the racing car department of the Premier Motor Corporation. In 3½ months the drawings have been worked out, the steel, which has all been ordered to special analysis, secured, the connecting-rods, crankshafts and various parts cut from solid billets of steel, and even the frames hand-made because the rolled sections could not be secured in the stock desired.

The design is a composite one, smacking somewhat of Peugeot, a little of Delage, and also with a suggestion of the Mercedes. The four cylinders are block-cast and have a bore of 3.66 and a stroke of 6.625 in., giving a displacement of 235 cu. in. The cylinder casting is probably one of the most complex ever made, as the waterjacket is only a sheet of metal 3/16 in. thick and does not touch the cylinders at any point except the top and bottom throughout the entire length of the casting.

Sixteen valves are used, and these are placed overhead, being driven by two overhead camshafts contained in separate aluminum housings. The intake valves are 1 15/16 in. and the exhaust 1 9/16 in., and each has a lift of ⅜ in. The valves are, like most of the other working parts throughout the car, of special steel, analysis and heat-treating specifications being the results of experiments by the designer.

The timing gears are pinned to the front end of the camshaft with a different number of holes in the gear and flange, thus giving a vernier style of adjustment. The camshaft is hollow and is carried on five bearings. The hollow through the camshaft acts as an oil lead, as will be described later.

Double springs are used on each valve, and there is provision made, by means of an enlarged section, to guard against the possibility of the valve dropping down into the cylinder in case of breakage. It takes a pressure of 150 lb. to operate the valve ⅜ in. against the spring pressure, which should be sufficient to guard against riding, even at the highest speeds.

No clearance adjustment is provided at the ends of the valve stems. The manner in which the adjustment is made is through the means of buttons. The valve tappets are hollow and in the ends of the tappets are inserted buttons which have a neck of sufficient length to guard against their falling out. The button nearest the proper size is selected and then filed to the correct clearance.

Although the reciprocating weights of the new motors are 2 lb. less than those of the Peugeots, the connecting-rods are stronger at the upper ends, the point where the rods in the Peugeot cars have failed once or twice. This result has been accomplished by using a differently shaped flange and a deeper web, although the basic I-beam section has still been maintained. The pistons are rendered stronger by the use of a supporting piece which is of cylindrical form, extending from the center of the piston head to the upper side of the wristpin.

The connecting-rod is cut away at the top of the wristpin and the aluminum supporting piece rests against the upper side of the wristpin with a bearing fit. This gives a solid column of support from the center of the top of the piston straight down to the lower connecting-rod bearing, through the support piece, the wristpin and connecting-rod.

Oiling Very Thorough

The oiling system has been particularly well worked out. The oil supply is carried under the seat, and amounts to 7 gal. It is fed to the crankcase under pressure, and then distributed by the force feed pump through five independent leads. Four of these are to the main bearings and the other enters the hollow camshaft at the rear and passes through it in a thick stream. There are leads drilled to each of the five camshaft bearings, and the shaft itself runs submerged in oil. The oil then passes out the front end of the camshaft and through a lead to the timing gears, which are supplied very liberally. A lead is also taken off to the water pump and magneto shaft bearing, the oil then passing back to the crankcase for recirculation.

The crankshaft is in two pieces and is carried on four ball bearings. The rear bearing is double, giving two single bearings for front and center.

The motor is mounted in a subframe which also contains the gearset. The subframe is mounted flexibly at three points, the front support being a single trunnion in the center of the cross-member, and the rear supports are ball and socket connections back of the gearbox, which is amidships.

Ball bearings are used throughout the three-speed gearset, the main gearset shaft extending through the driven member of the clutch and being connected to it by a squared section. The end of this shaft rests in the center of the flywheel. This fixes the alignment of the motor and gearset, and the whole flexible subframe could be swung as much as a foot out of line without affecting the drive.

Hotchkiss drive is used and a ratio of about three to one, with 35-in. wheels, will probably be fixed upon, although this is not certain as yet. The axle housings are swaged from solid steel tube under 40 tons' pressure.

All of the center housing of the differential is of aluminum, and the bearings used throughout the rear axle are ball. In fact, this type of bearing has been used liberally even for a racing machine. Each of the timing gears, for instance, has two ball bearings, and the pressure of a finger is sufficient to rotate the entire set.

A neat feature in the chassis is in the clutch. The cone is of steel, and behind it there is a fiber-to-steel clutch brake, the fiber being between two steel disks. Every detail of the car is special, and the only stock parts are the wheels and shock absorbers. The springs are semi-elliptic all around and the wheelbase is 106 in.

The magnetos used are Bosch, and the carbureters are Zeniths, with special ball bearing throttle connections.

Seven gallons of water are carried in the radiator, jackets and connections. The radiator is a square tube type made especially for this car by Fedders. It has a false front made up of a removable screen placed 3 in. in front of the radiator proper. The pump, being on the same shaft as the magneto, runs at magneto speed and is of the impeller type.

Gasoline is carried in a tank located in the aluminum tailpiece. The tank capacity is 29 gal., and it is calculated that, as the consumption will be a little better than 11 miles per gallon, the car will go through the race, if need be, without renewing the supply.

A Summary of Entries

The Peugeot to be driven by Charles Merz will have the motor as described and the old Grand Prix Peugeot chassis stiffened up and revamped by the Premier company.

The new Premier cars will be purchased by the Indianapolis Speedway Corporation and will be raced by them, with Anderson, Rooney and Stillman as drivers. These men are now working at the Mais plant on the cars.

Of the thirty cars entered for the Indianapolis race on Decoration Day, there are but two entirely new in every detail, these being the Premiers and the Frontenacs, already described. There are a few of which very little is known, the DuChesneau, the Richard, the Ogren and the Osteweg, had not appeared on the speedway at the time of writing, and no information concerning them has been given out. The two Maxwells which were described in THE AUTOMOBILE for May 11 are the same cars which competed in the speedway events last year, improved in detail during the winter by sundry small alterations.

The Peugeots are of the same type and have been subjected to various degrees of reconstruction. Parts which proved weak toward the end of the racing season of 1915 have been replaced. To take one instance, those belonging to the Indianapolis Motor Speedway Corp. have had fitted new connecting-rods of a slightly different section to the original Peugeot rod.

The Sunbeams are the same chassis which were competing last year, but instead of four-cylinder motors the engines now have six cylinders. The general design is almost exactly the same as that of the Peugeot.

The Duesenbergs have both of them sixteen-valve four-cylinder engines, but otherwise are similar to last year's cars. The general design of the engines with their horizontal valves is very much like the older pattern. Characteristic of the Duesenberg motor is the complete inclosure of all the valve mechanism, the appearance of the finished job being that of a rectangular metal box. The Crawfords also have Duesenberg motors.

The New Duesenbergs

The three new Duesenbergs which are being completed in the new quarters at Chicago look to be much speedier than any mount O'Donnell has had. Not only have they the sixteen valves which featured the new motor of last year, but the very light tubular connecting-rods and extraordinarily sturdy crankshaft make the new motors very powerful. In addition the cars are considerably lighter and will scale close to 1800 lb. The characteristic turtle back has given way to a pointed tail and a pointed nose is fitted.

There are two types of Delage, those driven by LeCain and Devigne being the 1914 Grand Prix cars described in THE AUTOMOBILE for March 23 and again briefly mentioned on May 11.

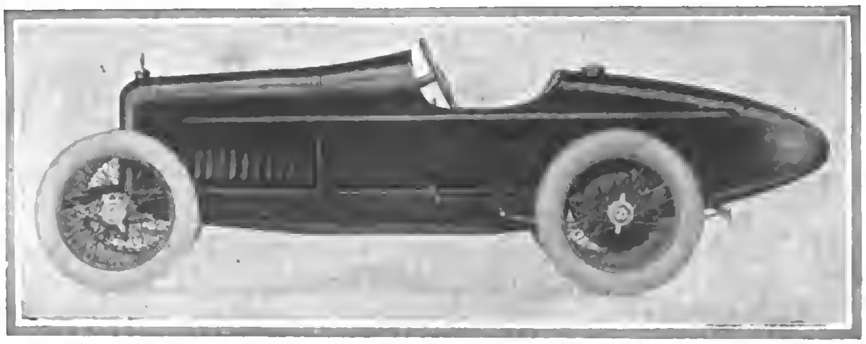
Oldfield has an earlier type with horizontal valves which is understood to be practically the same as last year.

The Erwins are special jobs with L-head engines, these being arranged with exhaust valves in the usual position, and overhead intake valves operated by pushrods and rockers.

There are two noticeable absentees: of these the most prominent is Ralph De Palma, who won the event last year, and it is also a disappointment that no Mercer team is to appear since this was rumored as possible some months ago. De Palma has been rebuilding the engine of his Mercedes and has had considerable difficulty in replacing the original parts since he can get nothing whatever from Germany.

The first International race at Indianapolis in 1911 was won by Ray Harroun in a Marmon, 74.59 m.p.h.; Joe Dawson in a National won in 1912, averge 78.70 m.p.h.; Jules Goux's Peugeot won in 1913, average 75.92 m.p.h., falling short of Dawson's speed. René Thomas in a Delage won in 1914, averaging 82.47 m.p.h. Last year DePalma and Dario Resta fought it out, with DePalma emerging victorious, with an average of 89.84 m.p.h. Goux and Thomas are fighting for France in the European war and can not race this year.

With the distance this year cut down to 300 instead of 500 miles, the contestants will go faster from the start and maintain a faster average all the way, it is believed, because they are saving 200 miles' wear on their cars. The Indianapolis speedway, which was the first in America, offers a thrilling race because the human equation plays such an important part. The track, being a brick paved oval 2½ miles around, has four high banked curves and two long straightaways. To encircle the track once a driver must change the position of his car eight times. At board tracks where the cars get in a saucer and stay there automatically, the driver's skill is not called into play so much as at Indianapolis, where every second may make a winner out of a trailer. Every race at Indianapolis has been full of exciting changes.



One of the team of three special Premier racers for the Indianapolis race

Power Lies in Valve Proportions

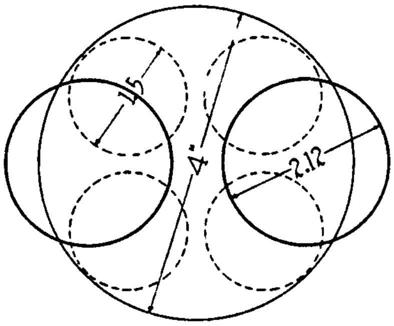
Difference Between Old and New Racing Cars Mainly Found in Valve Opening—Need for Large Valve Areas Controls Design

By A. Ludlow Clayden

TO SAY that the engineer responsible for a modern racing engine first designs his valve gear and then fits the rest of the engine to it is hardly too strong a statement. There is but one limitation imposed that is outside the control of the engineer, this being the 300 cu. in. piston displacement. Every two revolutions the engine may burn 300 cu. in. of gas if the designer can manage to persuade this amount to enter the cylinders.

Now the total power that can be developed by a gasoline engine depends upon the amount of gas it can burn, since each cubic foot of good mixture contains just about the same amount of heat. Therefore the engineer wants to get as many revolutions as possible per minute together with the largest possible percentage of charge into the cylinder on each suction stroke. It is no good to increase the speed if the valve area restricts the amount of gas that can pass in a given time. All other things being equal, the larger the valve area the faster can the engine be run without wire-drawing the charge, and this is why racing motor valves are the most important part of the design.

There is one other limitation in actual fact, as well as the 300 cu. in., this being the volume of the combustion space. To get the best compression ratio the total volume of the charge when compressed must not exceed about one-fifth of its uncompressed volume, which means that the total area into which valves can be put is definitely limited.



Corresponding sizes of two and four valves of equivalent area

Timing Not Important

To say that the timing of a racing engine is not important is almost a heresy, and the statement will no doubt be laughed at by many racing men, but it is none the less true. Given a certain engine, its power output may be varied considerably by altering the timing, but starting from the drafting board it is possible to lay out a variety of designs requiring different timing to give the best results. There is no secret timing applicable to all motors which always gives the best effects.

Let us look at the ideal timing. On the suction stroke the ideal is to have the biggest possible opening uncovered completely in no time at all at the top dead center and closed, also in no time at all, at the bottom dead center. For the exhaust stroke the ideal would be to take off the whole top of the cylinder *instantly* at the bottom dead center and put it on again at the top center. All valve gear and all timing is a compromise which gives some sort of approach to this ideal.

The intake valve timing to get the best effect is probably the most troublesome. Firstly, there is some exhaust pressure left in the cylinder at the closing of the exhaust valve, so the suction cannot begin till the piston is a little way down on its stroke. But the valve takes, and *must* take, a perceptible time to open; so it is usual to start the opening earlier in the stroke than real strong suction can begin. Suppose the intake valve opens at dead center, then no gas will pass through it till the piston has gone down an inch or so. As soon as the piston has descended enough to counteract the effect of the exhaust pressure left in the cylinder after the closing of the exhaust valve, the intake valve will be well open and ready to allow the suction to act strongly on the carbureter.

Therefore we have two courses open. One is to make the intake valve open quickly and start the opening late, 5 or 10 deg. after the top dead center, say. The other is to open the valve slowly, and commence the opening very early, even before the top dead center is reached on the exhaust stroke. Should the exhaust valve also be open at this time, only closing *after* the top dead center is passed, the exhaust will continue to travel out through the exhaust valve and little or none will be driven back through the intake valve into the carbureter manifold. This is called overlapping timing.

The intake valve will only be open a very small amount before the exhaust valve closes. Thus, the more rapid-acting the cam is, the later the valve can start to open, and the earlier it may close. So the problem before the engineer is to choose a happy mean. There are limits to the possible rapidity of valve movement, owing to the considerable force needed to open and close a valve in tiny fractions of a second, wherefore many designers prefer to use a slower opening and closing with a more widely spread timing.

Up to 1912 most of the European racing engines had the conventional two valves per cylinder, but that year and in the years following two-valve construction gave way to the four-valve design now most usual. This is not so much because four valves can provide a greater *total* area than two, but because four light, small valves can be opened and closed more rapidly than two of equivalent area which are essentially much heavier.

The weight of a valve head varies roughly in proportion with its area, and the area varies with the square of the diameter. Since the small valve does not require the same thickness of head as the large one, the weight increases actually more rapidly than the diameter squared. With a doubled diameter the weight is multiplied by four and then increased again by a substantial addition to the thickness of the head.

Forces Acting on Valve

To appreciate the forces acting on a valve assume the crankshaft speed is 3000 r.p.m., which, of course, means 1500 r.p.m. for the camshaft. Suppose the inlet valve starts to open 10 deg. after top dead center and remains open 25 deg. after bottom dead center, then it will be open for a total angular movement of the camshaft of 105 deg. During the first part of the opening, the valve is being accelerated from its seat. It is then decelerated, pauses for a tiny fraction of time, accelerates toward its seat and finally decelerates till it comes to rest on the seat.

With our assumed timing the acceleration period lasts for about a quarter of 105 deg., namely 26.5 deg., during which travel it will have been lifted half its total lift. At 1500 r.p.m. of the camshaft the angular speed is 900 deg. per second, so the acceleration period for the valve is 0.00294 sec.

Suppose half the lift is 0.2 in. and the weight of the valve 4 oz., then the force necessary to produce the acceleration, neglecting the spring pressure and the weight of the tappet, is 15.5 lb. in round figures. Add the weight of the tappet and half the weight of the spring plus the spring pressure and it will be at least doubled.

Furthermore, the spring has to do just the same work during the first half of the closing movement of the valve that the cam has to do in the first half of opening movement, thus a four-ounce valve if it is to follow the cam accurately at 3000 r.p.m. of the crankshaft may easily need a spring of considerable power.

Now assume the valve is double the diameter, which means four times the weight and more. Take the weight as being just 1 lb. and the force required increases to 62 lb., considering only the valve and neglecting the tappet, etc. Add the other masses and a spring giving a pressure of 120 lb. or so is the least that will be required.

Suppose the bore and stroke are 4 in. by 5 in., which is about right for a 300 cu. in. four-cylinder engine; and suppose that we allow a mean velocity of 200 ft. per second through the inlet valve, which is a normal velocity, then the area of inlet opening needed is approximately 3.15 sq. in. Allowing for the fact that the valve cannot be fully open for more than a small part of its period, we shall need at least 3.5 sq. in. of valve area.

Four Valves Need Half Spring Strength

Now a single valve of 3.5 sq. in. area will be 2.12 in. in diameter. Two valves to have the same total area, 3.5 sq. in., will have to be a shade under 1.5 in. in diameter each. The strength of spring required will be in proportion to the diameters squared as explained before, namely in the proportion 449 to 225, which means that the pressure throughout the valve mechanism will only be half the amount for the small valve that is necessary for the large one.

There is still another advantage in the lighter units. A very strong spring needs heavy wire and the rapidity of spring action is dependent upon the section to some extent. A heavy spring is bad, first, because of its weight, and second, because it is more sluggish in action than a spring of lighter section. Incidentally, it has been found that where a spring pressure of 80 lb. is required, faster action may be obtained by using two 40-lb. springs, one within the other, than by employing one spring of full 80-lb. strength.

The arguments applying to the inlet valves also apply to the exhausts, of course, though the need for size is a trifle less important.

Compactness a Feature

Taking another aspect of the case; suppose we start with a circle 4 in. in diameter and imagine this to be the top of the piston. On top of this draw two circles of 2.12 in. and also four circles each 1.5 in. This makes obvious the fact that two valves will necessitate a combustion head with a bulge on each side while the four valves will practically locate within the four-inch circle.

Instead of placing the valves with the stems vertical they are usually put at an angle of something near 45 deg. and this allows good water space all around each valve seat, while giving the necessary small combustion space. Also the combustion space thus becomes of a shape which approximates to a hemisphere, and that is the best shape from the viewpoint of thermal efficiency.

Many Arrangements Possible

There are many ways of arranging the four valves because, after the valves themselves have been designed, there remains the need for locating the parts to work them. Just as the weight of the valve is of paramount importance, so is the weight of the tappet or rocker to operate the valve. The least weight of valve-operating mechanism is got by following the Peugeot school of design, in which there are two camshafts contained in aluminum housings, mounted directly over each row of valves so that the axis of the valve stem passes through the center of the cam. In this design the cam is separated from the valve stem by a very short distance, just enough to allow for a short push rod to connect the cam with the valve that will have a long enough bearing in the case to prevent too much oil leakage.

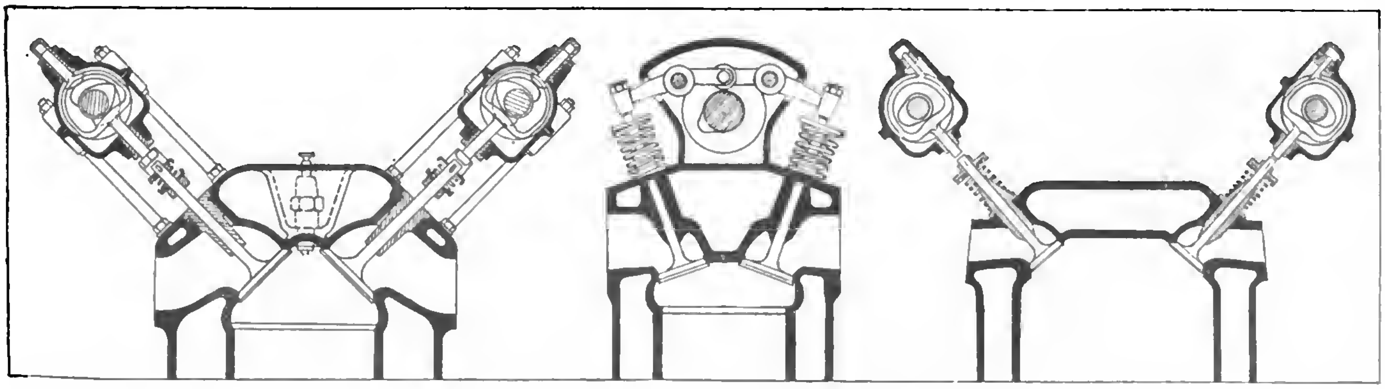
The drawback to this design is that the two camshafts with their necessary driving gears make for complication and, though the valve parts are kept low in weight, the total mass of the two camshafts, etc., is a consideration.

Rockers Give Same Results

Alternatively there is the older design developed by many different manufacturers of using one overhead camshaft placed centrally over the cylinders, the straight tappet rods of the Peugeot type being replaced by small rockers. This cuts down the complication and reduces the total weight, but the rockers are almost impossible to make so that their reciprocating mass is as small as the little push rod in the Peugeot. Results, however, show that practically the same power output is obtainable with either design. Prominent users of the rocker construction are Mercedes and Stutz-Wisconsin.

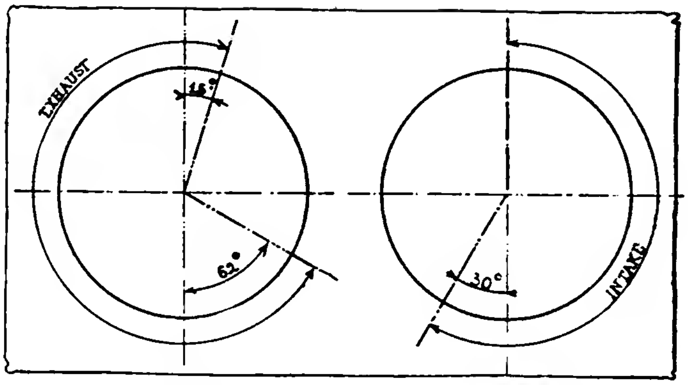
The old design where the camshaft was in the usual place in the crankcase and the valves operated by long push rods is impossible for racing to-day, as the long rods cannot be made light enough. It has been suggested that the action could be reversed and pull wires substituted for push rods, but the idea has never been tried and does not sound very promising.

Another school of design, which differs in detail though not in principle, is exemplified by the Duesenberg and the old Delage engines. Here the four valves are used just the



Left—The unique Delage mechanism whereby the cam closes the valve as well as opening it. Center—The Mercedes type of design with a single camshaft and rocker arms. Right—The Peugeot design, which is really the basis of all modern overhead valve engines same, but they are not set at 45 deg. in the head; instead they have the stems horizontal and open into a high, narrow combustion head, rather like the usual combustion space stood on end. For operating the valves there is a camshaft on each side of the crankcase and, in the Duesenberg motors, long rockers, set vertically, connect the cams with the ends of the valve stems. The old Delage had a different scheme. There were two camshafts in the crankcase, each operating four long push rods. On either side of the cylinder block was a rocker shaft, placed above the valves and running from end to end. On this shaft were rockers with three arms, of which one was lifted by the push rod while the other two pressed on the valve stems. Delage has since abandoned this design because the reciprocating weight of the push rods and rockers was too great, and the older Delage cars are therefore a sort of half step between the L head motor and the Peugeot type of overhead valve construction.

Though it has been described many times, the new Delage system cannot very well be omitted from a review of this character. Externally the present Delage racing engine looks very much like a Peugeot and the difference is all within the camshaft case. Each cam is surrounded by a stirrup, the cam pressing on one side to open the valve and on the other to close it, the stirrup being attached to the end of the valve stem through the medium of a very small but stiff spring which is in slight tension when the valve is shut. The idea is to eliminate the lag of the spring altogether and to shut the valve just as positively as it is opened, eliminating all lag.



Typical valve timing for a four-valve engine

The theory underlying the four-valve engine with overhead camshaft has been known and appreciated for very many years, and the reason why it is only recently that four-valve motors have been made is that the older racing cars gave so much trouble with other parts of the engine that the extra volumetric efficiency given by the four valves could not have been utilized without breaking up the rest of the motor. At present there is nothing in view that appears likely to displace the four-valve type after the fashion in which it has displaced the two-valve.

Boillot Killed in Aeroplane Battle

Race Driver, Attacked by Five German Flyers, Brings Down One

Georges Boillot, racing pilot, killed in battle

PARIS, FRANCE, May 21—Georges Boillot, winner of the French Grand Prix of 1912 and 1913, has been killed in a fight with five German aeroplanes, near Verdun, after bringing down one of the German machines before a bullet pierced his heart. Boillot, a second lieutenant, brought down his first German aeroplane on March 31, in Haute-Alsace and later won the cross of the Legion of Honor. He was 52 years old.

At the outbreak of the war he joined the Automobile Corps, and using his Grand Prix racing car, carried out many dangerous missions as driver for General Joffre. Later he entered the aviation service.

Boillot's first and only appearance in a race in the United States was on the Indianapolis Speedway, May 30, 1914, where he broke the 350-mile record, his time being 4:15:22.69. He was forced to drop out in the 352.5 mile, the next lap on account of a broken frame, finishing fourteenth in the race.

Boillot in a Peugeot will be remembered for his victory in the 1912 French Grand Prix when he won out after a struggle with the late David Bruce-Brown. In the 1913 event on the Amiens course, he dashed over the 569-mile course at the rate of more than 72 m.p.h., winning after a hard struggle with Goux in a Peugeot second.

Boillot gained renown throughout the French army as General Joffre's driver. His eagerness to gratify the General's desire for haste led him to take unnecessary risks. After one particularly narrow escape General Joffre announced his intention to make a change of drivers, not so much because of the danger to which he was subjected as because Boillot's daring swerves kept him awake. The General liked to sleep during his 100-mile dashes along the battle front. Boillot accordingly went to the aviation corps.

He was the airman who performed the service described in a recent official communication, as follows: "One of our pilots, in the course of a stirring flight, brought down an aviator, which fell between our lines at Suippes." It was nearly a week before the world learned that it was Georges Boillot who had accomplished this feat. At one time he was surrounded by a regiment of German soldiers, and escaped death by riding through them at high speed.

Georges Boillot was one of those rare beings who combine great engineering skill with a master hand at the wheel. He was the idol of the French racing fans and on practice mornings before a great race the crowds of villagers who always turn out in the chill gray of the morning, used invariably to cheer their favorite to the echo. Watching from a turn in the road, one could always hear the murmur of voices heralding the approach of the blue Peugeot even before the roar of its exhaust was audible.

Boillot was a personality which earned him friends everywhere and also gained for him universal respect. Strong both in mind and body, he had a vigor and vitality which permeated the whole atmosphere around him. When the next French Grand Prix takes place there will be no face worse missed and his absence will be keenly felt.

Ignition Most Reliable Part of Car

Proper Mechanical Layout of Ignition Gear Prevents Electrical Troubles — Two-Point Ignition Preferred for Racing—Four Valves Render Plug Accommodation Difficult

IT is commonly believed that in the two-spark magneto the spark at each one of the plugs is weakened by the fact that two instead of one have to be supplied. This is not true, as the electrical characteristics involved by the ratio of the high-tension to the low-tension winding are entirely different in the two instruments. In other words the two-spark magneto is not simply a single instrument with a double-distributer but, on the other hand, is primarily a different design, electrically as well as mechanically.

Mechanical Difficulties

It is in the mechanical side of the ignition system for racing cars that the greatest difficulties enter. Broadly speaking, there is no such thing as electrical trouble. Given the proper mechanical conditions and electricity will not fail to do its part. The high temperature at the spark plugs furnishes a good example of this. In operating the motor at the temperatures obtained in racing, the insulation and the electrodes are submitted to stresses that would never be reached under other conditions. The consequence is that in the long races we see plug failures.

Keeping Plugs Cool

There is only one way to keep the plugs cool and that is by proper waterjacketing. At the same time the wall supporting the screwed connection of the plug must be firm enough to endure the wedge action necessary in tightening the plug. This has been worked out in the cars of this year much better than in the past, and at the Sheepshead Bay track plug changes were very scarce. In the 300-mile event at Indianapolis there may be more of them on account of the greater distance. Nevertheless the troubles as a whole have been greatly reduced.

The difficulty in getting material has hampered the plug makers to a great degree. The Bosch company had its last plug stand at the Sheepshead Bay race. Owing to the fact that this concern can no longer secure the Steatite used in the insulation of its plugs further manufacture has had to await changes in conditions.

Four Sparks per Cylinder

One of the interesting ignition systems of the year from a mechanical standpoint is that used on Christiaens' Sunbeam. This is a six-cylinder car and ordinarily a magneto used with it would have to be driven at one and one-half engine speed in order to produce the three sparks per revolution necessary with the four-cycle, six-cylinder engine. The magneto on Christiaens' car produces four sparks per revolution and hence is driven at three-quarter engine speed.

This reduction of the armature shaft speed of the magneto by using a type which produces four sparks to the revolution is important in high-speed work. If the magneto is driven at a greater speed than that of the crankshaft it becomes the fastest moving part on the car. The armature shaft bearings are stressed to a much higher degree, not only due to the higher rate of travel, but also by the thrust of the step-up gearing. The result is that the bearing life on the armature shaft is apt to be shortened. This same effect has shown itself to be true on lighting generator shafts on passenger cars where they were operated at a higher speed than the crankshaft and is due to precisely the same causes.

The care in detail work on the ignition systems is even better now than ever before, although the ignition system has always been carefully watched on racing cars. The improvement is in the better location of the wires and the precaution against chafing or breaking. This is not as yet perfect, however, and there are some cars in which the wires are not as neatly tied down as they might be. That accidents can happen to even such things as high-tension leads to the plugs is shown by the fact that Eddie Rickenbacher had to stop in the Sheepshead Bay event on account of a broken lead.

Quick ignition being necessary, a large proportion of machines are using two-point ignition. It has been said that this phase is falling off, but if it is so, it is because combustion chambers themselves are now of more highly-concentrated volume, allowing a single spark to do the work much more rapidly than before and also, incidentally, four valves reduce the space permitted for plugs to such a degree that it is often only possible to fit one. In the Sheepshead Bay race, of the eighteen cars to start, seven were fitted with two-point ignition and the others with single plugs.

A Battery System's Performance

The hot spark at high speeds, which is the greatly-desired feature in racing, falls in well with the characteristics of the magneto; hence this has been supreme for the past few years. One exception has been noted, however, this year in which the battery-equipped Hudson went through to third position in the New York event without showing ignition trouble of any kind during the run.

Taken altogether, racing ignition has not changed in any material respect, but throughout the entire system there is a greater reliability. Plugs are lasting better because they are better cooled. Broken wires are fewer because they are fastened much more carefully and such things as broken magneto straps, etc., which used to be responsible for putting good cars out of a race, have been reduced until it can really be said that in the racing cars for the 1916 season the ignition is one of the most reliable parts of the car.

Statistics of Stops in Previous Indianapolis Races

	1912	1913	1914	1915
Number starters	24	27	30	22
Number finished	10	10	13	11
Per cent finished	42%	37%	43%	50%
Troubles Classified by Source				
Steering gear	..	2	..	1
Valves	4	2	3	3
Ignition	7	..	1	4
Connecting rods	5	..	2	2
Brake adjustments	1	..	..	1
Gasoline leaks	4	3	..	1
Water circulation	1	..	..	1
Differentials	1	..	..	..
Piston rings	1	..	..	..
Broken wheels	1	..	1	..
Bearings	..	4	1	2
Clutches	..	4	..	1
Carbureters	..	4	..	1
Camshafts	..	1	1	..
Pistons	..	..	1	1
Crankshafts	..	..	1	..
Tires	90	88	138	96
Total stops	115	108	149	115

Automobiles and Trucks Break Mobilization Records

Aid in Assembling 10,000 Guardsmen in 2 Hr.

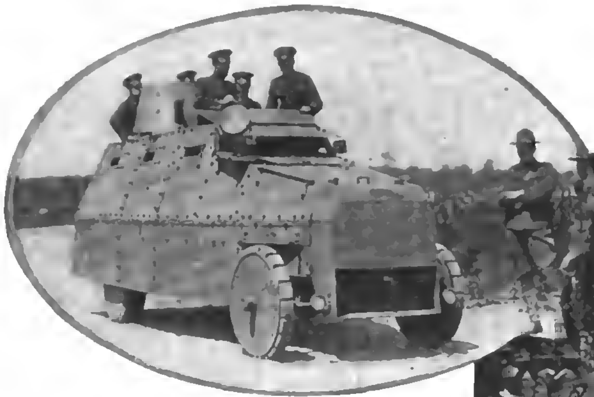
SHEEPSHEAD BAY MOTOR SPEEDWAY, May 21—Automobiles, armored cars and trucks played an important part in the mobilization of nearly 10,000 National Guardsmen for the opening of the military and naval tournament here to-day. Sixty civilian trucks and a number of passenger cars aided in transporting the men from the armories to the speedway.

A sham battle was held, the problem being the attack of a superior force on a smaller army covering the retreat of its main body. The coast artillery, Eighth and Ninth regiments, together with an armored battery, some engineers and signal corps men, defended one end of the inclosure and retired before the attacks of the infantry and field artillery units, aided by a troop of the First Cavalry. Sunday laws made the battle a silent one.

Attacking infantry advancing on the run across the speedway inclosure. Note the 2-ton Mack armored truck

Above—The Christie two-wheel, front-drive tractor, attached to a wagon type platform

Below—Transporting the troops. The drivers, being unused to convoy formation, were prone to pass each other, thus breaking the line



Above—The 2-ton Mack armored truck, which was a feature of the maneuvers, proving a formidable machine for either offensive or defensive work

The Jeffery quad service wagon. Like the armored truck, illustrated above, this belongs to the First Motor Battery of the N. G. N. Y.

The new Pierce-Arrow 2-ton tractor towing two of the twelve 1-ton Trailmobile trailers which it is designed to haul. This tractor has a cruising radius of 670 miles, owing to its large gasoline tank, and is to carry two machine guns, which can shoot over the tops of the trailers, mounted on the platform

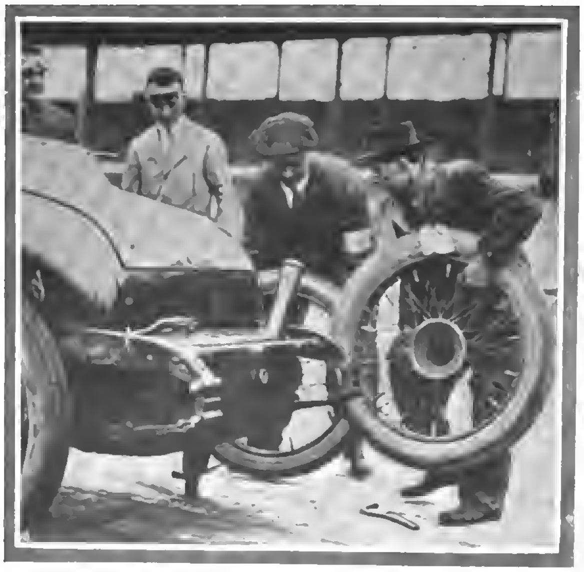
Start of the first heat of the amateurs' race at Chicago. This heat was won by W. A. Leet, who won the final

Mercer Winner in Amateur Race with 86.8 M.P.H.

W. A. Leet Covers 30 Miles in Final in 20:44.4—Same Car Wins Dealers' Race

Left—W. A. Leet, who won the amateurs' race. Right—Dr. R. R. Duff, who made a lap at over 94 m.p.h.

CHICAGO, ILL., May 21—William Leet in his red Mercer ground out each of the 30 miles in the final dash of the Western Inter-Club trophy race in 41.4 sec., taking the honors and silver cup in the first amateur race ever held on an American speedway. Leet, who drove under the colors of the Omaha Club, completed 15 circuits of the board oval in 20:44.4, his average being 86.8 m.p.h. He was about one-half lap ahead of his nearest competitor, Frank Warren, representing the Speedway Park Assn., who drove his Cadillac across the tape 1 min. 4 sec. behind the winner, while William Robbins, representing the South Shore Country Club, in a Mercer, finished third, being 27 sec. behind Warren. Frank Book, entered in the name of the Detroit Athletic Club and driving a Cadillac, was fourth and F. C. Sawyer, representing the Chicago Athletic Assn., fifth, their times being 23:04 and 23:14.2 respectively. The preliminary heats were run yesterday.



Changing a wheel on F. A. Sawyer's car

William Robbins led the field up to the end of the third lap with Dr. R. R. Duff less than a car length behind, Duff jumping into the lead in the fourth, and holding it until the end of the sixth when Leet took first position and held it until the finish. Duff and Leet drove a neck and neck race until the end of the eleventh when the former was forced to retire with a broken oil pump.

However, Dr. Duff's Mercer won an honor not scheduled in the program. After taking the lead in the fourth lap he went into the fifth with a spurt that was clocked at 1:16.2, or a speed of better than 94 m.p.h., the fastest time ever made by an amateur on the Chicago track.

With Al Schillo at the wheel, the same Mercer with which Leet won the amateur event, showed the way to the six other entrants in the 50-mile dealers' race, maintaining practically the same speed as in the first race of the afternoon. Schillo's time for the half century was 34:35.1, and his speed 86.7 m.p.h. The Cadillac finished second in the dealers' race as well as in the amateur race with Count de Constant losing to Schillo by a margin of only 45 sec. A. W. Bromstedt in a Mercer took third after he had challenged Schillo for the lead for 40 of the 50 miles. On the Twenty-first lap Bromstedt threw a right front tire in the back stretch and came into the pits on the rim. He lost a lap in making the tire change and was unable to recover it.

The sympathy of the crowd seemed to be with Ed. Schillo, brother of the victor, as he drove under a self-imposed handicap of one lap, stopping at the pits on the paced lap. His Mercer finished fourth.

Factors in Universal Joint Design*

American and European Constructions Show Great Variety—Rules for Determining Size—Protection and Lubrication Most Important

By A. Ludlow Clayden

THERE is hardly a part in an automobile that has more work to do and yet has less attention than a universal joint. It is liable to neglect, alike from the user of the car and the engineer responsible for the chassis layout. Usually made by specialists, the quality of material and workmanship in the average universal is of a high order of merit, but a little more attention given to the disposition of universals and to means for maintaining their lubrication would result in a higher chassis efficiency and a very greatly enhanced durability. The way in which the user has become accustomed to poor durability of universals may be noticed by appreciating one's own natural expectation that a car which has run 10,000 miles will have a good deal of slack and rattle in the transmission. It is not always so, but it is so often, and seeing that this undesirable slackness is neither necessary nor impossible of cure, it really is somewhat remarkable that we accept it so calmly.

Universals Highly Efficient

When properly proportioned to the work they have to do, and when properly lubricated, few parts of a machine are more efficient than a universal joint. This was shown by demonstration in tests made on a well known joint in the laboratory of the Mechanical Engineering Department, of the University of Kansas and, as these tests have been published already, there is no need to repeat the report on them in detail. The most important thing brought out by the tests was that the efficiency of the joints was near to 99 per cent for angular deflections up to 7 or 8 deg. It was also shown that the efficiency fell off more and more rapidly as the angle increased, but unfortunately the largest angle for which determinations were made seems to have been about 15 deg. In any case, however, it is obvious that the loss of power in a well lubricated universal is so small that it can be neglected.

Velocity Variation More Serious

Where a single universal is used to connect two shafts at an angle, if the first shaft runs at a steady and regular speed, the second shaft will run at a speed which varies during each revolution between maxima and minima, the values of these depending upon the angle of deflection. The change in the velocity of the driven shaft is very rapid, as it occurs during each quarter revolution, there are two maxima and two minima during each complete turn of the shaft. For determining the amount of variation the formula is

$$V_1 = V \cos \alpha$$

and

$$V_2 = \frac{V}{\cos \alpha}$$

where V = angular velocity of the driving shaft, V_1 and V_2 = the maximum and minimum angular velocities of the driven shaft, and α = the angle of intersection of the produced axes of the shafts. (See Fig. 1).

Now, it is obvious that a variation in velocity of a propeller shaft in a car having one universal only cannot take place without some curious reactions. At one end we have the inertia of the whole car as a moving mass tending to keep the road wheel turning at a constant velocity, and at the other end there is the flywheel of the motor. Obviously we could not accelerate and retard the road wheel, and so the whole car, twice during every revolution of the propeller shaft, even by a small amount, so it is to be assumed that the variation, which must take place somewhere, does so mainly on the flywheel.

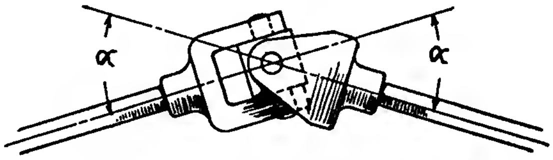


Fig. 1—Diagram to illustrate velocity ratio variation

Flywheel Fluctuations

Owing to the power of an internal combustion engine being made up from a series of explosions the flywheel has natural periodic fluctuations of its own and these will vary with the number of cylinders, the speed of the engine, the weight of the flywheel and the force of each explosion. With a four-cylinder motor the fluctuations would take place at the same rate as those due to the universal, in an eight at double that speed; so a four might have flywheel fluctuations that either coincided with or neutralized those due to the universal joint. That these fluctuations in speed are not so small that they can be neglected may be shown by quoting an actual value and, to take a low speed where variations have the greatest chance of being perceptible to the passengers in the car, we may assume a rate of revolution of 500 r.p.m. with

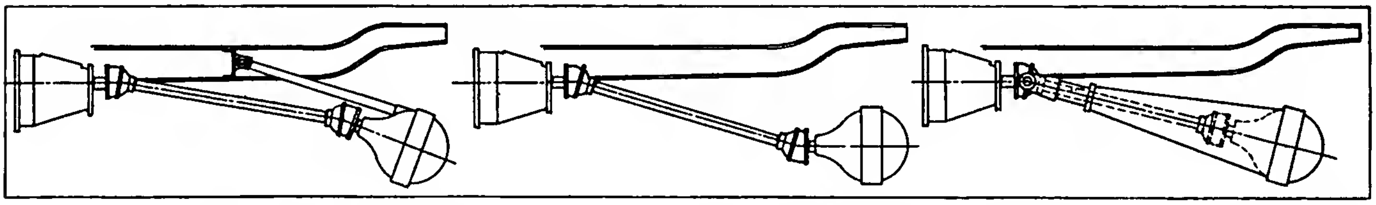


Fig. 2—Left—Layout for propeller shaft recommended by C. W. Spicer to divide angularity evenly between the two joints. Center—Layout obtained with Hotchkiss drive which bends both joints equally. Right—Layout with long torque rod which renders rear joint inoperative

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*Paper read at Cleveland section S. A. E. meeting, May 19.

an angular deflection of 10 deg. At 500 r.p.m. there will be 1000 maxima and 1000 minima of velocity in the propeller shaft which means 1000 vibrations per minute or about 17 per second. At the maximum positions the driving effort on the teeth of the bevels will be heavy, and at the minima it will be light, and an alteration in tooth pressure at so slow a rate of change as 17 per second would be distinctly perceptible in the form of vibration.

With a steady speed of the driving shaft of 500 r.p.m. and an angle of joint of 10 deg. the maximum velocity of the driven shaft would be 508 and the minimum 492 r.p.m. equal to a variation of 16 r.p.m. each quarter revolution. Now a quarter revolution at 500 r.p.m. takes 0.03 sec., an acceleration at the rate of 16 r.p.m. in this short space of time is rapid, so the load imposed on the bevel teeth is quite large. Practice shows clearly enough that cars with single universals are satisfactory enough, so the velocity variation is not serious, but it is probable that the elimination of the variation would render very smooth and effortless low speed running on high gear somewhat easier of attainment.

Two Ways of Eliminating Variations

There are two ways of eliminating the velocity variation, and both have been used successfully in practice. If we use two joints, one at each end of the propeller shaft, and if these make equal angles, the propeller shaft will vary in velocity owing to the angularity of the front joint, but the back joint will neutralize this and the bevel pinion shaft will run as steadily as the flywheel, any fluctuations of the speed of the crankshaft being reproduced faithfully on the pinion without reference to the universals.

The angle between the gearshaft, to which the front universal is attached, and the propeller shaft must be equal to that between the propeller shaft and the bevel pinion shaft, and this can be arranged either by keeping the bevel shaft always parallel to the gearshaft or by dividing the angular displacement between the two universals equally. If we adopt the latter style we gain the advantage that the angular displacement of either joint is only half what it would otherwise have been, and the efficiency is therefore better by some small amount. It is also unquestionable that the divided angle design is simpler to carry out than the parallel motion scheme, as the former can be secured by the use of a single, simple torque rod, while the latter requires regular parallel motion linkage of some complication.

It may be pointed out, however, that the so-called Hotchkiss drive, where the axle is locked rigidly to the springs, keeps the bevel shaft very nearly parallel to the ground at all times and so it is perhaps simpler, from this viewpoint, to use the parallel arrangement than the divided angle. The emphatic point is that the usual sort of torque rod which is anchored to the frame close to the front universal is not good, as it merely prevents the rear joint from doing its fair share of work, it prevents the second joint from damping out the velocity variation and it lowers the efficiency by throwing all the angular deflection upon the forward joint. Fig. 2 shows the three designs side by side for comparison.

Bearing Loads Are Heavy

However, the efficiency of joints is so high and the velocity variations of fairly small importance compared with the difficulty of lubricating the universals properly and their liability to wear and to rattle. Proper layout will minimize wear, but it does not help lubrication and does not prevent the creation of that slackness which produces noise.

Originally universals were very crude affairs and were both unprotected and unprovided with any means for lubrication, but of late years some very elaborate designs have been worked out, and there are just a few cars in which the universals can be trusted to last as long as any other part. The secret of durability is twofold; first the universal must be large enough for the load and, secondly, it must be bathed in lubricant continuously.

If the bearing surfaces are too small the torque of the motor will be able to squeeze out the lubricant and it must not be forgotten that the torque of modern motors is very high indeed. There is no need to go into detail examples, but calculation will show that among cars of all nations the bearing pressures in the universals when torque is at its maximum may vary from a few hundred to several thousand pounds.

The pressure on the bearings of a universal may be found by the following formula:

$$\text{Pressure per square inch} = \frac{HP \times 33{,}000 \times 12}{D \times \pi \times A \times R}$$

Where D = effective diameter of joint in inches, A = area in square inches of the two bearings carried by one fork and R = the minimum number of revolutions of the shaft at which the horsepower in question can be transmitted.

The allowable amount of pressure ought not, in the opinion of many engineers, to be allowed to exceed 1000 lb. per square inch at the maximum torque which the engine is able to apply no low gear. However, 2000 lb. is often permitted and even double this pressure, but the durability of the joints naturally suffers. A joint large enough to keep the maximum pressure below 1000 lb. per square inch is not cumbersomely big for passenger car use; it costs more than a smaller joint, but the extra outlay is well recouped in the better durability.

Just to consider an assumed extreme case take an engine developing 70 b. hp. at 2100 r.p.m. Assume the low gear in the gearset is 3 to 1 and we get:

$$12{,}600 = P \times D \times A$$

Or, if P is 1000 lb. per square inch,

$$D \times A = 12.6$$

Thus if there are two pins each with an area of 1 sq. in., the mean diameter of the joint should be 6 in.; or 3 in. with pins twice the size.

These figures, rough as they may be, serve to show that the size of joint necessary to give a safe bearing pressure is not excessive.

Formula for Joint Size

It would be impossible to do more than guess at the safe maximum load, but the lower it is the longer the life of the joint, goes without saying; also the poorer the system of lubrication the lower should be the pressure. The fact that the joint does not revolve on its bearings, but merely oscillates slightly, makes lubrication more difficult and this fact must be allowed for.

A convenient form of the formula for determining the safe diameter for a universal, when the size of the pin bearings and the maximum pressure have been chosen, is:

$$D = \frac{HP}{R \times A} \times \frac{126.000}{P}$$

Or the same formula can, of course, be used to determine A when D is fixed by other considerations.

In America there have been such good universal joints made by specialists, that automobile engineers have given little attention to their design, but in Europe each automobile manufacturer makes his own joint, as this is a part of the chassis which has never been taken up by specialists with the solitary exception of the Timken representatives, who have shown some remarkable durability with a taper roller bearing construction. As a result, the European makers have been more concerned properly to protect and lubricate the universals, having nobody else upon whom to place the responsibility.

Lubrication Is Difficult Problem

When first the idea that a universal needed protection from mud arose, covers were made of leather. These were of little use, as the centrifugal force drove the grease through every pore, straps broke and mud had a rotting action, so the cover was soon destroyed. The next step was to use a pressed brass cover and to close the mouth of the case with a smaller leather cover which, in this case, was just a plain cylinder. From this point development led to the use of a cover pressed or spun into a hemispherical form, the opening necessary to allow free movement to the shaft being closed by a corresponding pressed hemisphere held up by a coil spring outside the shaft. It is the last named type of covering that is in greatest use to-day and is very satisfactory indeed if made properly.

For lubrication all the different forms of case were supposed to be packed with grease, and grease is still the most common lubricant for universals. A well designed joint will contain enough grease to suffice for from 3000 to 5000 miles of running under ordinary conditions. There is one particular point to be kept in mind here, this being the effect of centrifugal action on the lubricant. If the outer case is very large the grease may all be thrown to the ends and the universal then runs in a cavity at the center where no grease touches it. Thus the case ought to fit fairly close to the joint. Next, the diameter of the case should be sufficiently greater than that of the hole through which the shaft protrudes to allow for the retention of a fair quantity of grease, supposing the piece which closes the hole to be removed.

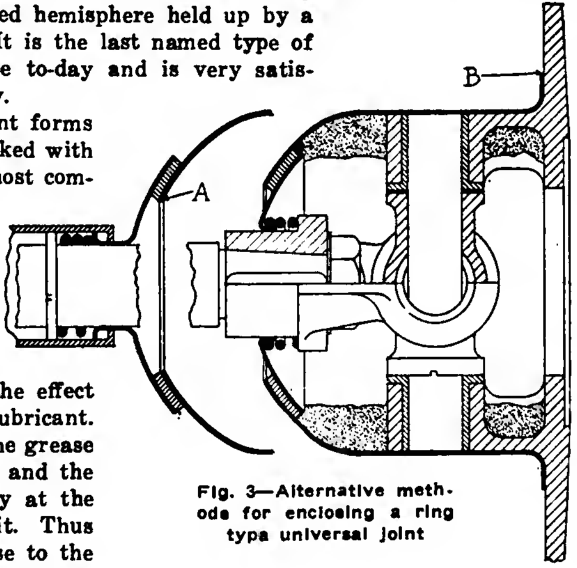


Fig. 3—Alternative methods for enclosing a ring type universal joint

If a joint casing is filled completely, centrifugal action will cause the middle part of the grease to be forced out through the joint between the case and the cover cap, however good the packing gland may be; the action is slow but sure. Thus the joint and case must be so proportioned and so arranged that the pins and their bushes are as close as possible to the outer circumference of the case and can be lubricated perfectly without the retention of grease at the very middle of the joint. In Fig. 3 is shown where the grease may reasonably be expected to remain. Even with these precautions in design the user should be careful not to use grease that is very hard because a certain amount of fluidity is needed to allow the lubricant to work its way into the pins.

Looking at Fig. 3 there might be reason to suppose that oil could be used, as there is no way for it to escape when the car is standing. However, most attempts to use oil have been disappointing because of the splashing that takes place. The usual way of arranging the cap is as shown at the left in Fig. 3. Presumably the oil is thrown against the inner surface of the cap, *A* Fig. 3, whence it is ejected past the packing. It seems thus that there are theoretical advantages to be claimed for inverting the usual arrangement and fitting the cap as shown on the right in Fig. 3, but even so it is to be doubted if oil would remain in the cover for long, and there would have to be some sort of a joint at *B* to allow the case to be assembled. This design has been used with success on several cars.

Experiments have been made with cases entirely independent of the joint itself and not revolving with it.

(To be continued)

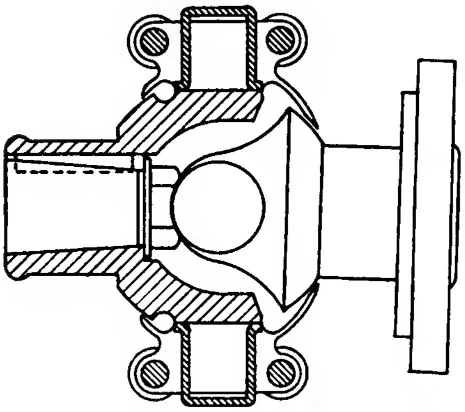


Fig. 7—Ring joint of the Wolseley car. A compact form in which the enclosure is obtained without additional case parts

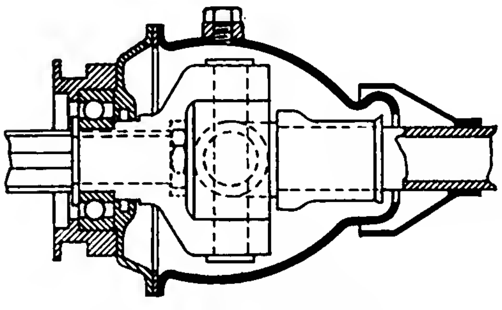


Fig. 9—Stationary cover used on a British chassis

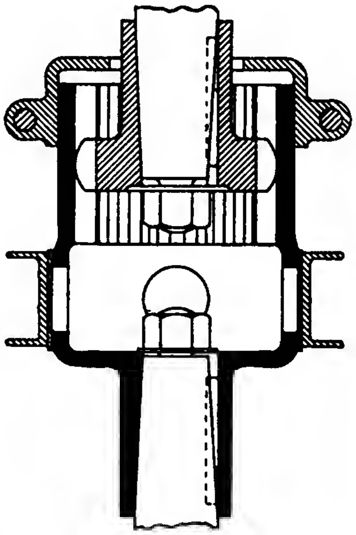


Fig. 4—Gear pinion telescopic joint used on some British commercial cars

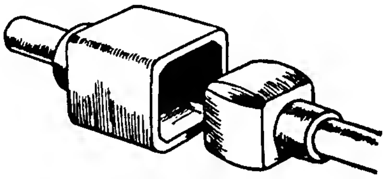


Fig. 5—The simplest possible combined universal and sliding joint, still used on the Lanchester car

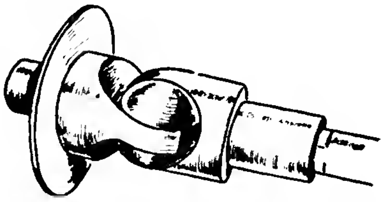


Fig. 6—Peculiar bell shaped universal used on British Rover cars

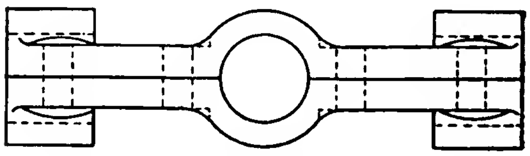
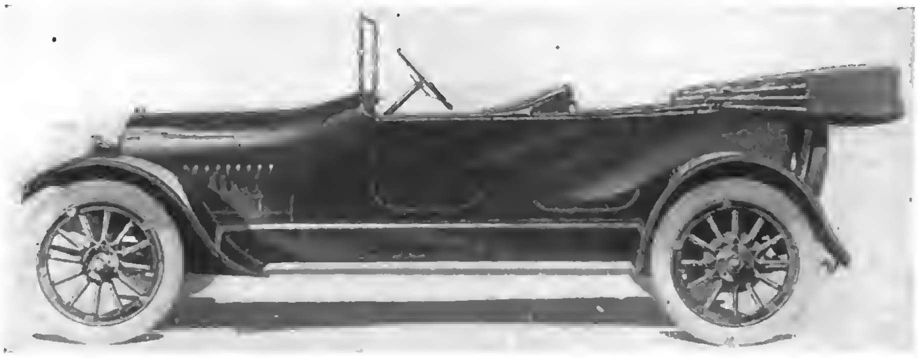


Fig. 8—Continental type of ring joint

Cloverleaf Roadster Features Crow Line

One Chassis with Two Bodies— New Electric System Employed



Side view of the Crow five-passenger touring car for the 1917 season

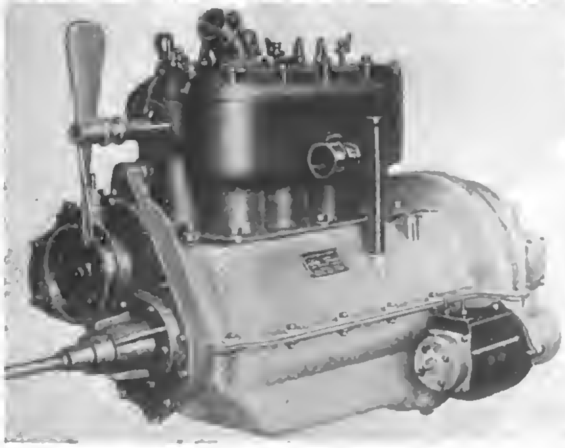
IN announcing the 1917 Crow cars, made by the Crow Motor Car Co., Elkhart, Ind., the important feature is the addition of a cloverleaf roadster, making two body models. Last year a coupé and sedan were listed but the cloverleaf is entirely new.

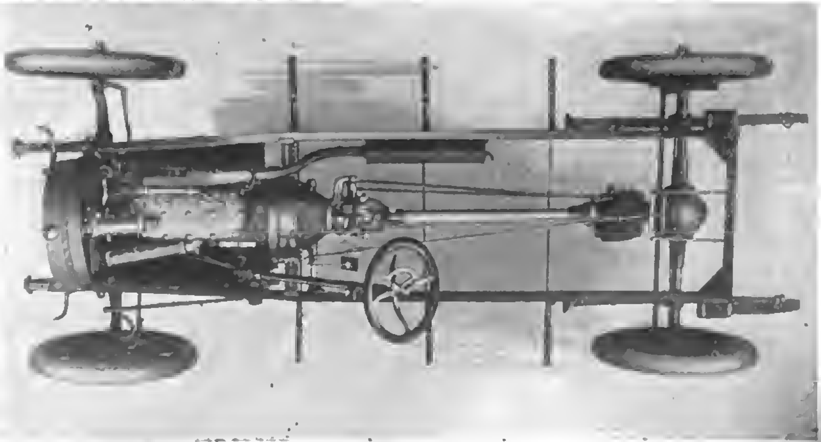
The five-passenger touring car has been improved in detail but still sells at $725 completely equipped, the cloverleaf selling for $795. Among the changes for this year is an alteration in the starting and lighting system which is now the Dyneto two-unit device in place of the system formerly used. A new body is employed to coincide with the tendencies of up-to-date streamline design. The body is built of white ash sawed into shape and not bent. It is covered with sheet metal and the braces are set into the wood at white heat.

Among the technical specifications is a detachable head four-cylinder L-head block motor 3½ bore and 5-in. stroke giving 34.9 hp. on the brake. Connecticut ignition is used, Zenith carbureter, dry-plate clutch and three-speed selective gearset on the floating rear axle.

A honeycomb type of radiator with an aeroplane style fan combine to give efficient cooling. Lubrication is by a combination pressure and splash system in which the main bearings are taken care of by pressure feed from the pump and the oil, after feeding the main bearings, flows to the splash troughs, from which the other bearing surfaces of the motor are lubricated. There is an oil indicator and filter also which form part of the lubricating system. The carbureter is a Zenith fitted with hot air supply.

The entire valve system is well worked out. The camshaft has integral cams and is made of a forging of low carbon steel 1 in. in diameter carried on three bearings. The front is 1¼ by 2 15/16. The center is 1.8595 by ¾ in., the rear is 2 9/16 by 1 in. The timing gears are helical in shape, cut to an angle to promote quietness and smooth running. The valves are 1⅜ in. in the clear and are located on the right side of the motor. The pushrods are flat-head type made of special case-hardened steel properly hardened and ground and adjustable by means of hardened adjusting screws and locknuts.





Top—The cloverleaf roadster which features the Crow line for 1917 and which is a new model that has just been introduced. Note the wire wheels and typical lines

Lower left—Three-quarter end view showing the motor used on the Crow 1917 car with its aeroplane type fan and compact layout of cylinders and crankcase casting

Lower right—Plan view of the Crow 1917 chassis showing motor mounting and layout of the drive members with the three-speed selective gearset mounted on the rear end of the propeller shaft adjacent to the rear axle

TYPE AND SIZE OF ELECTRIC LAMP BULBS USED ON THE PRINCIPAL CARS FOR 1916

Car	HEAD-LAMPS		SIDE LAMPS		TAIL LAMP		DASH LAMP		Fuses Amp.	Type of Socket	Wiring System	Type of Dimmer	Method of Focusing	Remarks
	Vol.	Cp.	Vol.	Cp.	Vol.	Cp.	Vol.	Cp.						
Abbott-Detroit	6-8	15	6-8	2H	6-8	2	6-8	2	10	Ediswan S	Single		Sliding bulb	
Allen	6-8	15	6-8	4	6-8	2	6-8	2	15*	Ediswan S	Single	Resist		*Side, Tail and dash lamp fuses 5 amp.
Alter, 8-Cyl	6-8	18			6-8	2			20	Ediswan S	Single			
4-Cyl	12-16	18			12-16	2			20	Ediswan S	Single			
Apperson	6-8	18			6-8	2	6-8	2	10	Ediswan D	Double	Resist		
Auburn	6-8	15	6-8	4H	6-8	2	6-8	2		Ediswan S	Single		Screw adj	
Austin	6-8	21	6-8	H	6-8	2	6-8	2	15*	Ediswan D	Single			*Tail and dash lamp fuses 5 amp.
Brewster	12-16	30-40	12-16	6H	6-8	4	6-8	4	10	Ediswan S	Single			
Buick	6-8	16	6-8	4H	6-8	2	6-8	2	C.B.	Ediswan S	Single		Adjust. bulb	
Cadillac	6-8	18	6-8	6	3-4	2	6-8	2	C.B.	Ediswan S	Single	None	Adjust. bulb	
Case	6-8	18	6-8	4H	6-8	4	6-8	4	15*	Ediswan S	Single		Adjust. bulb	*Side and tail lamps 5 amp.
Chalmers	6-8	15	6-8	4H	6-8	2	6-8	2	15	Ediswan S	Single			
Chandler	6-8	18	6-8	4H	6-8	2	6-8	2	20	Ediswan S	Single		Screw adj	
Chevrolet, H2 and H4	6-8	18		H	6-8	2	6	4	20	Ediswan S	Single		Adjust. bulb	
490	6-8	16			6-8	4			20	Ediswan D*	Single	Series		*Tail lamp Ediswan S.
Cole	6-8	21			3-4	2	3-4	2		Ediswan S*				*Dash lamp Ediswan D.
Corbitt	6-8	16	6-8	6	6-8	4	6-8		6	Ediswan D	Double	None		
Cunningham	6-8		6-8		6-8		6-8		15	Ediswan S	Single	None	Adjust. bulb	
Daniels	6-8	21	6-8	4H	6-8	2	6-8	2	15*	Ediswan S	Single	None	Adjust. bulb	*Side, tail dash lamps 5 amp.
Davis	6-8	16			6-8	4	6-8	2		Ediswan S	Single	Resist		
Detroiter	6-8	18			6-8	12	6-8	12		Ediswan S	Single	Series	Adjust. bulb	
Dispatch	12-16	24			6-8	4	6-8	4*		Ediswan D	Double			*Two dash lamps
Dodge	12-16	15			12-16	2	12-16	2		Ediswan S	Single	Resist	Adjust. bulb	
Dorris	6-8	15	6-8	4	6-8	2	6-8	2	15	Ediswan S	Single	Resist	Adjust. bulb	
Dort	6-8	16				6-8	2		10	Ediswan S	Single	Resist	Adj. socket	
Drummond	6-8	21		4H	6-8	2	6-8	2		Ediswan S	Single			
Elkhart	6-8	15			6-8	2	6-8	2	20	Ediswan S	Single	Resist	Adj. socket	
Empire	6-8	15	6-8	4H	3-4	2	3-4	2	10	Ediswan S	Single		Adj socket	
Enger	6-8	15			6-8	2	6-8	2		Ediswan S	Single	Resist	Adjust. bulb	
Farmack	6-8	18	6-8	6H	6-8	4	6-8	4	15*	Ediswan S	Single			*Side lamps, 10 amp; tail and dash 5 amp.
Fiat	6-8	15			6-8	4	6-8	4		Ediswan S				
Ford	6-8	15								Ediswan D	Double		Adj. socket	
Franklin	12-16	21	12-16	4H	6-8	2	6-8	2	15	Ediswan D	Double		Adjust. bulb	
F. R. P	12-16	25	12-16	6	12-16	6	12-16	4		Bosch	Single		Adjust. bulb	
Glide	6-8	15	6-8	4H	6-8	2	6-8	2	15	Ediswan S*	Single	None	Adjust. bulb	*Dash lamp Ediswan D
Grant	6-8	15			6-8	2	6-8	2	15	Ediswan D*	Single			*Tail and dash lamps Ediswan S
Haynes	6-8	15			6-8	2	6-8	2	C.B.	Ediswan D	Double	Series	Adjust. bulb	
Hudson	6-8	15			3-4	2	3-4	2	C.B.	Ediswan S	Single	Resist	Adj. socket	
Hupmobile	6-8	15	6-8	2H	6-8	2	6-8	2	10	Ediswan S	Single	Resist		
Inter-State	6-8	15	6-8	2	6-8	2	6-8	2		Ediswan S	Single			
Jackson	6-8	15		H	3-4	2	3-4	2	20	Ediswan D*	Doub**	Series		*Tail lamp Ediswan S. **Tail lamp single wiring.
Jeffery	6-8	18	6-8	4H	6-8	3	6-8	3	10	Ediswan S	Single			
Kearns	6-8	12			6-8	4			35	Ediswan D	Double	Resist		
Kline	6-8	18	6-8	4H	6-8	2	6-8	2		Ediswan S	Single			
King	6-8	15	6-8	4H	6-8	2	6-8	2	15	Ediswan S	Single		Adjust. bulb	
Kissel	6-8	18			6-8	3	6-8	3	20	Ediswan S	Single	Series		
Lexington	6-8	16		H	6-8	4	6-8	4	15*	Ediswan S**	Single	Series	Adj. socket	*Tail lamp 5 amp; **model 0, Ediswan D
Locomobile	6-8	21	6-8	6	6-8		6-8		10	Ediswan S	Single	Resist		
Lozier Four	6-8	18			6-8	2	6-8	4	10	Ediswan D*	Single	Series	Adj. socket	*Tail lamp, Ediswan S
Six	6-8	18	6-8	4	6-8	2	6-8	4		Ediswan D*	Single	Series	Adj. socket	*Side, tail and dash, Ediswan S
Madison	6-8	15	6-8	4	6-8	4	6-8	2		Ediswan S	Single			
Marion	6-8	18	6-8	6H	6-8	4	6-8	4	30	Ediswan S	Single			
Marmon	12-16	24	12-16	8	12-16	8	12-16	8	20	Bosch	Single			
Maxwell	6-8	15			6-8	2			20	Ediswan S	Single	Resist		
McFarlan	6-8	21	6-8	4H	6-8	2	6-8	2	10*	Ediswan S	Single		Adj. socket	*Side, tail dash, 5 amp.
Mercer	12-16	24	12-16	4H	12-16	4	12-16	4	6	Ediswan S	Single	Gr.glass	Adj. socket	
Metz	6-8	15	6-8	4H	6-8	2			20	Ediswan S	Single			
Mitchell	6-8	15			6-8	2	6-8	2	20	Ediswan D	Double	Series	Adj. socket	
Moline-Knight	6-8	15	6-8	4	6-8	2	6-8	4	20	Ediswan D*	Doub**			*Model MK-40 tail lamp, Ediswan S. **Model MK-40 Single
Monroe	6-8	15			6-8	2			10	Ediswan D*	Single	Series	Adj. socket	*Tail lamp, Ediswan S
Moon	6-8	15			6-8	4	6-8	4	C.B.	Ediswan S*	Single			*Model 6-30 headlamps, Ediswan D
National	6-8	15	6-8	6H	6-8	4	6-8	2		Ediswan D	Double		Adj. socket	
New Era	6-8	12	6-8	4H	6-8	2			20	Ediswan S	Single		Adj. socket	
Oakland	6-8	12			6-8	2	6-8	2	20*	Ediswan S	Single	Resist	Adj. socket	*Models 38 and 50, circui, breaker
Oldsmobile	6-8	16			6-8	1.5	6-8	1.5		Ediswan S	Single	Resist	Adjust. bulb	
Overland	6-8	16			3-4	2	3-4	2	20	Ediswan D*	Single	Series	Adj. socket	*Tail lamp and dash lamp, Ediswan S
Owen	28	24	28	4H	28	2	28	2		Ediswan D				
Packard	6-8	24	6-8	4	3-4	2	6-8	4	10	Ediswan D	Double		Adj. socket	Auxiliary headlamp bulb 6-8 V, 6 Cp.
Paige-Detroit	6-8	15	6-8	4H	6-8	2	6-8	2		Ediswan S*			Adj. socket	*Dash lamp, Ediswan D
Paterson	6-8	12	6-8	2	3-4	2				Ediswan S	Single	Series		
Pathfinder	6-8	18	6-8	4H	6-8	2	6-8	2	C.B.	Ediswan S*				*Dash lamp, Ediswan D
Peerless	6-8	15	6-8	4H	6-8	2	6-8	2	10	Ediswan S	Single		Adj. socket	
Pierce-Arrow	6-8	21	6-8	4	6-8	4	6-8	4	10*	Ediswan S	Single	Resist	Adjust. bulb	*Side, tail and dash lamp 5 amp.
Pilot	6-8	16			6-8	2	6-8	2	10	Ediswan S*	Single	Resist	Adj. socket	*Dash lamp, Ediswan D
Premier	6-8	15	6-8	4H	6-8	2	6-8	4	10	Ediswan D	Double	Resist	Adj. socket	
Pullman	6-8	15			6-8	2	6-8	2		Ediswan S				

Car	HEAD-LAMPS		SIDE LAMPS		TAIL LAMP		DASH LAMP		Fuses Amp.	Type of Socket	Wiring System	Type of Dimmer	Method of Focusing	Remarks
	Vol.	Cp.	Vol.	Cp.	Vol.	Cp.	Vol.	Cp.						
Regal	12-16	21	......	......	12-16	2	12-16	2	......	Ediswan D*	Single	Series	......	*Tail lamp, Ediswan S
Reo	6-8	15	......	......	3-4	2	3-4	2	5	Ediswan D	Double	Series	Adj. socket	
Ross	6-8	15	6-8	4H	6-8	4	6-8	......	......	Ediswan D	Double	......	Adjust. bulb	
Saxon	6-8	15	......	......	6-8	2	6-8	2	15	Ediswan S*	Single	Resist.	Adj. socket	*Dash lamp, Ediswan D
Scripps-Booth	6-8	16	6-8	4H	6-8	2	6-8	2	......	Ediswan S	Single	......	Adj. socket	
Simplex	6-8	40	......	......	3-4	2	6-8	2	10	Ediswan S*	Single	......	......	*Tail lamp, Ediswan D
Singer	6-8	21	6-8	6H	6-8	2	6-8	2	5	Ediswan S*	Single	......	......	*Dash lamp, Ediswan D
Spaulding	6-8	15	6-8	2H	6-8	2	......	......	......	Ediswan S	Single	......	......	
Standard	6-8	15	6-8	4H	3-4	2	3-4	2	15*	Ediswan S	Single	......	......	*Tail and dash lamp 5 amp.
Stanley	6-8	18	6-8	4H	6-8	2	6-8	2	15	Ediswan D	Double	......	......	
Stearns	12-16	20	......	......	12-16	2	12-16	2	20	Ediswan S	Single	Resist.	Adj. socket	
Sterling	6-8	16	......	......	6-8	3	......	......	20	Ediswan S	Single	Resist.	Adjust. bulb	
Stewart	6-8	15	6-8	2	6-8	2	6-8	2	15*	Ediswan S**	Single	......	Adjust. bulb	*Side, tail and dash lamp 5 amp. **Dasb lamp, Ediswan D
Studebaker	6-8	12	......	......	6-8	2	6-8	2	10	Ediswan S	Single	Resist.	Adj. socket	
Stutz	6-8	21	6-8	4H	6-8	2	......	......	......	Ediswan D	Double	......	Adj. socket	
Velie	6-8	15	6-8	4H	3-4	3	3-4	3	5	Ediswan S*	Single	......	Adjust. bulb	*Dash lamp, Ediswan D
White	18-24	21	18-24	4	18-24	2	......	......	......	Ediswan D	......	......	......	
Winton	6-8	21	6-8	12H	6-8	4	6-8	2	20	Ediswan S	Single	......	Adjust. bulb	
Westcott	6-8	15	6-8	4H	3-4	2	3-4	2	......	Ediswan S*	Single	......	Adjust. bulb	*Dash lamp, Ediswan D

NOTE—Where headlamps have small bulbs for side lamps, the candlepower is followed by the letter H. **ABBREVIATIONS—Type of Socket:** Ediswan single contact, Ediswan S; Ediswan double contact, Ediswan D; Circuit breaker, C.B.; **Dimmer:** Resistance, Resist; Series connection, Series.

Roller Bearing Takes Thrust in Novel Way

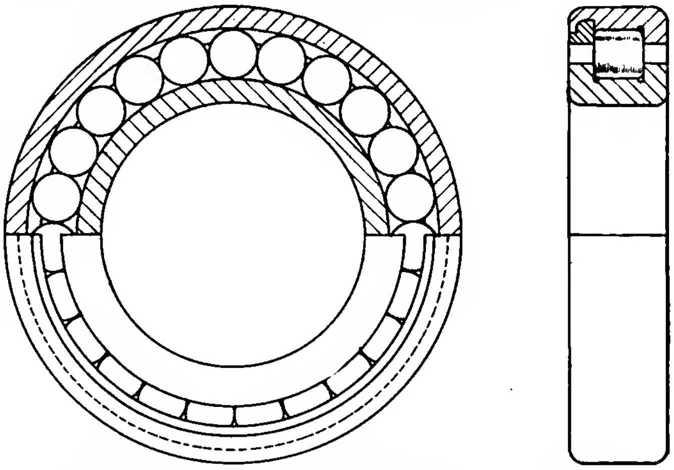
Acts as Parallel Roller for Journal Loads and as Self-Lubricating Plain Bearing Under Thrust—Intended Especially for Road Wheels

AXLE engineers have good reason to study bearing design closely, thus a new type produced by A. M. Laycock, chief engineer of the axle department of the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., is deserving of more than passing interest. Mr. Laycock has had the opportunity of studying ball and roller bearings of all kinds in service, and has come to the conclusion that the latter type are well adapted for the wheel bearings of trucks. He has been using several well-known types with great satisfaction and is now making, and experimenting with, a design of his own.

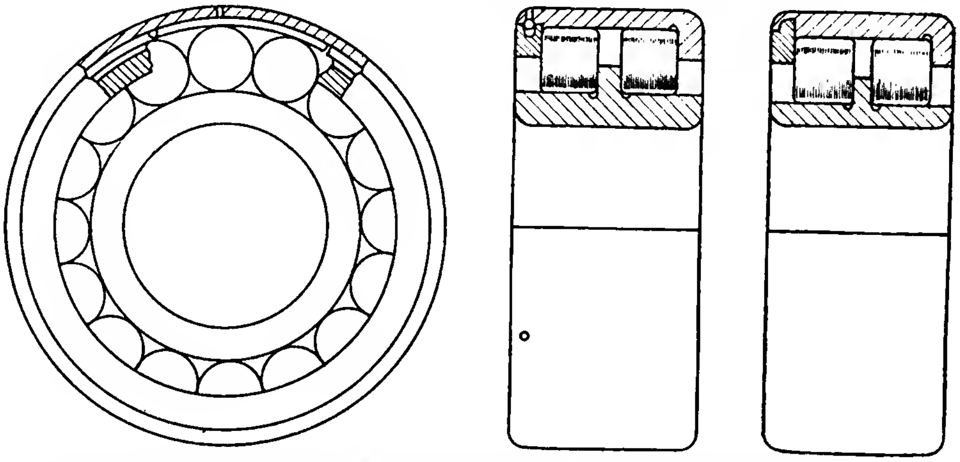
In this special bearing parallel rollers are used either with a cage for separating them or else with the race filled completely and the rollers touching each other. The rollers lie between flanges, and are finished off square at the ends, so that end pressure is taken on the ends of the rolls. Of course, this gives a purely sliding contact and so approximates to a plain thrust bearing, but it will be noticed in the illustrations that the rollers lie in a channel section race. This channel naturally is filled with oil, so that each roller entering the bottom part of the bearing passes through a bath of lubricant and the revolution of the roller spreads the oil well over the thrust surfaces.

Single and Double-Row Bearings

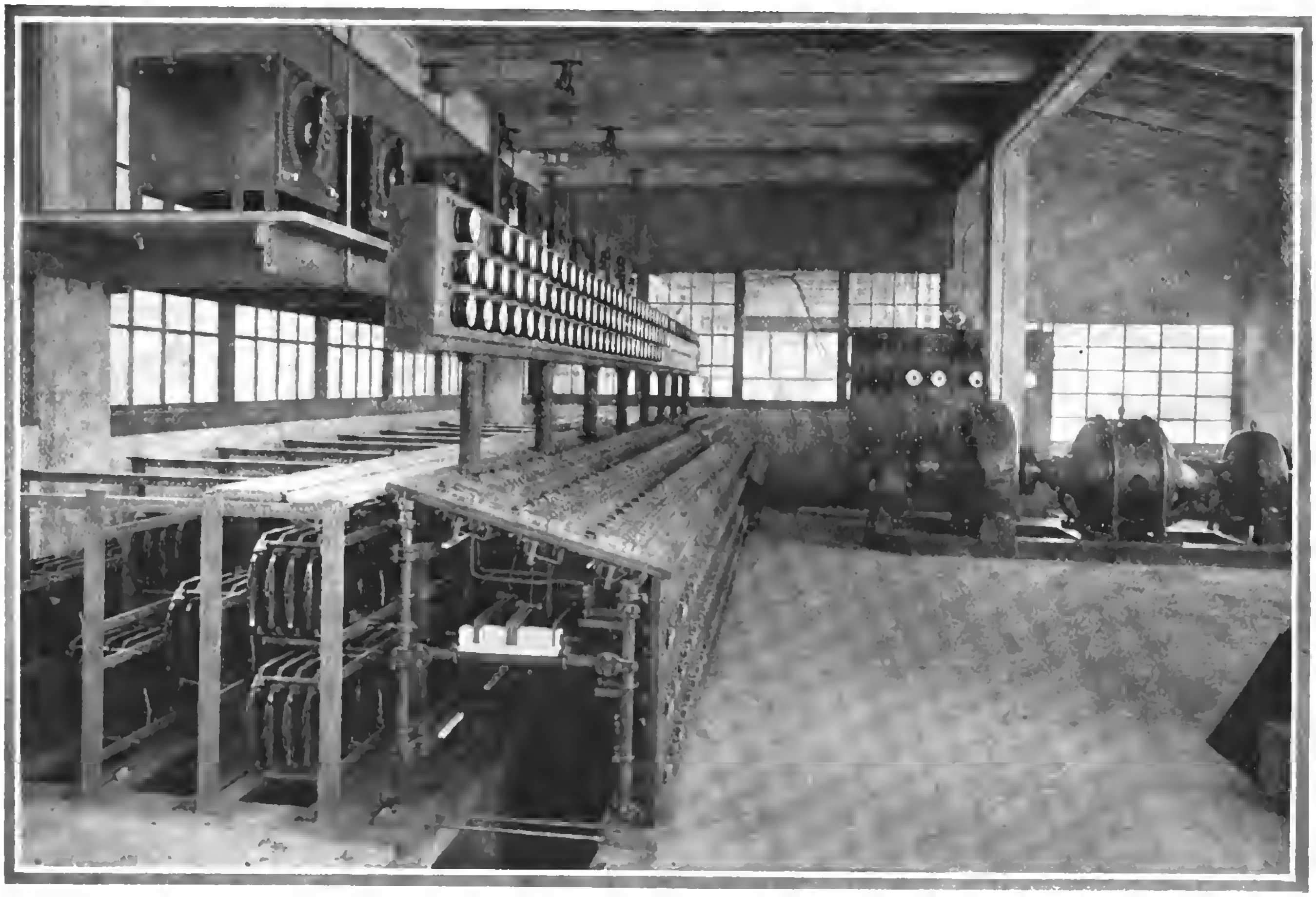
The experimental types now being made include both single and double row bearings, and several ways have been worked out for fitting them together. In the sections shown, the narrow, single row bearing has the outer race turned with a thin edge on one side. When the rollers have been put in the thrust ring is put in place and the thin edge is then rolled over by a burnishing tool. This same design is shown for one of the double row bearing sections, but the other has a different scheme. In the latter the loose thrust ring is grooved, as is the inner edge of the outer race. A sort of piston ring is pressed into the groove in the thrust race and this expands on the two grooves coming into register, so locking the parts together.



Laycock special single-row roller bearing. Note how the outer race is turned with a thin edge on one side and rolled over



The double-row bearing shown at the extreme right is similar to the single-row in its construction but the other uses a sort of piston ring pressed into the thrust race groove and this expands on the two grooves coming into register, locking the parts. Pressing the ring with the several pins similar to that illustrated, these pins being inserted through holes in the outer race, allows the bearing to be readily disassembled



Rheostats, desk control, motor generator set and switchboard in acid proof room of Prest-O-Lite storage battery plant

Prest-O-Lite Adds Charging Apparatus

Installation Includes Ninety-Six Independent Charging Circuits with Second Largest Desk Board Control in the World

IN connection with the program of the Prest-O-Lite Co., Inc., of Indianapolis, Ind., to manufacture storage batteries on a large scale an electrical charging apparatus having many new features has been installed. The installation provides ninety-six independent charging circuits controlled from a desk having sixteen slate sections by an operator who is in full view of every forming table on the main floor of the plant. The current supply has been carefully worked out with the idea in view of utilizing the discharge current from the batteries on the forming tables by passing it back through a booster generator where it is raised to the charging voltage and then used over again. The exact method by which this is accomplished is described later. Another of the striking features of this installation is the novel method of automatically disconnecting the incoming A. C. current, which is 4100 volts, and disconnecting the D. C. generators from their loads to prevent the discharge of the batteries back into the machines in the event of any great fluctuation in the A. C. voltage, overloading of the apparatus, or racing of the motor.

Control Equipment in Glass Room

The control desk by means of which the current is regulated for each of the ninety-six charging circuits is distinctly a new departure. It is said to be the second largest desk board installation of its kind in the world, one larger having been made up in this country for shipment to the Japanese government.

The entire control equipment is installed in a fume-proof glass room supplied with fresh air from an outside source. It is in this room that the operator works. It will be seen that while enjoying a full view of the entire floor in the forming department, by line of vision between the top of the benchboard and the bottom of the instrument frame, the entire apparatus is completely removed from the destructive acid fumes.

Underground Lead Cables Used

The current is carried from the control desk to the forming tables by lead cables in underground fiber conduit. The terminals at the tables are specially designed potheads, there being one, two and four conductors, according to the carrying capacity of the circuit and the location of the table. The potheads protrude through the floor which is constructed of acid-proof brick laid in asphaltum. The lines of batteries on charge are connected to the potheads during the forming process by means of flexible cable.

The incoming current is protected at the pole by a pole top switch, equipped with horn gap spark arresters, and an aluminum cell electrolytic lightning arrester located at the point of entrance to the building.

Among the New Automobile Books

Three Volumes Which Give Complete Information on the Design, Construction and Operation of Lathes, Modern Automobile Electric Systems and Car Repairing

INFORMATION of interest to the engineer, the repairman and garageman, and, last but not least, the automobile owner, is contained in the three books briefly reviewed herewith, these volumes being recently issued by the publisher, the Norman B. Henley Publishing Co. One of these works is a revised edition of Perrigo's book on lathe design, construction and operation, and bringing the subject matter up to date. The other two are by Pagé, one of them taking up the intricacies of the modern automobile electric system and describing the systems and detail and suggesting remedies for various troubles, and the other is a complete outline and description of the best shop methods, equipment and processes in automobile repair work.

Lathe Design, Construction and Operation. By Oscar E. Perrigo.—A new revised edition covering the subject suggested by the title up to date.

Lathe history and the relations of the lathe to manufacturing are given; also a description of the various devices for feeds and thread cutting mechanisms from early efforts in this direction to the present time. Lathe design is thoroughly discussed, including back gearing, driving cones, thread cutting gears, and all the essential elements of the modern lathe. The classification of lathes is taken up, giving the essential differences of the several types of lathes, including, as is usually understood, engine lathes, bench lathes, speed lathes, forge lathes, gap lathes, pulley lathes, forming lathes, multiple-spindle lathes, rapid-reduction lathes, precision lathes, turret lathes, special lathes, electrically driven lathes, etc. In addition to the complete exposition on construction and design, much practical matter on lathe installation, care and operation has been incorporated in the enlarged 1916 edition. All kinds of lathe attachments for drilling, milling, etc., are described and complete instructions are given to enable the novice machinist to grasp the art of lathe operation as well as the principles involved in design. A number of difficult machining operations are described at length and illustrated.

Large clear type and a clear style make this a desirable reference book. Published by Norman W. Henley Pub. Co., New York City, 400 pages 6 by 9; over 1800 illustrations, cloth binding, price $2.50.

Modern Starting, Lighting and Ignition Systems. By Victor Pagé.—A study of the construction and repair of up-to-date automobile electricity. In this work is included a full set of instructions for the repair and care of storage batteries, generators, regulating devices, starting motors, etc. The systems representing various classes of practice are described in detail and illustrated by complete diagrams showing the connections and the relations of the various parts of the assembly to each other. Data for the location of trouble in the various systems is given and there is also included a description of the various accessories which are operated from current supplied by the storage battery.

In the present state of uncertainty among non-technical owners and those not familiar with the principles of electricity this work should fill a useful purpose. Published by Norman W. Henley Pub. Co., New York City. Over 500 5½ by 8 pages with nearly 300 engravings and folding plates. Cloth binding, price $1.50.

Automobile Repairing Made Easy. By Victor W. Pagé.—Deals with shop methods, equipment and processes and is a complete treatise explaining approved methods of repairing all parts of all types of gasoline automobiles. This is a reference work for anyone engaged in the repairing of cars and outlines every process incidental to motor car restoration. Gives plans for workshop construction, suggestions for equipment, power needed, machinery and tools necessary to carry on business successfully. Tells how to overhaul and repair all parts of all automobiles. The information given is founded on practical experience, everything is explained so simply that motorists and students can acquire a full working knowledge of automobile repairing. Other works dealing with repairing cover only certain parts of the car—this work starts with the engine, then considers carburetion, ignition, cooling and lubrication systems. The clutch, change speed gearing and transmission system are considered in detail. Contains instructions for repairing all types of axles, steering gears and other chassis parts. Many tables, short cuts in figuring and rules of practice are given for the mechanic. Explains fully valve and magneto timing, tuning engines, systematic location of trouble, repair of ball and roller bearing, shop kinks, first aid to injured and a multitude of subjects of interest to all in the garage and repair business. All illustrations are especially made for this book, and are actual photographs or reproductions of engineering drawings.

Students as well as repairmen should find this a handy work as it is treated in a non-technical manner. Published by Norman W. Henley Pub. Co., New York City. Over 1000 pages 5 by 8 with 1000 specially-made engravings, cloth binding, price $3.

The new storage battery factory addition to the plant of the Prest-O-Lite Co., Inc., Indianapolis, Ind.

Paragraphs on Current Topics

By **Marius C. Krarup**

Motto: Radical Thought, Conservative Action.

More and more it becomes apparent that the automobile and motor industries are factors in all the big events of the moving world and near to the central forces in new developments. The automobile engineer who knows his book from A to Z, and also where its wisdom ends, is the most enviable of mankind for his opportunities.

* * *

If physicians had an S. A. E. and a live journal, there would be a public discussion on the human machine after 1300 Marathonian aspirants had struggled over 13 miles of roads and metropolitan streets, as they did last week in New York, only to be compelled at the end to yield first and second place to two durable Finns—two machines evolved abroad. Seventeen New York sporting editors, more or less, would then be enabled to make the welkin ring for a week or two with spirited argument on the proposition that the enduring human motor must be built up on a frugal diet from infancy, since nowhere in animal motordom the heavy eaters of meat make good for anything but spurts. Come on, physicians! Follow the lead of automobile engineers. Take your avocation in earnest and trust the public to reward the most capable. Remember, you should have a representative or two on a National Committee for Physical Preparedness. All are interested in the human motor.

* * *

Apropos of this watchword of the moment—Preparedness—which concerns the automobile industry so intimately, one national lesson is already written in luminous letters. A great sentimental sweep must precede every appeal to mere intelligence before the public gets deeply stirred. Every big business man probably knows this open secret intuitively. Every howling success is based upon it. The original Fordist inducement was the sentiment: "We, too, can be motorists," and the price did not stand in the way; neither was any detracting compromise offered in the type of the motor or in the possible speed; the sentiment was all there. There is money and results in sentiment well backed up. In almost any other country Preparedness would be considered a subject to be dealt with in commissions and committees first, and no statesman would venture to build up in advance a supporting sentiment on one glittering and abstract word. The American method, however, gets results in one-tenth of the time, and perhaps just as good ones. In some things we can guess as near right in a minute as in a month, and probably there is more guesswork in the biggest things than over-serious statesmen suspect. Hurrah for America! For sentiment first and specifications afterward. That makes things move.

* * *

F. P. A., celebrated jokesmith, initialist and manager of the "zink" for a New York daily, is tempted to give away his Jitnibus of Joy because a tire costs as much as a set of Hardy's books and produces less enjoyment. Just try it, brother, with one tire off and a set of Hardy's on board. Good rules work both ways.

* * *

"By learning a few rules and phrases every dolt now has a chance to become an efficiency expert and eventually an automobile owner," complains *Index of Contemporary Thought* gravely. Well, is not that a great step toward ability? Has anybody discovered a better method for improving dolts? They used to become dramatic critics or "flanneled oafs"; yet both the drama and tennis survive. Efficiency, too, can endure them.

* * *

Speculation on automobile design for coming years is more rife than ever, probably because most of recent changes have been inaugurated by prominent firms, making previous standards seem like mere commercial chaff that can be blown away by anybody whose wind is good. But commonly the speculation does not rise far above mechanical considerations of small complexity. Among repair shops in New York we find that a pretty industrial race is looked for between the spiral bevel gear and the worm drive, for ordinary cars. The reasoning, patched up from different sources, rounds up about as follows. It starts with a certain new fondness for the worm, coupled with objections to the sluggishness of worm-drive vehicles in the garage. Further, if this sluggishness or lack of coasting efficiency is remedied by trebling the diameter of the worm, the great gear reduction and the extra margin for road clearance are lost, and there are left only silence and relative immunity to wear (contingent upon careful lubrication); and these properties the spiral bevel and the worm have in common, though perhaps not in equal degree. It may then come to pass, where motors of more than 2000 r.p.m. are wanted, that the final drive will be taken by short shafts with universals to the wheels, or to internal gears in the wheels, while unsprung weight is reduced by hanging the spiral bevel gear or the worm gear in the vehicle frame. The rear wheels could then be dished or inclined, like front wheels, as may be advantageous with twin tires on crowned roads. But similar results—excepting the reduction of unsprung weight—could be secured with ordinary wheel drive by using the Renault or Mercedes compound rear drive (mainly used in trucks of these makes) comprising a special differential and double bevel gears, with spur gears, for further reduction of the ratio, to the inner ends of the wheel shafts. The demand for high-speed motors in conjunction with the desire for silent operation seems to lie at the bottom of these speculations which arrive at no definite conclusions but show the drift of ideas.

* * *

Suddenly there looms up from unexpected quarters—in this case from inventive but unindustrial Denmark—the proposition of an entirely new transmission system which may check all speculations about minor changes in design. A revolutionary plan, like Jakobsen's (described in THE AUTOMOBILE of May 11) might have the same reactionary effect, while its merits are being investigated, as that which followed, with regard to motor design, the acceptance of the Knight motor by the British Daimler company and lasted for a couple of years. With its suspended rear axle and brakes on the transmission only, the Jakobsen design reduces unsprung weight radically, while the independent spring action for each wheel almost promises speed and comfort on a corduroy road (if the wood is laid bias, as it ought to be, but seldom is). In examining the designer's drawing, it is noticed, however, that the movement of the cantilever spring, as planned, scarcely can be reconciled with that of the wheel spindle, so that we know for a certainty that this surprising mechanism so far exists on paper only. But its whole plan is so unusual and bold that one hopes to see the little slip remedied, as easily may be done by a shackle action, and the whole system entered among actual types of automobile design. It seems to solve, very largely, the knotty problem of cushioning the horizontal component of a road shock, for the driving wheels.

* * *

The current doctrine on unsprung weight claims a big share of attention in the possibilities referred to in preceding paragraphs. But there is something peculiar about this doctrine. It does not hold good under all conditions. Truck people find that tire wear depends on total weight and service conditions and that no special effect of unsprung weight can be traced. Many car owners hold that a heavy axle has no effect to spoil their comfort. Only with regard to light vehicles is there something akin to unanimity against unsprung weight. Now add the assumption that bad effects from excessive unsprung weight are mostly felt at moderate vehicle speeds—as is pretty well sustained in practice—and it becomes possible to get a nearer view of this important but tottering doctrine. First let it be admitted that tire inflation for light vehicles (say 60 pounds pressure under a body and load weight of 1000 pounds) is higher in proportion than that used with heavier vehicles (say 90 pounds under loads of 3000 pounds). Similarly, that the solid tire is more elastic for a light vehicle, which does not compress the rubber compound to its yield limit in advance of any shock, than for a truck. Now, comparing all reports, there is no difficulty about reconciling them. They all agree in this that the unsprung weight is most objectionable when it is not really unsprung; that is, when it is supported on actively elastic tires. One might say "re-actively elastic tires" to express the idea that at high speeds the elastic reaction of the tires gets small opportunity to spend itself against the unsprung weight and the vehicle springs above it. This is perhaps as far as one paragraph will take this subject. To go further with mere reasoning might challenge contradiction. Let it stand just like this for a while: Unsprung weight affects tire wear and comfort most at medium speeds—10 to 25 miles per hour—and when mounted upon tires of relatively powerful elasticity. Or, if a paradox is preferred: Unsprung weight is worst when not unsprung.

* * *

"Heads Up" and "Crossing at Corners" is the double title for three pages in the *American Magazine* recommending the disciplining of pedestrians and strict examinations for chauffeurs. F. U. Adams lends his name to the plan. With these safeguards and prompt revocation of driving licenses for transgression of traffic rules, he has convinced himself, vehicle speed can be given free up to 35 miles per hour for cities and higher for the country. Mr. Adams' theory is to scare everybody into an abnormal state of wide-awakeness, and the idea is borrowed, he says, from London and Paris. But the war has discouraged Americans from borrowing European ideas which in the end lead to a clash. And plain arithmetic persists in telling us that, in the traffic system which we shall adopt eventually, neither shall safety depend entirely upon the chauffeurs—which means reducing safety 50 per cent in advance—nor shall pedestrians be second-class traffic members, nor shall a costly army of traffic police be required for enforcing more or less arbitrary and injudicious rules. The automobile industry has managed to grow prosperous without embracing or subsidizing any measures savoring of subjugation for the general public—who in America are pedestrians one day and motorists the next—and can afford to continue on easy lines of evolution, cultivating by degrees a public opinion and public habits which eventually will solve the problem of securing both safety and freedom for all. On Adams' plan safety depends too much on others and too little on self.

Diesel Motors for Vehicle Work

THE question of forced fuel feed, rather than fuel feed by suction, and that of adapting the Diesel principle to automobile purposes are closely related, the object in both cases being the utilization of cheap fuels with full cylinder charges and a combustion—of excess lubricant as well as fuel—so complete as to forestall, in a great measure, the formation of carbon deposits. To combine these objects with the light weight and the highly sensitive throttle control required for automobile purposes represents a task which has engaged designers for a number of years and which the general fuel situation now renders more important than ever.

In practical familiarity with small Diesel engines Europe is ahead of America and it is therefore of more than ordinary interest to present the European view of the necessities and probabilities in the situation. The *Commercial Motor* of April 6 offers material of this nature in an article explaining the Diesel system on the assumption that the reader is not previously acquainted with it and suggesting the modification illustrated in the accompanying sectional view. The article explains in substance as follows:

Explanation of Diesel System

Little progress has as yet been made as to the development of the Diesel engine in making it suitable for installing in commercial vehicle chassis. The difficulties of design undoubtedly increase as the size of the engine decreases. The principle of working is as follows:

The engine is made in three forms, viz., as a four-stroke-cycle single-acting engine, as a two-stroke-cycle single acting, and as a two-stroke double-acting engine. An essential feature in the actual Diesel engine is that it requires, besides its own cylinders and pistons, an auxiliary air compressor capable of producing a pressure of up to 700 lb. per square inch. The principal difference between the Diesel cycle and the ordinary gasoline motor cycle is that air only is compressed in the cylinder instead of a mixture of air and fuel.

In the four-stroke Diesel engine there is an air inlet valve, a fuel valve, and exhaust valve worked by cams, and a valve for starting purposes.

First (down) Stroke.—The inlet valve is opened during the whole of the stroke, and the cylinder becomes filled with atmospheric air at atmospheric pressure.

Second Stroke.—The air valve is closed and the piston returns to the top of the cylinder compressing the air. The clearance is so proportioned that in ordinary working the pressure becomes about 500 lb. per square inch and the temperature of the air about 1000 deg. Fahr. Near the end of the stroke a quantity of fuel is injected through the fuel valve into the cylinder by means of a blast of compressed air supplied from the auxiliary air compressor. The construction of the fuel valve is such that the oil is divided into a spray of fine particles. These, coming into contact with the very hot air, ignite automatically, and combustion takes place, increasing the pressure in the cylinder.

Third (down) Stroke.—The fuel valve remains open for about one-tenth of the stroke. During this portion of the stroke the pressure remains practically constant, about 600 lb. per square inch. During the remainder of the stroke the products of combustion expand. This stroke is the working stroke.

Fourth Stroke.—The return of the piston (during which time the exhaust valve is open) drives out the burnt gases. After this the cylinder starts afresh.

The Two-Stroke Type

In the two-stroke engine, the cylinder head is similarly fitted with fuel valve and air valve for starting purposes, and with an air valve called a scavenging valve, but the exhaust valve is replaced by ports cast in the cylinder walls. In some makes of two-stroke engine, scavenging ports are also cast in the sides of the cylinder. The cycle of operations is then as follows:

When the piston is at the bottom of the stroke, the cylinder is full of air at atmospheric pressure, which air has just been admitted through the scavenging valve. During the up stroke the air is compressed to a high pressure, and attains a high temperature. At the top of the stroke, fuel is injected by the blast of air into the hot air within the cylinder, combustion takes place, and the gases expand, thus acting on the piston. When the piston has reached about six-sevenths of the down stroke, the piston commences to uncover the exhaust ports cast in the cylinder walls. The scavenger valve opens and air is admitted under low pressure, about 5 lb. per square inch, which blows out the burnt gases and fills the cylinder with air ready for the next compression stroke. Different arrangements are used by different makers for supplying the scavenging air, some makers using a separate air pump, other makers using a stepped or double piston.

In the double-acting engine the piston is attached to a piston rod which works through a gland and metallic packing at the bottom of the cylinder. A cycle of operations, similar in action to that described for the two-stroke engine, takes place at both ends of the cylinder.

Difficulties and Variations

From the foregoing descriptions it will be seen that various difficulties arise in the design of the Diesel engine. The engine requires to be stoutly designed, owing to the high pressure involved. The high temperatures attained make it necessary for careful attention to be given to the cooling of the various parts of the engine, and the air compressors necessary for supplying the air for starting purposes and for fuel injection, and the fuel valves themselves, all present difficulties which, although overcome in large engines, tend to put the Diesel engine at a great disadvantage when used for comparatively small powers.

Various makes of small-power, semi-Diesel engines have appeared which require no compressors for starting or injecting the fuel. These engines have a much lower compression than the purely Diesel engine, varying from about 120 lb. to 200 lb. per square inch, but they require blow-lamps to heat up the cylinder heads for starting purposes. On the cylinder head a bulb-shaped chamber is formed, which is heated by means of the blow-lamp. Into this chamber the air drawn into the cylinder is compressed. The temperature of the air is increased by the hot bulb and by the increase of the pressure. Fuel is injected into the cylinder by means of an oil pump, and the pressure due to the combustion of the fuel acts on the piston.

Example of Modified Diesel Motor

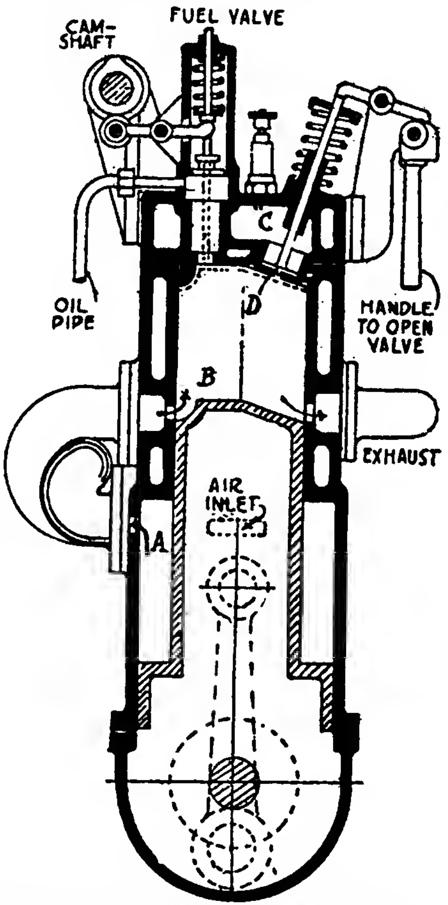
Various methods have been invented for reducing the compression in small motors intended to work on the Diesel cycle. One of these is illustrated herewith, showing a section through a two-stroke, two-cylinder motor having a stepped piston, the larger one acting as an air pump for scavenging.

By this particular method the invention is intended to provide a scheme by means of which the engine could be started as an ordinary gasoline engine by rotating the crankshaft. It is obvious that in an ordinary Diesel engine it would be impossible to turn the motor over the centers, owing to the high compression. Cast in the cylinder covers is a chamber *C* which can be put into communication with the working cylinder through the valve *D*. This chamber is used for burning gasoline supplied by an ordinary carbureter and incidentally for reducing the high compression, so that the motor may be started by rotating the crankshaft. A valve is introduced in connection with the inlet valve of the motor, which may allow it to draw either pure air or a mixture from the carbureter.

To start this particular engine, the valve *D* is opened, putting chamber *C* into communication with the cylinder. A mixture of air and gasoline is drawn into chamber *A* through the air inlet on the downstroke of the stepped piston. On the upstroke the gas is transferred into the upper part of cylinder *B* and is compressed into chamber *C*. It is ignited by means of a spark plug, and the combustion of the gas sets the engine in motion. Heavy oil is now injected into the cylinder through the fuel valve, the gasoline supply is cut off, and pure air is drawn into the cylinder. Valve *D* is shut and the spark plugs are also put out of action. Exhaust takes place through ports cast in the cylinder wall. The engine is now working on the pure Diesel system.

Such a scheme could probably be applied to the hot-bulb type of motor, so that a blow-lamp could be dispensed with. The motor would use gasoline as fuel until it was sufficiently hot for combustion to take place when oil was injected into the air in the cylinder. The gasoline supply could then be cut off. After so starting the motor could be run as a hot-bulb motor.

It seems probable that if an engine is developed suitable for use on commercial vehicle chassis, it will not run on the pure Diesel cycle, but some sort of engine will be developed that can be started as an ordinary gasoline engine and afterward changed over to run on the Diesel or the hot-bulb system, or some combination of these methods. After much experience, a solution of the problem may perhaps be found along these lines, and although the difficulties are much greater than appear at first sight, the proposition is far from hopeless, seeing that Diesel and semi-Diesel engines have been adapted to other branches of employment with success.



Suggested adaptation of Diesel motor to vehicle work

The FORVM

Fuel Consumption and Tire Wear without Differential

By George D. Bailey
Gearless Differential Co.

THE writer, with the assistance of several prominent engineers, among them W. H. Diefendorf, chief engineer, New Process Gear Corp., Syracuse, N. Y., and F. W. Hawes, consulting engineer, formerly chief engineer for the Cadillac Motor Car Co., Detroit, Mich., has spent about five years in perfecting an improved differential. During that time innumerable tests have been made covering differential action and also every known type of differential, and our experience is based on actual practice and not theory, which is as follows:

A car without a differential will never be a success because before differential action can take place, such as turning corners, one-half of the traction must be overcome before the turn can be made. The inner shaft has an overload of the resistance offered in overcoming the drag of the outer wheel so that it can slip and allow the car to make the turn.

This necessary slippage is divided about equally on both wheels when traction is equal, and is, of course, greater at the wheel with the least traction. This necessary slippage, by the way, is about 7 ft. 4 in., or nearly a complete revolution of a 30-in. wheel. Were traction made great enough, either by excessive load, spikes or cleats, it would be impossible to make a turn without some driving parts being broken or the motor being stalled. The differential could be dispensed with under certain conditions, but it would be absolutely necessary to increase the strength of all driving parts, which would, of course, necessitate more power, more weight, greater cost and unnecessary waste of fuel and tires.

We believe it should be plain to anyone that a car or truck having sufficient power and strong enough driving parts to be efficient without a differential has more power and heavier driving parts than are necessary with the differential.

Classified in Four Types

This differential proposition can be divided into four classes or types:

No differential.
Spur or bevel (balanced gear).
Spiral or worm (internal friction).
Bailey gearless (slow wheel drive).

The efficiency in differential action can be determined by the power required to equalize the difference of travel of the driving wheels. With no differential, having to overcome one-half of the traction, we will put the loss at 50 per cent. With the internal friction type, in order to be anywhere near efficient, prevent wheel spinning and give a semi-positive drive, this should be placed at not less than 25 per cent. The conventional gear type, owing to differential friction, about 12½ per cent. The slow wheel drive, due to an absolute free release of the faster wheel, 00 per cent.

It is generally assumed that the differential is necessary only for making turns. We have found that the aggregate of differential action is usually greater in the straightaway than in making turns. This is from the fact that practically all road surfaces are made up of miniature hills and hollows, and the wheel going into the hollow or over the hill is running ahead; consequently, there is almost constant differential action, so that any differential that consumes extra power, more fuel and excessive tire wear in turning, does the same thing to a certain extent in the straightaway.

We do not believe that the public will take kindly to the extra fuel consumption and tire wear in the no-differential job. Besides, we are quite sure that, even disregarding the greater power necessary, that the cost and weight will be actually more than with an efficient positive drive differential.

A perfect differential is one that has the virtues of no differential, namely, its positive drive, which means no wheel spinning, side-sway, etc., and will allow the outer wheel to run ahead freely. An efficient slow wheel drive type has identically this action and automatically performs every differential function.

> *A CAR WITHOUT A DIFFERENTIAL CAN NEVER BE A SUCCESS BECAUSE IN MAKING TURNS ONE-HALF THE TRACTION MUST BE OVERCOME BEFORE THE TURN CAN BE MADE—MANEUVERING AND TIRE WEAR*

Maneuvering a Factor in Eliminating Truck Differential

By L. C. Crilley

FOR several weeks I have been following with much interest the discussion of the advisibility of eliminating the differential for motor truck rear axles. Many ingenious and thoughtful arguments have been advanced both in advocation of this plan and against its practicability, but as yet no one seems to have mentioned a factor in the situation which seems to me of sufficient importance to warrant at least passing consideration. This is the tremendous amount of expense due to increased tire wear which the great amount of backing around necessary with commercial vehicles would cause if the differential were not used.

If you have ever paid much attention to the loading and unloading of motor trucks, especially the large and cumbersome vehicles used in hauling and other heavy freight work, you have doubtless been struck with the great amount of negotiation and manipulation required to place the machine in the proper position for loading or unloading. Perhaps it occurred to you at the time that this maneuvering as well as that required by traffic conditions must entail a considerable waste of fuel and lubricating oil as the engine is always kept running and its speed constantly changed; perhaps you have also pondered on the unnecessary tire wear as well as that upon mechanical parts of the machine. But when one realizes that these operations are gone through by each truck many times a day this waste and wear expense begins to assume astonishing proportions. Increasing this to the degree which would be caused by the elimination of the compensating action of the differential would seem to me exceedingly unwise.

The History of the Pneumatic Tire—4

Bradford's Tire Patent of 1868—Greene's Patent on Flat Rubber Strip on Iron Tire—Thompson's Solid Types—The Forerunner of the Modern Tire Chain

The History of the American Automobile Industry—31

By David Beecroft

CLOSE to the Goodyear patent of 1854, for vulcanizing, are the patents of Marcy, Nov. 7, 1854; Meyer, Feb. 28, 1854; Fostrick, in 1856, with De Wolfe and Eaton, in 1859. In 1850 Trotter took out a patent for the use of zinc hyposulphite as a vulcanizing medium, using no free sulphur. Little is heard of rubber tires, however, until 1868, when we find a patent issued to C. K. Bradford, claimed by some to be the first rubber tires in the United States. In the same year, Dec. 15, J. A. Greene patented a flat strip of rubber bolted to the iron tire by bolts passing through the felloe and having springs on their nutted ends to take up the bolt movement as the rubber strip compressed.

Thompson's Solid Tires

Thompson, in England, seems to have continued his tire experiments along the line of solid tires, having failed to find a market for his aerials. In 1868 we find road steamers, a sort of light traction engine, giving good service on both sides of the water, fitted with Thompson tires, those on the drivers being a foot wide and 5 in. thick. These tires were watched with considerable interest and a set that had run 1200 miles are reported to have shown no symptoms of deterioration or decay. The Edinburgh *Scotsman* of that year speaks very enthusiastically of them and says "the application of vulcanized India rubber to the tires of road steamers forms the greatest step ever made in the use of steam on the common roads." Another British publication reports the road grip as marvelous, the riding smooth, with no jar, and the machinery spared. These remarks are interesting because they show that the destructive effects of road vibration on machinery were appreciated even with the heavy and clumsy construction of that time, and it is probable that this destructive effect was even more noticeable than to-day, because of poorer materials.

Prototype of Tire Chain

In the *Scientific American* for Sept. 24, 1870, the Thompson solid tires were described as being mounted on a broad rim with flanges, but the interesting part of this description was that over this tire was an endless chain of steel plates, connected together at each side of the wheel. No rigid connection is made with the wheel, but this chain of plates was free to move around the tire "as they please without consulting each other." Clearly, this was the predecessor of the modern tire chain, and the fact that there was much question as to traction ability and freedom from slipping, in wet spots, very plainly indicates that the anti-slip abilities of such a chain could not have been overlooked at that time even if the principal thought was to protect the rubber. That this latter was not the principal thought must be evident to anyone accustomed to the use of rubber tires, and it was undoubtedly well known in those days that metal, more or less loosely attached to rubber, quickly destroyed it.

That rubber was coming rapidly into use is shown by a report of 10,000,000 lb. in 1870 and a belief that the supply was inexhaustible.

$1,050 for a Set of Tires

In April, 1871, we find a further statement regarding the Thompson tires, the weight of a 6-ft. tire being given as 600 lb., which, at 2 shillings per pound, would make a set cost $1,050 in gold. The set mentioned had made 260 journeys of 7 miles each way, being loaded on the one to ten average up-grade direction, a total of 1820 miles, and their outsides were slightly marked, but the insides smooth. "Clams" of metal were attached to prevent slipping when needed. This description would indicate that these broad, flat bands of rubber were not cemented in place, but simply retained by the rim flanges. That they did not continue in use, and so are not mentioned in later publications, seems to indicate that their cost was prohibitive.

Rubber Segment Tires

U. S. Patent to L. W. Cheever, in February, 1869, shows a D-shaped rubber mounted in a rim that seems to have been produced by planing or milling a groove in a thick iron tire, this groove being slightly dove-tailed. It was presumably cemented in place, and having a flat base, should have carried light loads very satisfactorily. In 1870 we find tires consisting of rubber segments mounted on metal plates which were mechanically fastened to the wheel, a method employed by inventors thirty or more years later. The year 1871 shows a spring tire brought out by J. H. Clapham.

The Rostrum

A Formula for Computing Pulling Power

EDITOR THE AUTOMOBILE:—As a subscriber, I ask your consideration of the following method for computing the relative pulling power of various machines in high gear.

Multiply the engine displacement by the gear ratio and we have the number of cubic inches of gas fired during two revolutions of the rear wheels. Multiply twice the diameter of the rear wheel by 3.1416 and divide this into the product obtained above, and we have the maximum number of cubic inches of gas that can be fired in propelling the car 1 in. forward. Now, if we have the weight of the car in pounds, move the decimal point three places to the left and divide it into the above result, and it will give the number of cubic inches of gas the motor expends to the 1000 lb. when working to its full capacity.

Or briefly, $\frac{\text{ratio} \times \text{disp.}}{n \times 2 \text{ r. w. diam.}} \div \frac{\text{weight}}{1000}$ = cubic inches to 1000 lb.

If this is computed for several different machines it seems that the results would show the comparative power of each machine. Of if preferred, it might be more fair to add the weight of a passenger load to that of each machine. Of course different motors vary, so will you please state what factors enter to make these results less accurate, also whether you think this method worth any consideration at all.

Also will you please give the following information:

1—What was the gear ratio of the Hudson super six that made the twenty-four hour record at Sheepshead Bay?

2—What is the weight of the Hudson super six ready for the road?

3—Kindly publish the power curve of the Oakland model 6-32 motor, or if this is not available state at how many revolutions per minute it reaches the peak of its power curve.

4—What is the weight of the Moon model 30 ready for the road?

Plattsburg, Mo. C. E. J.

—As a method of comparison the plan you suggest is quite interesting as it incorporates both the considerations of volumetric efficiency and fuel economy. Of course we do not know exactly to what extent the cylinder is filled in every revolution. Therefore the results you obtain will not be exactly accurate as they must be multiplied by the volumetric efficiency factor, but taken for different cars your figure would be very interesting.

1—The gear ratio used in this endurance test and with which the records were made was 3½ to 1 in place of the standard 4 5/11 to 1.

The reasons for the selection of this particular gear ratio may be summed up in a few words. The trials were made to prove endurance. Speed was purely a secondary factor, although it was naturally due to the power developed in proportion to car weight. The object in making these tests for endurance was to prove that the super six motor would last longer under the greatest possible strain than other cars. In other words, to clip some time off previous records. It does not take 76 hp. to propel the super six, having a total weight of 3500 lb. at 65 m.p.h. Only about 50 hp. would be necessary. If, therefore, it had used the 4 5/11 gear ratio, the speed would have been limited to about 68 m.p.h. The car speed would have been limited by motor speed, not by the insufficiency of power. But to propel this car at an average speed of 75 m.p.h., 76 hp. is absolutely necessary. The main object of the test was, therefore, to develop 76 hp. under actual running conditions for 100 miles. The Hudson company states that it was not to create records for speed that it made these attempts at record-breaking, but rather to prove the endurance of the super six motor.

2—The weights of the super six models, complete with wood wheels, tools, extra rim, oil, gasoline and water, are as follows:

Model	Lb.	Model	Lb.
Phaeton	3365	Cabriolet	3310
Roadster	3170	Limousine	3750
Touring sedan	3600	Town car	3660

The car complete with wood wheels, but without tools, extra rim, gasoline or water, weighs as follows:

Model	Lb.	Model	Lb.
Phaeton	3161	Cabriolet	3106
Roadster	2966	Limousine	3546
Touring sedan	3396	Town car	3456

3—The horsepower curve of the Oakland 6-32 is not available. Its peak is reached at 2650 r.p.m.

4—The weight of the Moon 6-30, as given by the manufacturer, is 2750 lb. ready for the road. This includes an extra casing.

Use of Two Storage Batteries

Editor THE AUTOMOBILE:—Would it be advisable to install a separate storage battery to be used exclusively for either lighting or starting the type 53 Cadillac car? Also advise how regulation of charging apparatus should be worked out, so that either battery would not become overcharged.

Huntington, Pa. F. B. P.

—A single battery can be used for both starting and lighting provided it is designed for the purpose. Regulation of the charging apparatus depends upon the type of generator and if you are buying a generator, this is generally incorporated with it.

Rebuilding 1908 Packard as Raceabout

EDITOR THE AUTOMOBILE:—The above illustrations, Fig 1, show what can be done with an ordinary stock chassis in the way of turning it into a raceabout. I have seen several inquiries in your magazine as to the advisability of making such a car and think, therefore, this might be of some interest to your readers.

The car is a 1908 Packard runabout. The main changes, such as the body, wire wheels and the dropped gas tank, are quite evident from the photographs. Otherwise about the only real change is the fitting of aluminum alloy pistons and a racing type Master carbureter.

I dropped the gas tank and put smaller wheels on the car to make it hold the road better and now, owing to the light body and the aluminum pistons I have gotten it up higher

Fig. 1—Two views and a glimpse of the instrument board of a 1908 Packard runabout converted into a raceabout by a reader

than 80 m.p.h. and it holds the road perfectly. It will also beat any car I have ever seen on hills.

The price of a job of this kind would, of course, vary, depending on how far it was carried out, but the body work and wire wheels would cost about $400. This includes dropping the steering wheel and gas tank.

New York City. J. B. T., Jr.

Aluminum Pistons for High Speeds

Editor The Automobile:—When using oversize tires is it necessary to change the speedometer gearing in order to obtain a correct reading?

2—Would it be advantageous to fit aluminum pistons to such cars as the Dodge, Overland, or cars having pistons of more than 3½-in. diameter?

3—Where does the Willys-Knight use Timken bearings?

4—In order to manufacture a motor embodying the Knight sleeve valves, what are the requisites as regards royalties on the invention?

5—What is the principle of the vaporizing plug manufactured by the Detroit Carbureter Co.?

Ponce, P. R. E. T.

—Yes.

2—If you desire to make extremely high speed it would be advantageous.

3—Both front and rear wheel bearings are Timken and also the differential end of the rear axle shaft.

4—This is a matter which must be arranged with the Knight & Kilbourne Patent Co., Chicago, Ill.

5—The vapor plug is so arranged as to admit additional air to the intake.

13% Use Valve-in-Head Motors

Editor The Automobile:—How many 1916 model cars use valve-in-head motors?

2—Is this type of motor gaining any favor in this country?

3—Are all racers valve-in-head?

4—How many makes of car motors are built in the U. S.?

Upland, Neb. H. D. L.

—The number of 1916 model cars using valve-in-head motors is twenty-three. This is 13 per cent of the number of chassis regularly listed.

2—This type is regaining its lost prominence. In 1910 18 per cent of the chassis had I-head motors. This gradually dropped until in the years of 1912 and 1913 it was down to 9 per cent. The lowest point was reached in 1914 when it was 6 per cent. It has been steadily increasing since, being 8.5 per cent in 1915 and 13 per cent for 1916.

3—No.

4—The number of car manufacturers making 1916 cars is about 125.

Various Gear Ratios for Blitzen Benz

Editor The Automobile:—What are the gear ratios of the Blitzen Benz recently purchased by H. S. Harkness?

2—How many speeds has this car?

3—How many cylinders?

4—What is the bore and stroke?

5—Does the Duesenberg company manufacture a passenger car or are its activities confined to racing?

6—What is the bore and stroke of the Duesenberg motor? Also the gear ratios?

Ithaca, N. Y. F. S. W., Jr.

—There are numerous gear ratios used on this car to accommodate it to the track upon which it is running.

2—Three speeds.

3—Four cylinders.

4—The bore is 185 mm. and the stroke 200 mm.

5—Other motors are also built.

6—The bore is 3¾ and the stroke 6¾. The gear ratio is different on the different Duesenberg cars, but is generally a little over 3 to 1.

Cadillac Switch Lock for Protection

Editor The Automobile:—For the benefit of all drivers of 1916 Cadillac cars tell us how one can start the motor if he should have his switch locked and forget his keys.

2—Publish name and address of some firm where I could get a book on the 1916 Cadillac Delco system.

3—Please explain the action of the timer on 1916 Cadillac.

4—If a twin six crankshaft is making 3000 r.p.m. how many sparks take place in that minute? Please explain.

5—What is meant by the tread of a machine?

6—If you had a tire without a size marked on it how would you proceed to tell the size?

7—How much clearance is there between head and top of the cylinder on the 1916 Cadillac?

Brooklyn, N. Y. H. B.

—Publishing this information would deprive all Cadillac drivers of the benefit of their switch locks.

2—The Cadillac instruction book goes into the adjustments of the Cadillac Delco system quite fully. Further information, however, can be obtained from the Dayton Engineering Laboratories Co., Dayton, Ohio.

3—The timer on the type 53 Cadillac is fitted with two sets of contact points connected in series, the object being to distribute over two sets of points the current which would otherwise pass through one set, which cuts down burning of the points and makes frequent adjustments unnecessary.

4—If a twin six crankshaft is making 3000 r.p.m. 18,000 sparks are being delivered in 1 min. This is readily explained by the fact that on any four-cycle engine there are half as many sparks per revolution as there are cylinders, for the simple reason that each cylinder is exploded every other revolution. Hence, since there are twelve cylinders, there are six sparks per revolution, and at 3000 r.p.m. there are 18,000 sparks per minute.

5—The tread of a car is the distance transversely from the center of the tire contacts on the left side to the center of the tire contacts on the right side. The standard tread of an automobile is 56 in.

6—Measure the interior diameter from the point where the two beads come together up to the inside of the top of the tire. This will give the small dimension. The large diameter is obtained by adding twice this dimension to the diameter across the inside of the beads.

7—The clearance between the piston heads and the top of the cylinders on the type 53 Cadillac when the engine is on the upper stroke is approximately ½ in.

Diagram of Starter on Cartercar

Editor THE AUTOMOBILE:—Kindly print diagram of the Jesco starter No. 3 used on the Cartercar.

Humphreys, Mo. E. H. R.

—The diagram you desire is published herewith in Fig. 2.

Wants Information on Floating Axles

Editor THE AUTOMOBILE:—What style axle is most used, full floating or floating? What is the difference between these two?

2—Have they ever been discussed or has a description been published in these columns giving advantages and disadvantages? What issue?

3—What kind is used on the model 80 Overland?

4—Give good way to clean carbon out of the motor?

5—How can the radiator be cleaned without hurting the motor?

6—Why is the carbureter placed so low on the model 80 Overland? Is it not best to have it high so as to get a short manifold?

7—What are the advantages of the single cast cylinders over block cast cylinders or vice versa? Are the single hard to keep in line when overhauled?

8—How can I get the most speed out of the model 80 Overland? What speed should this car make?

9—What model carbureter is used? Has it a two-speed adjustment on it? How is it turned if more speed is desired, up or down?

Bouton, Iowa. C. M.

—The full floating and floating axles are identical. There is no difference between them.

2—A full description of the different types of axle and their advantages was given in THE AUTOMOBILE for Sept. 9, 1915.

3—The Overland car uses a floating type of axle.

4—A good method of removing carbon from a motor is by the oxygen process with which it is burned out or by scraping after removing the valve caps.

5—As has often been stated in THE AUTOMOBILE, a radiator can be cleaned out by using a saturated solution of hot water and common washing soda.

6—Regarding your inquiry as to why the carbureter is placed so low on the 80 Overland, would state that this is a question of individual design which can best be answered by the Overland company. Some makers believe in placing the carbureter very low in order to be sure of adequate gasoline flow.

7—The advantages and disadvantages of cylinder arrangement are largely concerned with economical manufacture. There is no difference in the difficulty of lining up the cylinders whether they are block cast or singly cast.

8—THE AUTOMOBILE has no record of the maximum speed which can be obtained with a model 80 Overland. To get this to its maximum the valve timing should be altered to give an early exhaust opening. Aluminum pistons can be fitted and the gear ratio changed to nearer direct.

9—Several makes of carbureters were fitted to the model 80 Overland. The carbureter generally used had a hot air attachment and only one adjustment.

Car Harder to Start with Naphtha

Editor THE AUTOMOBILE:—Will naphtha injure the motor of an automobile, and is there any objection to using it? My neighbor drained the gasoline out of his car and put in a gallon of naphtha and it seemed to work all right and even seemed to have more power; it tests 52.

Moline, Ill. A. V. B.

—There is no definite distinction between gasoline and naphtha. If you are using 52 gravity fuel it will work out successfully, only it will be more difficult to start. There is more power in 52 fuel than there is in the 60 because it has more thermal units to the pound.

Correct Gearing for Warner Autometer

EDITOR THE AUTOMOBILE:—What is the correct number of teeth in road wheel gear and driven gear to give correct mileage and indicate correct speed at which the car is moving when using a Warner autometer, size of wheels being 37 by 4½?

Morenci, Mich. F. D. K.

—To insure correct indication of a Warner autometer under the conditions you mention the drive gear should have seventy-five teeth and the driven gear twenty-nine teeth, or the ratio should be equivalent.

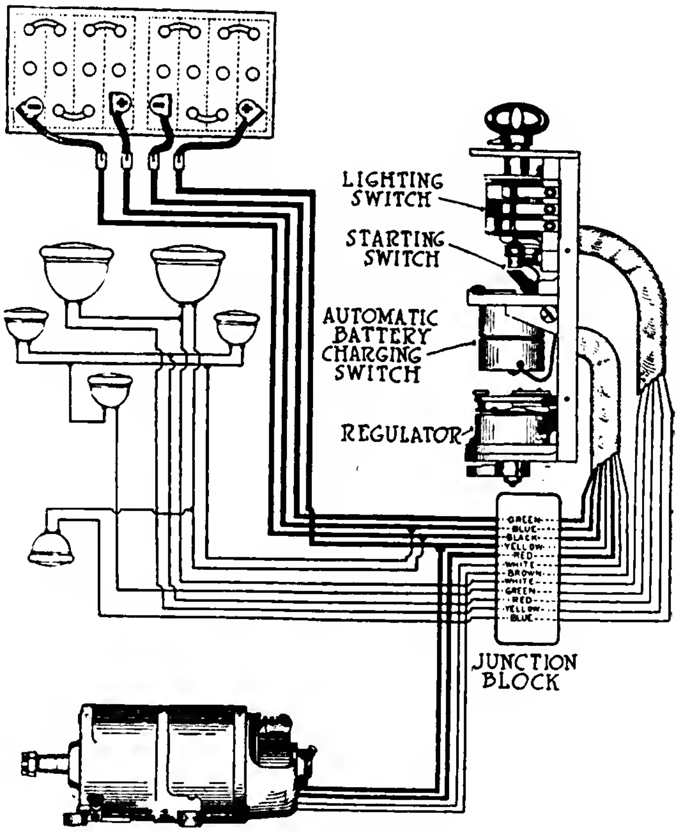


Fig. 2—Diagram of the Jesco starter No. 3 used on the Cartercar

ACCESSORIES

Truck Attachment for Fords

THIS is a truck unit for Ford cars which follows closely the scheme of attachment and drive that has been worked out in a number of instances. The auxiliary truck frame is arranged to slip over the regular Ford frame, and when in position the Ford rear axle becomes the jackshaft, driving sprockets being attached to the axle shafts in place of the regular Ford wheels. It is said to be a very easy matter to attach the unit and requires the drilling of only a few holes in the regular Ford frame in order to bolt the front end of the truck frame in place. Suspension of the truck frame from the auxiliary truck axle is by three-point platform construction, so arranged that the rear cross spring acts as an auxiliary when carrying a light load up to 500 lb. For loads above that amount the weight is transferred to the side springs. The frame has a 4-in. depth of channel with a 2½-in. channel width and is made of 3/16 in. pressed steel. Timken bearings are carried in the truck wheels and the drive is transmitted through Covert & Taylor chains.

The truck unit gives the Ford a rated capacity of 2000 lb., although it is said to be capable of a 50-per cent overload. The wheelbase is 135 in., and the rear wheels measure 32 by 4 in., being fitted with Firestone solid tires. The service brakes are on the rear wheel drums and are controlled by rods running forward, while the emergency brakes act upon the jackshaft. Substantial radius rods maintain proper alignment between driving sprockets and wheels, and the frame is substantially reinforced by diagonal cross pieces to assist the cross members. The unit is priced at $350, and where the Ford chassis is also furnished the total cost is $750.—Automobile Mfg. & Engineering Co., Detroit, Mich.

Water-Shed Windshield Paste

Water-Shed Paste is a compound applied to windshields to prevent water accumulating on the glass during stormy weather. A portion of the glass surface of a windshield may be rubbed with the paste and a cup of water thrown on it with the result that the glass will be free from drops or streaks of water where the paste was applied, while the surface near it ill be blurred. The paste is sold in tubes at 25 cents each.—C. O. Thomas Co., New York City.

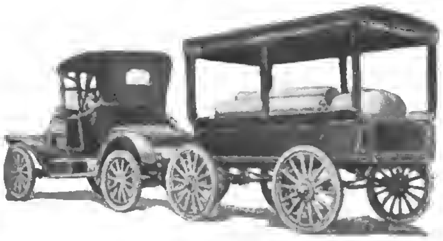
Trailmobile Trailer

This trailer is made in two capacities, 1250 and 1500 lb. The wheels, of wood with solid rubber tires, run on roller bearings; the front wheels are mounted on knuckles of the automobile type connected by a drag link with the drawbar, so that the steering is the same as that of the car that pulls the trailer. All springs are semi-elliptics. The maker states that a fully-loaded trailer can easily be moved by hand. 'Coupling fixtures are supplied for various types of rear end construction, and a special type is made for Fords. The smaller chassis has a loading space of from 39 to 42 in. wide and 85 to 95 in. long, according to body; wheelbase, 62 in.; wheels, wood, with 32 by 2 truck-type tires; weight, 530 lb.

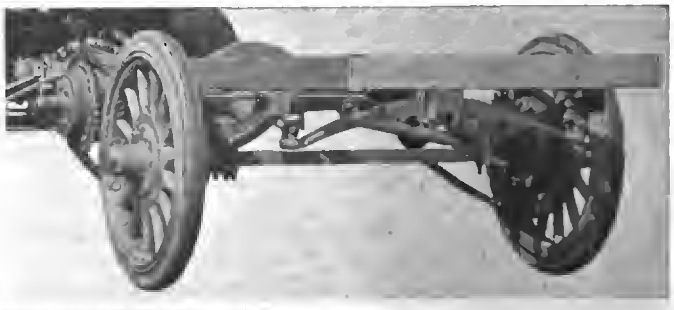
The larger chassis specifications are: Loading space, 40 to 42 in. wide and 95 to 100 in. long; wheelbase, 62 in.; wheels, wood; tires, 32 by 2 front, 34 by 2½ rear; weight, 570 lb. Both have standard tread. A spring shock absorbing device in the coupling system takes up shocks due to sudden starting and stopping, running in and out of pitchholes and the like. Practically any type of body can be had, open or inclosed. Prices, $208 to $300, according to type of body. Chassis only, 1250 lb. capacity, $179; 1500 lb., $209.—Sechler & Co., Cincinnati, Ohio.

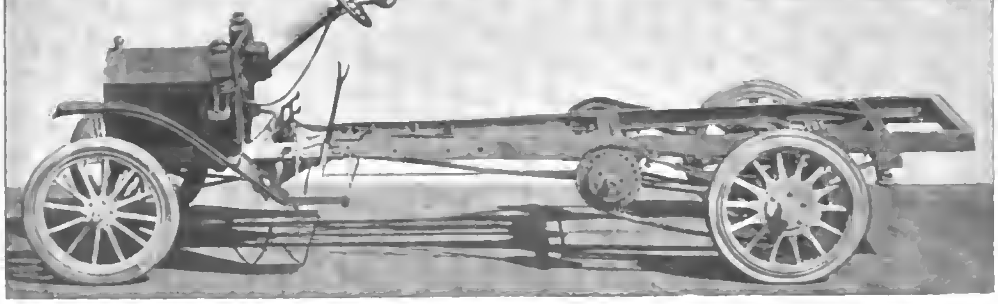
Low's 5-Min. Vulcanizer

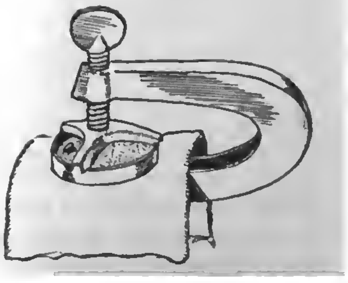
This vulcanizer is simply a screw clamp with a three-arm spider on the end of the screw. The patch is of pure gum rubber and comes set into the concave side of the metal pan; a rim around the pan forms a shallow cup on the side opposite to the patch, and in this cup is a disk of cardboard impregnated with a chemical substance which causes it to burn without flame and with exactly the amount of heat required to vulcanize the patch. Thus the patch mold and the fuel are combined in a unit; the metal pan is thrown away when a patch has been applied. To apply a patch the metal pan is clamped on the tube, rubber side next to the tube, the cardboard disk is lighted and allowed to burn out and the job is finished in 5 min. The gum rubber is liquefied by the heat and runs to a feather edge all round, making a permanent repair. Long rents in a tube can be repaired by applying a row of patches with overlapping edges. Price, with twelve patches, $2; extra patches, $1 per dozen. —5-Minute Vulcanizer & Auto Supply Co., Kansas City, Mo.



Left — Trailmobile trailer. Right—Rear view of truck attachment for Fords which is illustrated below. Lower right — Low's 5-min. vulcanizer







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The Differential

THE vigorous correspondence which has been taking place in the Forum proves the amount of thought that is being given to the improvement of the differential. Besides the letters published, we have received scores expressing interest and many which show that invention is active in this field. There are all sorts of alternatives to the standard form of differential and it seems likely there will soon be many more made public, which is another argument against the theory that the automobile has reached a stage of development nearing the final.

Transcontinental Racing

IN congratulating the Empire Company on the performance of its car in crossing the continent in record time, thus beating an almost equally remarkable record just made by a Cadillac, it is well to sound a note of warning. That these tests provide a magnificent demonstration of the strength of a car is undeniable. It would be hard to find any possible test in the world that means more, but sustained maximum possible speed on the road is not without its dangers to all road users. Thus it is to be hoped that the recent successful attempts will not set a fashion for records of this sort. If there are many such, it is only a matter of time before some less skillful driver overestimates his ability, or till some chance occurrence brings about disaster. Rather, if the public takes as much account of these demonstrations as it ought to do, such runs prove once more, if proof were needed, that there is everything in favor of stock car racing over a road course which can be properly cleared and guarded.

Picking a Winner

NEVER before has there been an Indianapolis race with so many possible winners in the field. Last year was thought to be difficult to forecast, but this year the result of next Tuesday's race is harder than ever to guess. There is a big field of cars which are known to be in good condition, with drivers of known ability. There are some newcomers who may prove as sensational as did the Stutz team last year; there is a less prominent "tail" of cars which have not a chance to win, barring the most extraordinary events.

Thus visitors to Indianapolis are assured of seeing an extremely fine race. It cannot be a walk-over for anyone and several can fall by the way still leaving sufficient first rank cars to make a magnificent struggle. Seldom if ever has there been a race which promised better from the spectacular viewpoint.

Horsepower Rating

ALL over the world where automobiles are used in any quantity, there is need for some sensible method of comparing their power. For taxation in some countries, for competition rating, for insurance rating and for many other reasons a good formula is needed.

A few years ago in England a highly scientific committee was appointed to work out an answer to the problem and they evolved a formula of great complexity. It gave good results but almost needed a sliderule and a book of logarithims to apply.

Now, there is no simpler rating than that of piston displacement, used universally for racing limitation of power. Different motors have different degrees of volumetric efficiency, but it is not difficult to pick out a definite volume and to say that an average engine ought to give one horsepower for this volume.

Somewhere between 5 and 7 cu. in. per horsepower is normal. It is a poor engine that will not give a horsepower for every 7 cu. in. and a good one that betters 5. Why cannot the S. A. E. and the N. A. C. C. give the world a lead by making America the first nation to adopt, and use, a sensible method of comparing the power of conventional cars?

The adoption by America of some simple method of rating which would be better than the obsolete A.L.A.M. formula would be likely to lead to an international system. At present England and America both use the same formula when they use any formula whatever. If America were to adopt the assumption that normal engine power could be represented by dividing the piston displacement by six, this would fit in well with the metric system, as 6 cu. in. is almost exactly 100 cu. cm. Thus an engine could be measured in either inches or millimeters and the power would work out almost the same.

Federal Reciprocity in Sight

Adamson Bill, Which Provides for a Single Car Tax, Favorably Reported

WASHINGTON, D. C., May 20—The Adamson bill, providing that no automobile owner licensed in one State, district or territory, shall be required to take out a license or pay an automobile tax of any kind in any other State, district or territory was ordered favorably reported to-day by the House Committee on Interstate and Foreign Commerce. It is expected the bill will be enacted into law within the next few weeks, as strong pressure is being brought to bear upon members to this end.

Maxwell to Share Profits

DETROIT, MICH., May 20—Employees of the Maxwell Motor Co. are to become beneficiaries of the company, in a profit-sharing system, which is to take the form of a substantial bonus at the end of the year.

Directors of the Maxwell company at a recent meeting gave approval to a resolution providing for inauguration of the bonus system at the end of the year. Details of the plan have not yet been announced, but it is understood the payments will be in the form of a specified amount to each employee.

Nones Elected Norma President

NEW YORK CITY, May 19—W. M. Nones has been elected president and treasurer of the Norma Co. of America. Mr. Nones was secretary-treasurer, as well as general manager.

Link Is Redden Consulting Engineer

DETROIT, MICH., May 19—Vincent Link, formerly chief engineer of the Universal Motor Truck Co., has been engaged as consulting engineer of the Redden Motor Truck Co.

Scripps-Booth Occupies Addition

DETROIT, MICH., May 22—The addition to the Scripps-Booth factory, which will enable the company to double production, was occupied for the first time to-day, having just been completed and equipped with the necessary machinery.

James Dugan has been promoted from the position of factory superintendent to production manager. T. M. Rude, who is in charge of follow-up work, has also been placed in charge of purchasing.

Oggel in Charge of Purchasing

KALAMAZOO, MICH., May 18—P. H. Oggel has taken charge of the purchasing department of the Fuller & Sons Mfg. Co., this city. G. W. Fuller is now connected with the sales department of that company.

The company has been running day and night since last October and will probably continue this schedule for the balance of the year. Two new buildings have been erected and plans are being made for further additions.

Winton Doubles Output

CLEVELAND, OHIO, May 22—The Winton Motor Car Co., this city, like the majority of other automobile manufacturers, is feeling the effects of the greatly increased demand. Having an output of from 1200 to 1500 cars per year the present indication is that at least 4000 of the two present models will have to be made to satisfy demands. Consequently, the plant is rushed to the limit of its capacity and the floorspace has been augmented by the erection of some large tents on an adjoining lot.

Decision in Spark Plug Suit

NEW YORK CITY, May 24—A. R. Mosler & Co. and the Benford Mfg. Co., are enjoined from selling their Ford plugs as now organized, according to a decision of Judge Hand in the U. S. district court, in the case of the Champion Spark Plug Co. against the two defendants, charging unfair competition in the sale of spark plugs resembling its model Champion X used on Ford cars.

In the case of the Mosler company which makes the Mosler Superior plug for Fords, this company will be enjoined from selling this plug unless it changes the color of the shell and bushing nut, and of the porcelain, so as to distinguish their appearance. The name Mosler must be retained, and in the case of plugs made for jobbers, the name of the jobber or some trade mark in letters other than red which shall be unlike Champion X.

The same decision applies to the Benford company, except that an injunction also stands against the use of the name Ford and the symbol Ford X on its plugs.

Eustis Joins Chevrolet Co.

NEW YORK CITY, May 23—After being motor truck editor of *The Evening Mail* for 5 years, John R. Eustis has resigned to become advertising manager of the Chevrolet Motor Co. Mr. Eustis was formerly automobile editor of the *Brooklyn Daily Eagle* and the New York *Globe*.

Hinkley to Direct Purchases

JACKSON, MICH., May 18—Burton C. Hinkley, former purchasing agent for the old Argo company, has been appointed director of purchasing for the Argo Motor Co.

A. A. A. Favors Single Car Tax

Advocates Adamson Bill at Annual Meeting—Dr. Rowe Elected President

WASHINGTON, D. C., May 20—At the annual meeting of the American Automobile Assn., held yesterday at the Hotel Willard, Dr. H. M. Rowe of Baltimore was elected president. Other officers are: Vice-Presidents, Ralph W. Smith, Colorado; P. J. Walker, California; H. J. Clark, Minnesota; Preston Belvin, Virginia; David Jameson, Pennsylvania; C. C. James, Ohio; treasurer, H. A. Bonnell, New Jersey; secretary, John N. Brooks, Connecticut. While the chairmen of the various boards have not been selected, it is understood the present chairmen will be continued in office.

The meeting was opened by President John A. Wilson, whose annual report was unanimously adopted by the 200 delegates in attendance.

Richard Kennerdell, chairman of the contest board, told of the work accomplished by this important committee and how motor competition had been kept on a high plane. George C. Diehl, chairman of the good roads committee presented a brief report on the work of the committee during the year and aroused much enthusiasm with his reference to the passage by Congress of a $75,000,000 good roads bill.

E. L. Ferguson, in the absence of David G. Joyce, chairman of the touring committee, explained the route and map work of that branch of the association during the past year. He pointed out that as a result of travel in this country last year 150,000 tourists invaded New York State, spending approximately $15,000,000. New Jersey, he said, fell behind in this respect, while New York and New England forged ahead. Between $16,000,000 and $35,000,000 was spent in New England.

The report of H. A. Bonnell, treasurer, showed the association to be in the best financial condition in its history. Richard H. Lee, chairman of the legislative board, told of the efforts that have been and are now being made to discourage motorists generally from joining so-called bargain organizations.

Resolutions were passed calling for uniform regulation for all types of vehicles and for single taxation for the automobile; for the abolition of fees required for drivers' licenses; for the reduction of the registration fee in States where a personal tax is levied to cover only the cost of such registration; for the passage of the so-called Adamson bill; and for equal rights for all vehicles on public highways.

Empire Four Sets New Record

Transcontinental Trip of 3485 Miles in 6 Days, 10 Hr. and 59 Min.

NEW YORK CITY, May 23—A new transcontinental record of 6 days, 10 hr. and 59 min. for a distance of 3485 miles has been set up by a stock Empire four, driven by Robert Hammond. The old record of 7 days, 11 hr. and 52 min. for a distance of 3380 miles was established the very day that Hammond and his Empire started out from San Francisco, this being May 17. When Baker and Sturm in the Cadillac eight reached this city after their record-breaking trip, they little thought that that record would be shattered in so short a time.

Hammond, who averaged 22½ m.p.h., followed the Lincoln Highway, starting at San Francisco, through Oakland, Truckee, Ogden, Cheyenne, Omaha, Clinton, Ill., Fort Wayne, Ind., Lima, Ohio, Pittsburgh, Philadelphia and New York City.

His longest run was between 'Frisco and Ogden, a distance of 917 miles, which was negotiated in 36 hr. He arrived at Omaha May 20, and after a run of 700 miles in 17 hr., reached Elkhart late Saturday evening, where he had his first rest of 10 hr.

At the start Hammond ran into a deep coat of snow on the roads over the Sierras, but overcame this obstacle by following a train through a snowshed for about 40 miles. Owing to this maneuver, he was able to make his long run to Ogden in 36 hr. Near Cheyenne, Wyo., the car hit a thank-you-ma'am at 45 m.p.h., and Harold Bell, the passenger, was thrown out, landing 25 ft. away with an injured arm. Hammond drove alone from there to Ft. Wayne, where he picked up Herbert Wasson, from the Empire factory.

2 M.P.H. at Canton

At Canton, Ohio, the previously good weather changed to rain squalls and the car crawled through the mud at 2 m.p.h. After colliding head-on near Pittsburgh with an automobilist who got in the way at the cost of a front wheel, the car was ditched in the Blue Ridge mountains. At this point the only tire-casing change necessary was made. Seventy punctures in all occurred during the trip. Gasoline consumption averaged 10 to 13 m.p.g. and a gal. of oil was used every 150 miles.

Hammond went the whole distance without touching the motor or spark plugs. He managed to avoid being arrested up to Newark, N. J., where he was stopped for reckless driving and fined $20. Threat of further police interference held him down to a slow pace all the way into New York, which he reached at 1.49 p. m. to-day.

Hammond, who will go after new records in the near future, will be remembered for his tour of the world in an automobile several years ago. He was the first to climb the Alps in a car and was one of the drivers of the New York to Paris race, which was won by the Thomas. One of his achievements was a drive of 3 days and 2 nights in an endurance contest on a dirt track. In that event he succeeded in going the full distance without leaving the car seat. In his latest transcontinental trip his sleep amounted to between 11 and 12 hr.

The following table gives the runs between the stopping stations:

San Francisco to Ogden	917
Cheyenne	317
Omaha	551
Elkhart	650
Ft. Wayne	64
Canton	222
New Oxford, Pa	293
Philadelphia	109
New York City	100

The mileage of the route followed is:

San Francisco to Truckee	252
To Reno	35
To Austin	188
To Ogden	442
To Lyman	124
To Cheyenne	354
To Fremont	516
To Omaha	35
To Jefferson	136
To Clinton	250
To Elkhart	264
To Ft. Wayne	64
To Lima	64
To Bucyrus	65
To Canton	93
To Pittsburgh	106
To Philadelphia	296
To New York City	100

The car was equipped with Horseshoe tires, Bales puncture pluggers, Prest-O-Lite tank, Stewart-Warner speedometer and vacuum feed, Rex spark plugs, Pyrene fire extinguishers and Auto-Lite electric system.

Strong Succeeds Collins as Buick General Sales Manager

FLINT, MICH., May 22—E. A. Strong, formerly manager of the Chicago branch of the Buick Motor Co., has been appointed general sales manager of the parent Buick organization to succeed R. H. Collins, resigned. Strong has been connected with the Buick organization since 1911, and previous to that was identified with the McCormick Harvesting Machine Co. and later with the International Harvester Co.

Strong's first connection with the Buick company was as branch manager at Buffalo. He held that position for a year and then was Indianapolis branch manager for 2 years, after which he went to Chicago. Collins does not officially relinquish his duty until the end of the company's fiscal year, Aug. 1, but it is understood that Strong will take up the active management soon. D. A. Burke, now in the sales department of the Buick company, succeeds Strong at Chicago.

Indiana S. A. E. Plan Preparedness

Howard E. Coffin to Address Meeting at Dinner Given by Section to Council

INDIANAPOLIS, IND., May 22—The Indiana section of the Society of the Automobile Engineers will give a dinner at 7.15 in the Claypool Hotel, Monday evening, May 29, to the members of the council of the Society. The chief discussion of the evening will be on Industrial Preparedness and Howard E. Coffin (vice-president the Hudson Motor Car Co.), chairman of the committee on production, organization, manufacture and standardization of the Naval Consulting Board, will be the chief speaker.

This banquet will mark the closing of the 1915-16 meetings of the Indiana section which have been most successful. Plates are $2.50 each and accommodations can be secured from R. H. Combs, of the Prest-O-Lite Co.

The occasion is of some importance, as it will mark the first address of Mr. Coffin to the automobile industry, since he took upon his shoulders the bulk of the work of the industrial preparedness scheme. Briefly, the desire of those responsible for the scheme is to put America in such a position that in the event of war she can avoid Europe's errors.

Program of Papers for S. A. E. Summer Meeting Is Complete

NEW YORK CITY, May 24—The program of papers for the summer meeting of the Society of Automobile Engineers, to be held on the steamship Noronic on the Great Lakes, June 12-16, has been completed and comprises reviews of twenty-one pertinent subjects, as follows:

Future Scientific Development of the Automobile—C. F. Kettering.
Large Single vs. Dual Tires for Truck Rear Wheels—W. H. Allen.
Farm Tractors—C. M. Eason.
Motors for Trucks and Tractors—H. L. Horning.
Refinements and Generalities in Truck Design—H. D. Church.
Truck Subject—B. B. Bachman.
The Differential and Its Substitutes—D. D. Ormsby.
Motor Fuels of the Next Decade—W. F. Rittman.
Kerosene vs. Gasoline in Standard Automobile Engines—Prof. E. Lucke.
Pressed Steel in Automobile Construction—E. A. Nelson.
Crystallization in Cold Drawn and Pressed Steel Parts—R. H. Sherry.
Dynamics of Vehicle Suspensions—Benj. Liebowitz.
Straight Side vs. Clincher Type Pneumatic Tires—J. E. Hale.
Bronze Alloys for Motor Cars—W. M. Corse.
High Speed Motors—A. P. Brush.
Possibilities of the Constant Pressure Cycle Engine—A. B. Browne and Herbert Chase.
Car Performance—Prof. D. L. Gallup.
Recent Aeroplane Engine Developments—Neil MacCoull.
The Automobile Engineer and Preparedness—Howard E. Coffin.
Mechanical Transport Mobilization—A. J. Slade.
Automobile Experience in the Great War—W. F. Bradley.

Conditions Determine to What Extent Car Builders Shall Make Parts

H. M. Jewett, Paige-Detroit President, Tells Detroit S. A. E. That There Is No Uniformity About the Question, Each Manufacturer Being Guided by His Experience

DETROIT, MICH., May 18—In answer to the questions: Should a car manufacturer make his parts, or should he assemble them, and if he should manufacture them, what proportion should he make and which should he buy? H. M. Jewett, president of the Paige-Detroit Motor Car Co., told the large attendance at to-night's regular monthly meeting of the Detroit Section of the Society of Automobile Engineers that it is all a case of the individual conditions with each company. Through the particular experiences and troubles each maker has encountered, each has his own ideas of what he should and should not buy from the parts makers, and there is no uniformity about it. One large producer may make some part that another concern equally big has always purchased from a parts manufacturer, and there are so many qualifying conditions that no rules can be laid down. It is a safe prediction, however, that each maker has good and sufficient reason for the policy he follows. There are reasons back of each move he makes.

D. McCall White in Chair

The meeting was the first under the régime of D. McCall White, Cadillac chief engineer, who was elected chairman of the section at the April meeting. In taking the chair for the first time, Mr. White praised the work of the retiring officers and bespoke the hearty co-operation of all in carrying on what has already been accomplished. Because all cannot avail themselves of the annual midsummer outing of the entire society, which this year takes the form of a lake trip, it has been decided to hold a family outing for the section on June 24 somewhere in the vicinity of Detroit.

That the subject of assembly versus manufacture is of great interest to manufacturers was evidenced from the fact that some of the leading factory representatives entered into the interesting discussion that followed Mr. Jewett's talk. Among the speakers were Alvan Macauley, Packard; C. T. Meyers, Timken; K. W. Zimmerschied, General Motors; G. W. Dunham; W. A. Brush; J. W. Wright, Golden, Belknap & Swartz; J. G. Vincent, Packard; T. P. Chase, King; E. V. Rippingille, Hudson, and others.

Each manufacturer can take his particular viewpoint on the subject of manufacture versus assembly from his own personal experience in the business, Mr. Jewett stated. He divided the subject into four parts: first, the manufacturer producing a high-priced car costing $3,000 or over, in limited quantities; second, the volume producer making 10,000 machines or more; third, the maker that is forced into the manufacture of certain parts through business necessity; fourth, the parts that are seldom manufactured by the automobile company.

Price the Main Factor

Taking up the first of these, naturally the high-priced cars are produced in limited quantities, and the result is that in order to get high price, the machine must have extreme individuality. The maker of that car must really make practically everything there is in it, for the purchaser of a high-priced car has to feel that he is getting the worth of his money. The automobile maker in that class can ill afford, according to Mr. Jewett, to buy axles, engines, bodies, frames, wheels, etc., from parts manufacturers, because the latter are producing parts for cars in volume business, and it would be very difficult, from a sales standpoint, to convince the car buyer that such parts are any better than the ones made for the volume producer. This is especially true because the volume producer is advertising that on account of his quantity he can buy cheaper, so naturally, with his limited output, the high-priced maker would have that argument to face.

Going to the second division—the volume producer—there is great opportunity for diversity of opinion here. It is a common supposition that a manufacturer producing over 10,000 units can make his parts cheaper, said Mr. Jewett, but he questioned if that is entirely true, mentioning some conflicting policies of big makers to show that all do not hold any unified view of the matter. He showed where Overland, for instance, buys certain parts; he cited some of the Buick company's units that are made outside its plants; he called attention to Studebaker's purchasing certain things; mentioned other plants in a very frank manner, and gave it as his opinion that conditions altered cases and that there were good reasons back of each policy.

Many of the accessory makers themselves are not making every part. They assemble too, Mr. Jewett explained. A great many of the axle companies to-day are buying the gears that go into their units; gearset makers do the same thing, buying gears and malleables and machining and assembling them.

But there are certain things that manufacturers very seldom make. Bearings are one. Usually these are patented processes, require intricate and costly machinery, and a car maker can go out and purchase a bearing from a firm making a specialty of this part and secure a better bearing and cheaper than it could be made by the car plant. This example holds good for a great many of the parts that are seldom made by the car factory. Steering gears are another thing seldom made by the car factory; frames might come under this class also.

The machinery often required for the making of certain parts would not be economical for a great many manufacturers of cars to install. Take, for instance, rear axle housings. A press to do this would be capable of such large production that unless the maker were a very large producer the press would lie idle practically three-quarters of the year, which is not economy.

Manufacturers have two ways of looking at the condition. One spends a great deal of money telling the public that he is an assembler; another that he makes everything in his cars.

As an illustration of peculiar conditions that are to be found in each individual plant, Mr. Jewett told of walking through a purely assembly plant one day and noticing that they were enamelling fenders. He asked why this was done, since no other part of the car was manufactured. The reply of the superintendent was that they could not get the fenders enamelled well enough outside. This suggests the thought as to why others are not enamelling them for the same reason. Very possibly those others that are not enamelling them are having very good success with fenders they buy already enamelled. That is the only answer, because if all were having trouble in getting deliveries on properly enamelled fenders, they would all have enamelling plants the same as this particular case.

This leads to a consideration of the manufacturer who is forced to make his parts. Wherever a maker makes his own parts there is a substantial reason why he spends his money in machinery, tools, equipment and material instead of buying the unit. According to Mr. Jewett, you will find generally that each part that a manufacturer produces himself results from not being able to get deliveries or a fair price from the parts maker or through not being able to get this part good enough. He may not wish to buy a standard motor because that engine may be used by several different makers of cars selling at various prices.

The amount of capital needed to make cars outright is another consideration.

Where the maker buys from a parts producer the latter's capital is being used in the business, and just as long as the car maker can buy those parts as good as he thinks they ought to be and at a right price, Mr. Jewett does not think any car maker is going to get into the the parts making business. However, the motor is the most logical thing to produce, it being the most important part of the car.

The Paige president paid tribute to the brains of the S.A.E. that have made possible the interchange of parts of standard design through standardization.

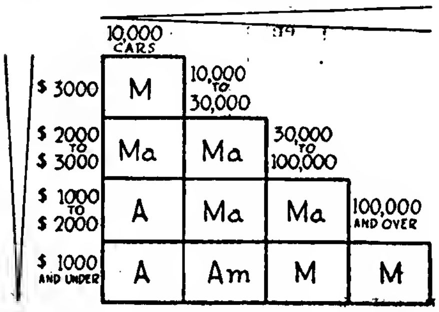
Opening the Discussion

In opening the discussion Mr. White commented that in one particular price class the reason why manufacturers make a great many of their parts is because of class individuality. Another is the refinement of workmanship. Special conditions of silence, durability and workmanship dictate the individual manufacture of special parts. Then there is the matter of quality of material, which the individual maker can insure if he makes his own parts.

The chairman said further that in another class, in quantity production, where they have to buy parts, they have trouble due to lack of material. Sometimes there is practically only one part maker making a particular thing, and these concerns may be so full of orders that they are incapable of producing parts having special refinements. There is also the matter of prices which certain parts makers charge. In making special things, parts concerns are often confronted with the lack of floor space, and sometimes for financial reasons they simply cannot afford to lay down the special equipment necessary.

Taking up the discussion, Mr. Zimmerschied said:

"I have been very much interested in Mr. Jewett's exposition of this subject, and I know that the engineers can profit greatly by it, because he has given us a business view of it; and if there is anything that most of us engineers need, it is a little glimpse of the business side once in a while. At the same time we like to draw pictures and look at diagrams and curves, and perhaps I can organize the thoughts I have in my mind if I draw such a chart.



	10,000 CARS	10,000 TO 30,000	30,000 TO 100,000	100,000 AND OVER
$ 3000	M			
$ 2000 TO $ 3000	Ma	Ma		
$ 1000 TO $ 2000	A	Ma	Ma	
$ 1000 AND UNDER	A	Am	M	M

Chart drawn by K. W. Zimmerschied

"To my mind, the automobile industry can be subdivided in two ways, a sort of dual classification. First, quantity, and second, price; something like the illustration. Quantities up to 10,000 cars, in the first class. From 10,000 to 30,000 is what you might call the medium quantity production. Thirty thousand to 100,000 cars is the fairly large production, and the 100,000 plus is the super-quantity production class, you might call it. Then down the other way we will start with $3,000 and up, $2,000 to $3,000, $1,000 to $2,000, and under $1,000. Now, we find, if we go to cross-section all this area, that we would not be able to fill in all these spaces, because the $3,000 class never rises above 10,000 a year; so we have a square for that class that never will get higher in production. However, the $2,000 to $3,000 class will run over here into the 10,000 to 30,000 per year. The $1,000 to $2,000 might run over into the 30,000 to 100,000, and in the $1,000 down we run out into the 100,000 plus. So that that covers practically the field of all our automobile endeavor.

"Now, if we plot the tendency toward the manufacture of his own parts, we would find, as Mr. Jewett has said, that in the $3,000 class, that is the maximum, because the manufacturer wants the extreme of individuality; so we will draw here a wedge, running to practically zero at the bottom, the thickness of that wedge at any point indicating the tendency toward manufacturing his own parts which the manufacturer in that class follows. And in the same way we find another wedge, running out this way, which would indicate the pull on the manufacturer to make his own parts, on account of quantity.

"Now, in any one of these squares, it is evident that the summation of these two tendencies, and these two bases, would be in the $3,000 class, to manufacture all the parts. We will see here, more than in this case of maximum production, a maximum cheapness to manufacture all the parts. We might find very largely the same tendency here, and a similar tendency toward assembly; so I will introduce two small a's. Maximum tendency to manufacture, but on account of this component, a small tendency toward assembly. Why? On account of these two, it is all assembly, small quantity, small price. They have not the capital, they have not the draw to manufacture the parts.

"Now, then, suppose a group of men are going to start manufacturing an automobile. They think it is a good field to go into, and they are going to market the product. Following the line of least resistance, they would start in some of these classes here to manufacture a conventional product, which has a steady market, buying most of their parts outside. In trying to sell that product, however, they find at the end of the second or third year that they are not getting along very fast, because they have not this individuality which sells. They have got a lot of parts, a lot of manufacturers, and they are very much like their neighbors' cars; so in order to gain an influential position in the industry, they have either the choice of going up in price and getting into the individualistic class there, or else going out the other way and getting a large volume, and larger profits, without necessarily sacrificing individuality. But you notice it is always a question of individuality, if you are going to establish, to attain a position in the business, an influential position.

"Now, on the position of the parts manufacturer, I think that we owe a great tribute to the parts manufacturers for a great many of our big advances. The old saying that 'necessity is the mother of invention' is not so true, to my mind, as that 'competition is the mother of invention.' "

Cleveland S. A. E. Talks Efficiency

A. L. Clayden Presents Paper on Universal Joints at Season's Closing Session

CLEVELAND, OHIO, May 20—Last night night in the ballroom of the Statler Hotel the Cleveland section of the Society of Automobile Engineers held their concluding meeting of the season.

A. Ludlow Clayden, chairman of the Standards Committee, talked extemporaneously on the subject of efficiency, pointing out that the effieciency of an automobile in the widest possible sense was liable to be neglected when considering the efficiency of parts of it. He drew attention to the fact that a motor bicycle weighs little more than the load it carries, whereas a touring car often weighs seven or eight times as much as its load. Mr. Clayden said that it was often assumed automobile development was nearly complete. With this view he wished to disagree entirely because if the automobile had been developed to the limit of the present style of construction it was still a very long way from the fulfillment of ideals.

There was a short discussion and later Mr. Clayden presented his paper on universal joints, reprinted on page 934.

Following the reading of the paper there was a good discussion in which several members recited their experiences with joints made from flexible material. It appeared the results so far have not been very encouraging.

Following the precedent established by the Cleveland section the meeting was preceded by a dinner at which about eighty members were present.

Pa. S. A. E. Holds First Picnic

PHILADELPHIA, PA., May 20—The Pennsylvania Section of the Society of Automobile Engineers held its first annual picnic to-day. Thirty members from all parts of the State attended the outing to Browns Mill, N. J., a drive of 35 miles. Canoe races, quoits, bowling and baseball were the main attractions of the day. J. W. Watson, president of the American Bronze Co., Berwyn, Pa., acted as chairman of the entertainment committee.

Auto Kamp Equipment Co.

SAGINAW, MICH., May 17—The Auto Kamp Equipment Co., has been organized with a capital stock of $15,000. Automobiles, trailers, and other vehicles and appliances will be bought, sold and manufactured. The incorporators are C. W. McClure, Harry E. Oppenheimer, Allen D. Jackson and W. O. Sustins.

U. S. Army Has Much to Learn About Motor Truck Preparedness

Metropolitan S. A. E. Hears Army Men and Transport Engineers on Lessons and Experiences of Warring Powers with Automobile and Motor Truck Branch of the Service

NEW YORK CITY, May 19—Armored cars and trucks were the chief topic of discussion at the May meeting of the Metropolitan section of the Society of Automobile Engineers held last evening at the service station of the International Motor Co. The subject of preparedness and the Automobile Reserve Corps was also discussed. About 100 were in attendance.

The United States has much to learn about motor truck preparedness from England, it developed from the addresses made by Captain Kilburn, who attended as the representative of Maj. Gen. Leonard Wood, commander of the department of the East, U. S. Army, and of Mr. Murden, who is in this country purchasing war material and who has had considerable practical experience with mechanical transport in the present war.

Showing the need for adequate preparation of motor transport equipment in times of peace, Captain Kilburn stated that the Mexican expedition of our army had been held up for 6 days because of the lack of motor trucks for the transport of troops and their supplies. He stated that had plentiful supplies of motor trucks been available the troops could have started in pursuit of Pancho Villa without delay and that by now the trouble would probably have been all over.

Segregation by Makes

According to Captain Kilburn, Captain Johnson, of the department of the East, who has been giving the subject of motor transport a great deal of study, has arrived at the conclusion that each division should be supplied with trucks of uniform make and that on account of the likelihood of our troops operating in rough country and also on account of the limited supporting capacity of our bridges and culverts the 1½-ton truck is regarded as the maximum size practicable.

That the new Automobile Reserve Corps law now in process of passage in Congress will permit the President to appoint any volunteer men or bodies of men to serve the army in case of need in the Quartermaster Department of the army was an interesting point brought out by Captain Kilburn, who also stated that this law would place no limits on numbers of such appointments.

Captain Kilburn emphasized the importance of organizing a large and efficient reserve of commercial vehicles available for service in case of war. He also urged the advisability of standardizing on given makes for each division. He stated that in the formation of the reserve corps, it was his opinion that the motor truck manufacturers must do the recruiting.

Value of Armored Trucks

Respecting armored trucks Captain Kilburn was sceptical as to their value inasmuch as they are dependent upon roads for operation and can very quickly be put out of action by well-directed artillery fire as they constitute excellent targets. He stated that up to the present such armored cars as have been experimented with in this country have been equipped with machine guns but that more effective work could be done with larger guns.

In connection with this he stated that it was planned to experiment with a 1-lb. automatic gun with a cushioning arrangement which absorbed practically all of the recoil.

In response to an inquiry concerning the standard of capacity set by the government, Captain Kilburn stated that it was possible that the maximum load of 1½ tons might be increased as a result of improved roads, bridges and culverts.

That Great Britain has found the 1½-ton truck too light; that it has determined that efforts to standardize detail design are undesirable and that a very effective motor reserve corps was in operation in that country before the war were the most interesting points brought out in a short talk by Mr. Murden.

In 1912 the British war office started to lay the ground work for a motor truck reserve. The War Office provisional subsidy provided that purchasers of such trucks were to receive a bounty of £70 per year—about $348—in return for their agreement to surrender their vehicles to the army in case of national emergency, and in the meantime to constantly carry a prescribed supply of spare parts on the trucks and to have them inspected by government inspectors at stated periods.

At the outbreak of the war, stated Mr. Murden, many thousands of these subsidy trucks were landed in France 48 hr. after the order of mobilization.

As to the segregation of makes into divisions, as proposed by Captain Kilburn, Mr. Murden stated that his government had not found this necessary, so long as individual convoys were made up of but one make, this being due largely to the subsidy standardization plan.

Going into the details of the subsidy plan, Mr. Murden stated that the subsidy agreement provided for reporting the trucks for duty at predetermined mobilization points on 24 hr. notice. It applies only to 3-ton trucks, 1½-ton types having been experimented with and discarded, inasmuch as army men loaded them with 3 tons anyway, and there was no apparent advantage in having the smaller capacity.

In respect to the tests, in response to an inquiry from one of his listeners, Mr. Murden stated that these cover a period of 1 month. Three days out of every week are spent on long and level runs, to test the ability of the trucks on sustained, heavy-duty service, the remaining 3 days on narrow, hilly, rough, soft and crooked roads. On all of these tests the trucks are fully loaded, the total weight being about 15,200 lb. One driver, a helper and a military observer accompany the truck.

The hood is locked at all times except for 15 min. each morning and 35 min. when gasoline and oil are being put in. Demerits are made for all excess time for repairs or adjustments, for defects and for failure to make the proper mileage. The trucks are equipped with governors set for 1100 r.p.m., and the speed limit is 16 m.p.h. Timed hill-climbs are made, and the temperature of the water at top and bottom noted. In the evening of each day 75 min. for work is allowed, with 1 demerit for each minute exceeded.

After 2000 miles have been covered, the governors are removed and the trucks are run at full speed for 3 hr. on Brooklands. The survivors of these tests are then taken down completely and each part minutely inspected for wear and defects in materials or workmanship.

Rear tires are dual 1050 by 140 mm. front tires being 1020 by 120 mm.

Urges Co-operation

Albert F. Masury, chief engineer of the International Motor Co. urged strongly that the S. A. E. appoint a committee to consult with the Motor Truck Club, explaining that the latter body had conducted some highly-illuminating experiments to show that the army's standard of 1½-ton capacity was too low, and that it had recommended that 5-tonners be used.

He then went on to tell about the battery of armored cars in various stages of completion which were drawn up on one side of the room in which the meeting was held, stating that they were to become the first armored motor battery of the National Guard of New York.

Mr. Masury also called attention to a new Mack 1½-ton transport truck fitted with the new Goodrich pneumatic truck tires on all wheels. These tires are of the low-pressure type, 38 by 5½ by 8. The three sizes refer to the three dimensions of the tire, namely, diameter, depth and width. They are straight-sided and on the rear have curved steel guards at the side to prevent excessive flattening if punctured and to protect the sides of the tire from chafing.

In line with the motion of Mr. Masury, it was voted to have the governing committee name a committee to assist the Motor Truck Club in its work and to study armored cars.

Studebaker Adds 68,000 Ft.

DETROIT, MICH., May 22—The announcement has just been made public from the Studebaker offices of the closing of an important property purchase, which will result in factory extensions and a still further increase in car production.

The new property which is located between Campau and Scotten Avenues, adjoins the Studebaker plant No. 3 on the north, and embraces 68,000 sq. ft. At present seventeen residences stand on this site, and the work of tearing down these houses will be begun immediately.

With the annexing of this property, the Studebaker plant No. 3 space will extend from Fort Street to Jefferson Avenue. The Studebaker factories now cover more than 150 acres of space—108 acres of actual floorspace—and employ over 7000 men.

Twin City Truck Makers Expand

MINNEAPOLIS, MINN., May 20—The Four Wheel Drive Mfg. Co., Minneapolis, and the Twin City Four Wheel Drive Co., St. Paul, are to begin making trucks under the J. L. Ware patents. The latter company is to occupy its new manufacturing plant at Cromwell and University Avenues next week. This company is capitalized at $500,000 and is headed by Mr. Ware. It is now manufacturing in cramped quarters.

The Minneapolis company, capitalized recently at $1,000,000, has bought the Nott Fire Engine Co. plant with 50,000 sq. ft., at Central and Eighteenth Avenues, Minneapolis, and in 90 days expects to turn out ten trucks a day, ranging from 2- to 4-ton. It reports a contract for 3000 trucks for delivery abroad in 2 years.

Ward Elected to Defense Society

DETROIT, MICH., May 18—Artemas Ward, Jr., president of the King Motor Car Co., Detroit, has been selected as a member of the National Committee of the American Defense Society. This consists of well known men.

Electric Interests Convene

Exhibition of Cars and Trucks —Study Quantity Production Opportunities

CHICAGO, ILL., May 22—The former Electric Vehicle Assn. of America, now the Electrical Vehicle Section of the National Electric Light Assn., held its first joint session with the parent body at the Auditorium and Congress hotels here this week. The sessions of the Electrical Vehicle section took place on Wednesday and Thursday simultaneously with the convention sessions. An exhibit was staged in the foyer and over a subflooring of the Auditorium theater. Several truck and passenger car makers and car equipment manufacturers of all kinds presented attractive booths. There were about sixty exhibits in all. The Walker Vehicle Co. of Chicago displayed a 1-ton chassis and a Walker balance drive exhibit unit opened to show the principle of motor inclosed in the rear axle housing driving through spur gears within the wheels. The General Vehicle Co., Inc., also showed a truck chassis. A chassis and a delivery car were in the booth of the Ward Motor Vehicle Co. Edison batteries were fitted in both. The only passenger car display was that of the Detroit Electric Co. which consisted of two handsomely appointed coupés.

Opportunity for Electrics

The present unusual opportunity for quantity production of electric passenger and commercial cars in competition with gasoline cars, due in a measure to the great strides in electric car perfection of the past 3 or 4 years, but especially to the now high and constantly soaring price of gasoline, was the subject upon which a majority of the section and committee reports and individual papers of the meetings were founded. In his paper on Electric Passenger Vehicle Problems and Activities, E. P. Chalfant summed up the reason for failure of the electric car manufacturers to establish themselves on a competitive plan with gasoline car makers as follows:

"The first reason is the failure of the manufacturers to properly educate the general public regarding the wonderful utility of the electric.

"The second reason is the failure of the central station to make it easy to own and operate the electric, by an adequate distribution of charging and boosting stations."

He makes the assertion that the gasoline car is but 5 per cent more efficient than the electric and attributes this 5 per cent to surplus with reference to power, radius, speed, energy and fuel.

"There was a time," said Mr. Chalfant, "when gasoline cost but 10 cents a gallon. About that same time it required about 10 hr. to recharge the cells of an electric, at an average of 8 cents per kilowatt-hour for current. Since then gasoline has advanced in most localities to a price above 30 cents a gallon and it is said to be on its way to 50, while electric juice has declined to an average of 5 cents per kilowatt-hour. To-day the constant potential charging system will bring the battery up to two-thirds of its capacity in 1½ hr.—a lunch time boost for instance—while a full charge requires but 3 hr. The ordinary charging station requires about 6 hr., and the motor generator set or the mercury arc rectifier installed in a private garage requires but little more.

The Cost of Power

The cost of power comparative between gasoline and electric cars was outlined by Mr. Chalfant as follows:

"Placing the daily mileage of each type at the conservative figure of 35 miles a day—1000 miles a month, statistics show that current for electrics averages $8.50 per month. Let us assume that a closed gasoline car, with six-cylinder motor of average power rating consumes gasoline at the rate of 8 m.p.g. at a cost of 30 cents per gallon and the expense for the month is $37.50, over four times the cost of current. Nor does it take into account the same proportionate expense for oils, greases and general repairs."

This argument was further strengthened in the paper given by William P. Kennedy on Central Station Promotion of Electric Vehicle Use. His plan embodies a battery service system added to the present power service and lighting service of central station organizations, the principal function of which would be to supply energy and maintain this type of energy consuming apparatus in working condition.

P. D. Wagoner's paper on Battery Service—A Unit in a Comprehensive Plan for the Successful Exploitation of the Electric Vehicle, detailed the use of duplicate batteries in commercial vehicles which is being successfully carried out in a large way in such cities as Hartford, Spokane, Boston, Baltimore, Harrisburg, San Francisco, Los Angeles, Worcester, Fall River and Wichita. The system, as now practised on the Geveco trucking system, calls for sale to the purchaser of a car less battery, the vehicle being supplied with a specially designed, detachable battery cradle. By the use of this interchangeable cradle the company furnishing power is enabled to exchange a discharged or partly discharged battery for a fully discharged one in from 2 to 5 min. The current used is sold by the mile, according to the size of the vehicle and amount of mileage used as recorded by the odometer.

The paper on Greater Garage Service, by Harry Salvat, was a plea for more unity than now exists between the electric car manufacturer and garage owner.

F. E. Whitney's paper on Electric Truck Troubles and Means Taken to Eliminate Them, was an outline of the various troubles brought to light in the early electric vehicles and the remedies devised to eliminate them.

Motor Castings Co. Organized

DETROIT, MICH., May 19—The Motor Castings Co. has recently been organized to manufacture cylinder castings only. The foundry is located on Hart Avenue near Mack Avenue, and the show room and general sales office has been opened at 997 Woodward Avenue. The officers of the company are J. D. Curry, president; E. H. Briggs, vice-president; W. T. Cullen, sales manager, and J. A. Lanigan, general manager.

Fisk Strike Ends

SPRINGFIELD, MASS., May 21—The striking machinists and tire workers of the Fisk Rubber Co., Chicopee Falls, Mass., have accepted the latest propositions made by the company. Twenty-six hundred men will return to work. An 8-hr. day will go into effect at once. Time and one-half will be paid for overtime, and double time for Sundays and holidays.

Hofer Goes to Ross Co.

DETROIT, MICH., May 22—Walter C. Hofer has resigned as special representative of the Lozier Motor Car Co. and has joined the Ross Automobile Co. as district manager of southwestern territory.

McCord Joins Bankers Commercial Corp.

NEW YORK CITY, May 22—D. C. McCord has resigned his position as manager of Harris Brothers Co., Detroit, Mich., to become general manager of the Bankers Commercial Corp., this city, which finances installment sales.

First Armored Car Driver Dies

De La Touloubre, Pioneer Race Driver, Was Crippled in Moroccan Campaign

PARIS, May 10—De La Touloubre, pioneer race driver and first man to take an armored car into battle, died at Paris this week, after having been partially paralyzed and dumb for 3 years. De La Touloubre was a prominent figure in all European road races from 1900 to 1908. An artillery captain in the French army, he had adopted the name of De La Touloubre for racing purposes only, his real name being Henri Genty. In the early days he was a member of the Darracq team together with Hemery and Wagner. He won his first important long-distance race on a Darracq light car in the Belgian Ardennes in 1904. Later he linked up with the Bayard-Clement team and had the late Albert Clement as one of his companion drivers.

De La Touloubre's most important work was the organization of an armored car corps of Panhards which took part in the Moroccan campaign of 1907 and following years. This is doubtless the first use ever made of armored cars in actual warfare. His armored cars were recognized to have rendered valuable service, but the campaign left him a physical wreck. While chasing the enemy the car he was driving fell down the El Kantara gorge. For a time De La Touloubre's life was in danger, but he recovered only to spend the last 3 years of his existence partially paralyzed and without the use of his voice. Before being lost to public view he published a book dealing with his armored car experiences in Morocco.

Copper Prices Lowered

NEW YORK CITY, May 23—A drop of three-quarter cents a pound in copper featured the materials markets last week. This metal declined to 29¼ cents yesterday. Lead and tin prices which are very elastic, declined 7½ and 50 cents, respectively. The market in general was steady with few changes.

Open-hearth steel dropped to $42 a ton. Interest in the steel trade last week centred mainly in the placing of contracts for war munitions. Domestic automobile makers are still making a large demand for steel. Last week a contract of 250,000 tons of blue annealed sheets of steel was received from one of the manufacturers.

Rubber demand is apathetic. Para is quoting at 68¼ cents a lb., while Ceylon is steady at 70. American manufacturers of automobiles consume 36.3 per cent of the world's annual production of crude rubber, according to statistics. Allowing an average of 42 lb. of crude rubber for an automobile's tire equipment and taking 2250 lb. for the ton measure, the amount of rubber required by American-made automobiles in 1916 will be approximately 69,000 tons, as compared with an estimated total production of 192,000 tons. The rubber requirements for American automobiles in 1906 of 1866 tons have grown by leaps and bounds to 68,805 tons.

To Oppose S. R. B. Reorganization

PHILADELPHIA, PA., May 20—A stockholders' protective committee has issued a letter asking for deposits of the Standard Roller Bearing Co. stock. The committee is composed of F. T. Aldridge, chairman; J. S. Stanton, F. P. Fiske and Merrill Bishop.

The letter says in part: "The immediate purpose of such deposits is to enable the committee to oppose in court or otherwise the proposed plan of reorganization set forth in the circular bearing date of April 21, 1916."

The committee objects to the terms of the reorganization plan including the five-year voting trust, and five-year option on $1,000,000 common stock at par. Deposits of stock before June 1 are requested by the committee with the Brooklyn Trust Co.

Argo Buys Plant Site

JACKSON, MICH., May 23—The Argo Motor Co. has completed a deal with the Briscoe Motor Corp., whereby it has purchased the property which Mr. Briscoe purchased last year, upon which was to be erected a new plant for the Briscoe company, also a number of workmen's homes. All told, about 120 acres of ground are involved in this transaction. President Mansell Hackett of the Argo company announced that a new Argo plant will be started at once, and when completed the Detroit Chassis Co., in which he is strongly interested, will be moved to Jackson. In addition to the new plant for the Argo company, a number of homes for workmen will be built.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'gs
Aluminum, lb.	.58	.58	.58	.58	.58	.58	...
Antimony, lb.	.29½	.29½	.29½	.29½	.29½	.29½	...
Steel Beams and Cbannels, 100 lb.	2.77	2.77	2.77	2.77	2.77	2.77	...
Steel, Bessemer, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.30	.30	.30	.30	.30	.29¼	— .00¾
Copper, Lake, lb.	.30	.30	.30	.30	.30	.29¼	— .00¾
Oil, Cottonseed, bbl.	10.80	10.75	10.75	10.85	11.00	11.00	+ .20
Oil, Fish, Menbaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Oil, Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Oil, Lard, prime, gal.	1.10	1.10	1.10	1.10	1.10	1.10	...
Lead, 100 lb.	7.30	7.30	7.30	7.27½	7.27½	7.22½	— .07½
Oil, Linseed	.73	.73	.73	.73	.73	.73	...
Steel, Open-Hearth, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Oil, Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Oil, Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Oil, Rapeseed, refined, gal.	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para, lb.	.68	.68	.68	.68	.68	.68¼	+ .00¼
Rubber, Ceylon, First Latex	.70	.70	.70	.70	.70	.70	...
Sulpburic Acid, 60 Baume, 100 lb.	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	49.38	49.38	49.38	49.38	49.38	48.88	— .50
Tire Scrap, lb.	.05½	.05½	.05½	.05½	.05½	.05½	...

Paige Features Securities

Rises 230 Points on Announcement of 80 Per Cent Dividend

New York City, May 24—Paige-Detroit featured the securities market last week with a rise of 230 points on the strength of the announcement that action would be taken by the company on an 80-per cent stock dividend. The market as a whole was unusually strong with Chevrolet, Miller Rubber, Packard, Reo Truck, and New Departure showing substantial gains. Chevrolet rose 15 points, Miller Rubber 45, Packard common 39, Reo Truck 7¼, and New Departure 60.

Chandler's New High

Chandler Motor has been an active participant in the recent advance in the automobile securities market and sold to a new high of 98.

United Stock Oversubscribed

Dominick & Dominick, syndicate managers of the United Motor Corp. financing, who have been receiving public subscriptions for that stock at $62 a share, report that the subscription, which closed last Saturday, was twice oversubscribed. Application will shortly be made to list the shares of this corporation on the local curb market. Subsequently application will be made to list the stock on the Stock Exchange. Two shares of United are offered for one of Perlman.

Rumors emanating from Wall Street state that the Willys-Overland Co. will pay in July a somewhat higher cash dividend and also an extra stock dividend on its common stock. The rate now being paid on the common is 6 per cent regular, although in 1915 an extra 5 per cent was paid in stock.

Torrington Co. to Distribute Splitdorf Electrical Co. Shares

Newark, N. J., May 19—The directors of the Torrington Co. have voted to distribute to the common stockholders the preferred and common shares of the Splitdorf Electrical Co. now held in the Torrington Co.'s treasury. There are 9800 shares of Splitdorf preferred and 14,000 common held, and each share of Torrington common will receive seven one-hundredths of a share of preferred and one-tenth of a share of common. Distribution will be made July 1.

Until recently there have been 28 per cent accumulated dividends on the Splitdorf preferred. A few weeks ago 7 per cent was paid; then came another 7 per cent, and by June 1 the 28 per cent will have been made up.

Frost Is Westcott Service Manager

Detroit, Mich., May 22—Allen H. Frost has resigned as factory manager of the Detroit Wire Spring Co., to become service manager of the Westcott Motor Car Co., Richmond, Ind. This corporation will move to Springfield, Ohio, next month.

Drivers Tune Up at Indianapolis

Aitken, Rickenbacher and Oldfield Make Fast Time in Practice Laps

Indianapolis, Ind., May 21—Although but five cars have been reeling off practice laps at the Indianapolis Speedway, a steady crowd of bleacherites are on hand every day. Yesterday, being Sunday, about 1800 turned out in spite of the weather and saw some fast time made by Johnny Aitken and Eddie Rickenbacher. Each of these drivers made the circuit in 1:34, or at over 95 m.p.h. Barney Oldfield sent his car around for a lap in just over 1:35, but on the succeeding lap had to be towed by Rickenbacher. Examination showed that his Delage had a broken valve rocker arm. This is now being repaired.

Rickenbacher had a little engine trouble to-day, but will be out again in the morning. The car he was driving yesterday was not his own but that of his team-mate, Pete Henderson, who is laid up temporarily with a slight illness.

Resta and Christiaens of Peugeot and Sunbeam fame are both repairing their motors, which suffered in the recent Sheepshead Bay event. One of the reasons that the drivers are so late getting to Indianapolis this year is because they had ample opportunity to try out their mounts in New York, and those who are not repairing their cars are resting

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	66	68	..
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	76	82	86	90	—1
Chalmers Motor Co. com	90	93	160	165	+5
Chalmers Motor Co. pfd	95	98	96	100	—2
Chandler Motor Car Co	..	..	96½	97½	..
Chevrolet Motor Co	..	..	231	234	+15
Electric Storage Battery Co	80	88	64	65	+4
Firestone Tire & Rubber Co. com	..	485	830	860	..
Firestone Tire & Rubber Co. pfd	110	112½	113	114	..
General Motors Co. com	135	137	431	460	—29
General Motors Co. pfd	97	100	116½	117	—1½
B. F. Goodrich Co. com	443	451	75¾	76¼	—2
B. F. Goodrich Co. pfd	101¾	102½	115	118⅛	..
Goodyear Tire & Rubber Co. com	225	235	380	385	..
Goodyear Tire & Rubber Co. pfd	105	106½	105	106	— ½
Grant Motor Car Co	..	..	11	11½	..
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	12	14	10	15	+3
International Motor Co, pfd	30	33	22	27½	+1
Kelly-Springfield Tire Co. com	124	128	74	74½	— ¼
Kelly-Springfield Tire Co. 1st pfd	81	83	96	97½	—1
Kelly-Springfield Tire Co. 2nd pfd	115	130	..	..	..
Maxwell Motor Co. com	39	41	86	86½	+ ½
Maxwell Motor Co. 1st pfd	82	83	88½	89	—1
Maxwell Motor Co. 2nd pfd	34	36	57½	58	—1½
Miller Rubber Co. com	180	188	300	..	+45
Miller Rubber Co. pfd	104	105	115	..	..
New Departure Mfg. Co. com	136	141	277	278	+60
New Departure Mfg. Co. pfd	106	..	113	..	—1
Packard Motor Car Co. com	..	104	204	210	+39
Packard Motor Car Co. pfd	98	..	100	105	..
Paige-Detroit Motor Car	..	..	980	1050	+230
Peerless Motor & Truck Corp	..	..	20	21	—3½
Perlman Rim Corp	..	..	128	130	..
Portage Rubber Co. com	35	38	85	88	..
Portage Rubber Co. pfd	85	88	107½	108½	..
Regal Motor Co. pfd	..	..	20	..	+2
*Reo Motor Truck Co	15	15¾	37	38	+7½
*Reo Motor Car Co	32¾	..	44½	45	+2
Saxon Motor Car Co	..	..	73½	74	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Standard Motor Co	..	..	8	8¼	..
Stewart-Warner Speed. Corp. com	64	65	88	90	+1
Stewart-Warner Speed Corp. pfd	102	105	109	111	..
Studebaker Corporation com	65	67	137¼	137¾	—3¾
Studebaker Corporation pfd	96	98	109	112	..
Swinehart Tire & Rubber Co	80	90	83	84	..
Texas Company	123	124	191	193	—1
United Motor Corp	..	..	63½	64	..
U. S. Rubber Co. com	61	63	54¾	55¼	— ¾
U. S. Rubber Co. pfd	104¼	106¼	109	110	+2
Vacuum Oil Co	195	205	243	246	+6
White Motor Co. (new)	..	..	51½	51¾	+1½
Willys-Overland Co. com	111	113	259	262	—5
Willys-Overland Co. pfd	99⅛	102	106	107	+1

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	..	34	..
Chalmers Motor Co, com	89	92	162½	..	..
Chalmers Motor Co. pfd	94	97	96	100½	..
Continental Motor Co. com	..	185	37½	38¾	+1¼
Continental Motor Co. pfd	84	85½	9½	10½	+ ¼
Ford Motor Co. of Canada	900	..	..	405	—5
General Motors Co. com	137	139	430	460	..
General Motors Co. pfd	98	101	116	118	— ½
Maxwell Motor Co. com	40	42	85	88	+1½
Maxwell Motor Co. 1st pfd	83	84½	89	91	..
Maxwell Motor Co. 2nd pfd	35	36½	55	57	—3
Packard Motor Car Co. com	..	104	206	..	..
Packard Motor Car Co. pfd	..	100½	101	..	..
Paige-Detroit Motor Car Co. new	..	..	55	56½	..
Paige-Detroit Motor Car Co. old	..	..	980	1050	..
*Reo Motor Car Co	32¾	33¾	44½	45¼	+1¼
*Reo Motor Truck Co	15	15¾	36	37½	+7¼
Studebaker Corp. pfd	..	..	108	..	..
Studebaker Corp. com	66	..	135	138	+1
*W. K. Prudden Co	19½	21	48	49½	+14½

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	26	28½	40	..
Kelsey Wheel Co	200	..	340	350	..
Regal Motor Car Co. pfd	..	25	16	13	..

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*Par value $10.

in the interval before the 300-mile event which takes place on Decoration Day.

Repeated attempts to get post entries in the race have brought forth an official announcement from Manager Myers of the speedway that under no conditions will post entries be permitted. This reply has been made to Ira Vail, who tried to get in with his Hudson; De Palma with his Mercedes; to the Brooklyn owners of the Adams Special and Olsen Special cars; the Super-six Hudson that Mulford tried to get in, and a car from Detroit.

Hyatt Service Managers Meet

DETROIT, MICH., May 20—Hyatt service managers from every city in the country where there is a Hyatt branch closed their first annual convention to-day at the offices of the Hyatt company in this city.

Those present at the sessions, which began 2 days ago, were: J. J. Hanrahan, Los Angeles, Cal., representing the three Hyatt branches on the coast; J. W. Hutchinson, Boston, Mass.; L. R. Remington, Chicago, Ill.; R. B. Campbell, Atlanta, Ga.; K. H. McQueen, Newark, N. J.; N. S. Swan, Minneapolis, Minn.; H. Jay, Detroit, together with Service Supervisor A. K. Hebner; R. C. Brower, recently appointed traveling supervisor; J. W. Taylor, assistant service supervisor, and A. W. Robbins, assistant service manager at Detroit.

Venice Plans 100-Mile Race

VENICE, CAL., May 16—Plans are under way for a 100 mile race on the Venice road race course limited to cars of 231 cu. in. and under. The date suggested for the proposed event is July 4.

Reliability Run For Trucks

SAN DIEGO, CAL., May 17—July 15 and 16 are the dates set aside for the Los Angeles to San Diego motor truck reliability tour being promoted by the Los Angeles truck dealers under A. A. A. sanction. The trucks are to carry California products on the run.

Invoke Bay State Blue Law

SPRINGFIELD, MASS., May 20—As a result of the legislature not passing the law to allow the sale of gasoline and tires, etc., on Sunday the police here have notified the garage men that they must obey the law. Under the law a motorist cannot buy gasoline, tires, etc., and if he runs short of fuel and has a couple of punctures and has no extra tubes he may be marooned in a garage all night. The only alternative would be to borrow a tube or some fuel from a passing motorist.

$13,500 to Champion Drivers

Goodrich Adds $10,000 to Bosch Prizes for Three Leaders

NEW YORK CITY, May 18—Thirteen thousand five hundred dollars will be distributed by the Contest Board of the American Automobile Assn., to the champion automobile racing driver and the next two to finish in the championship award table during 1916. In addition thereto there will be a $1,000 cup.

The champion automobile racer of America will be officially declared this year by the A. A. A. and he will be awarded the cup and $7,000; to driver scoring second position, $4,000 will be given; and third position will receive $2,500.

Back of this cash offer are the B. F. Goodrich Co., and the Bosch Magneto Co. The Goodrich company will give $10,000, divided into $5,000, $3,000 and $2,000; and the Bosch company, as announced last month, will give $3,500 divided into $2,000, $1,000 and $500 and a $1,000 cup.

The championship award will be made according to a points system evolved by the Contest Board. The first of the championship events was the Metropolitan Cup Race at the Sheepshead Bay Speedway on May 13, which was won by Rickenbacher in a Maxwell. The standing of the first five as a result of this race is as follows:

Driver	Car	Points
E. V. Rickenbacher	Maxwell	600
Jules Devigne	Delage	320
Ira Vail	Hudson	170
C. J. Devlin	Duesenberg	90
George Adams	Adams	55
Bert Watson	J. J. R.	35

The 300-mile race at Indianapolis on Decoration Day is the next championship race and after that comes the 300-mile race at the Chicago speedway on June 10 and the 150-mile race at Des Moines on June 26.

Saxon Makes 34 M. P. G. in Spokane Fuel Economy Run

SPOKANE, WASH., May 18—The first economy run ever staged by Spokane automobile dealers was the feature event of the second annual Spokane automobile show. Sixteen cars competed in five classes, all the entrants showing exceptional ability to go many miles on 1 gal. of gasoline.

Before starting each car was fitted with a special gasoline tank, which was filled with 3 gal. of gasoline, and every car made the 37.5 mile run on less than the 3 gal.

To the Saxon goes the honor of making the best showing. With a piston displacement of less than 100 cu. in., it used just a little more than 1 gal. of gasoline, the car traveling at the rate of 34 m.p.g.

In the next class the Maxwell was the winner, averaging 29.3 m.p.g. The Buick light six roadster led its field, averaging 26.6 m.p.g.

In division No. 6, the class in which there was the greatest number of entrants, the Reo four, driven by Herb Alderson, was the winner. It averaged 25.4 m.p.g.

C. A. Martin driving a Paige six roadster was a winner over the Studebaker in the large car class, averaging a little better than 16.5 m.p.g.

To Renew Desert Classic

LOS ANGELES, CAL., May 17—Interest in the revival of the Los Angeles-to-Phoenix Road Race is growing. Four entrees have been promised already, in case the desert classic is staged this fall and in each case, no reference has been made to prize money, indicating a sporting angle which was largely responsible for the success of the first desert races.

Vanderbilt and Grand Prize in Nov.

LOS ANGELES, CAL., May 22—The dates for the Vanderbilt Cup and International Grand Prize races at Santa Monica will be Nov. 16 and 18, respectively.

Yellowstone Park Tour July 20

DENVER, COL., May 18—The Yellowstone National Park Tour will start from Minneapolis, Minn., July 20. The tour will be to Yellowstone Park by way of Fargo, Bismarck, Dickinson, N. D., Medora, N. D., Miles City, Mont., Forsyth, Billings, Livingstone and Gardner. A hotel train on the Northern Pacific Railroad will follow the tour, supplying accommodations and carrying a complete repair shop.

Racers Used Magnalite Pistons

NEW YORK CITY, May 22—In the equipment table of the cars in the Sheepshead Bay race last week it was stated that the two Delage cars driven by Limberg and Devigne used steel pistons. These cars were equipped with Magnalite pistons made by the Walker M. Levett Co., New York City. Magnalium piston equipment was given for Lecain's Delage, Devlin's Duesenberg, Resta's Peugeot, Rickenbacher's and Henderson's Maxwells, Watson's J.J.R., the Adams Special, the two Crawfords and the two Erwin Forties. All these cars also used Magnalite pistons.

British Industries Fair in 1917

LONDON, May 20—The Board of Trade has decided to hold the British Industries Fair in London next year from Feb. 26 to March 9, inclusive. Participation in the fair will be confined to manufacturers.

Factory Miscellany

Ford to Add in London—The Ford Motor Co. will add to its factory in London, Ont. The estimated cost is $75,000.

Douglas & Rudd Doubles Capacity—The Douglas & Rudd Mfg. Co., Bronson, Mich., maker of automobile accessories, has let contracts for an addition to its plant that will more than double its capacity.

Ford Plant in Chicago—The Ford Motor Co., Chicago, Ill., has let the contract for an additional plant in connection with its assembling plant in that city, which will be 56 by 365 ft., two stories, and will cost $60,000.

Elizabeth Co. to Build—The Elizabeth Auto Body Co., Elizabeth, N. J., will erect a plant, 100 by 100 ft., on South Spring Street, and an engine room, 40 by 40 ft.

Begg Motor to Add—The Begg Motor Co., Vancouver, B. C., will have an addition built at its plant immediately at a cost of $15,000.

Standard Truck to Build—The Standard Motor Truck Co., Detroit, will build a three-story reinforced concrete factory, 130 by 153 ft., to cost $50,000.

Takes Over Top Dept.—The Auto Vehicle Parts Co., Cincinnati, Ohio, has made a deal with the Higgin Mfg. Co., Newport, Ky., to take over its carriage top trimming department. The business will be removed to Cincinnati as soon as arrangements can be made.

Inter-State to Enlarge—Tentative plans are being made by the Inter-State Motor Co., Muncie, Ind., to build an addition to the plant this summer, 800 by 50 ft., and two stories high. This will give the factory approximately 350,000 sq. ft. of floor space. Two large enameling ovens have recently been installed.

Wis. Factory News—The Federal Rubber Co., Chicopee Falls, Mass., has filed articles and a statement to do business in Wisconsin. Of the $10,000,000 capital, $2,000,000 is represented by Wisconsin holdings, consisting of the property of the Federal Rubber Mfg. Co., Milwaukee, which recently disposed of its business to the Fisk interests, as noted at the time. The Wisconsin corporation will be dissolved and lose its identity. As has already been stated, the main plant at Cudahy, Milwaukee County, will be nearly doubled in size during this year.

The Continental Motor Truck Co., Superior, which engaged in the manufacture of motor trucks more than a year ago, is preparing to spend $50,000 in the erection of a factory of its own. The moving spirit of the company is Dr. John G. Barnsdale, 618 Tower Avenue, who designed the car, which has been manufactured on a small scale. Under the enlarged facilities, the truck will be built in four sizes and a large production attained.

The Perfex Radiator Co., Racine, a large manufacturer of radiators for passenger cars, trucks and tractors, is preparing to build a plant of its own. Plans have been prepared for the first unit, to be 65 by 250 ft. in size, one story high, of fireproof construction, to be ready during mid-summer. The company has been occupying leased quarters for several years, but these have been outgrown. G. W. Bartlett is president.

Ohio Seamless Tube Adds—The Ohio Seamless Tube Co., Shelby, Ohio, has purchased a building site and has started the erection of an entirely new plant in addition to its present plant, for the manufacture of seamless cold drawn and hot finished tubes. This mill will have a capacity of 2000 tons per month. The combined capacity of all of the mills of the company, when completed, will be 4000 tons per month. This new plant will be in operation Dec. 1.

Tracy Adds to Plant—Additional apparatus has been recently installed at the motor testing plant of Joseph Tracy, including a late model high-speed Sprague electric dynamometer, two hydraulic brakes and a chassis testing machine of the rear wheel type.

The Automobile Calendar

ASSOCIATIONS

May 22-26—Chicago, Ill., N. E. L. A. Convention, Electric Veh. Section, Congress Hotel.
May 26-27—Del Monte, Cal., Meeting, Three Divisions of National Assn. of Automobile Accessory Jobbers.
June 12-16—S. A. E. Summer Trip on Great Lakes.
July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

May 30—Des Moines, Iowa, Iowa Derby, 20 miles; Des Moines Special, 10 miles.
May 30—Tacoma, Wash., 10, 20, and 30-Mile Races, Tacoma Speedway Assn.
May 30—Elmira, N. Y., Track Race, Elmira Auto & Motorcycle Racing Assn.
May 30—Indianapolis Speedway 300-Mile Race.
May 30 — Minneapolis, Minn., Speedway Race.
May 30—Newark, N. J., Track Race, Olympic Park Racing Assn.
June 4—Sheepshead Bay Speedway, 30-mile Race, American Liberty Day Committee.
June 10 — Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Assn.
June 16-17 — Sheepshead Bay Speedway, 24-Hr. Race, Trade Racing Assn., New York City.
June 20—Galesburg, Ill., Track Race, 100 miles.
June 28—Des Moines, Iowa, Speedway Free-for-All, 300 Mile Race.
July—LaGrande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash, Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300-Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 4—Newark, N. J., Track Race, Olympic Park, Auto Racing Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hillier-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Assn.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hillier-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4—Indianapolis Speedway Race.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14—Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Nov.—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

MISCELLANEOUS

June 8—New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphans' Automobile Day Outing Assn.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16—Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Trade Happenings

New York City Trade Items—The P. J. Durbam Co., 244 West Forty-ninth Street, has added the Willard storage battery service station to its equipment, in addition to its present work as official service representative for the Electric Auto-Lite Co., Toledo, Ohio, and Gray & Davis, Boston.

The Redden Motor Truck Co. has moved its office and showroom to the Locomobile Building, Sixty-first Street. C. A. Redden, president of the company, recently moved the general offices of the company to 676 Woodward Avenue, Detroit, and will divide his time between these two cities.

The organization of the Colonial Motors, Inc., which was recently formed by J. F. Plummer, former local Locomobile manager, to distribute the Liberty car, has been completed. Arnold Wood is vice-president, H. B. Van Loan is secretary and treasurer, J. L. Bailey is sales manager, and L. W. Beck is service manager.

Robert Lurie & Co., Metz distributor, is now located at 240 West Fifty-sixth Street. The wholesale department is to be placed in operation with W. L. Schmidt; formerly of the International Motor Truck Co., in charge.

Charles Rifenberg, who for a time managed the service station of the King Motor Co., will superintend the service station of the C. T. Silver Motor Co., Overland distributor in Bronx.

E. J. Stern has taken on the agency for the Palmer-Moore truck, with an office at 1777 Broadway.

W. J. Taylor has joined the C. H. Washburne Corp., Moline-Knight distributor, as sales manager and efficiency expert. Mr. Taylor entered the Overland company in 1914 as efficiency engineer. Last year he joined the C. T. Silver Motor Co. and continued on the same work.

The Glidden Motor & Supply Co. has leased the building at 604 West Forty-seventh Street and the Dayton Rubber Mfg. Co. has leased the store at 1764 Broadway.

Columbus News Items—The Buckeye Tire & Supply Co., 75 North Fourth Street, has been made central Ohio distributor for Portage tires and tubes.

The Willys-Overland Co. will take over the central Ohio agency for the Overland June 1 and operate a branch house in the Buckeye capital. The agency had been handled for eight years by O. G. Roberts & Co. The branch service house will remain at the former location of the Roberts Co., 933 East Gay Street. A salesroom will be opened in the downtown automobile section. The manager of the Columbus branch has not been announced.

The Times Square Automobile Co. has opened a store for parts and accessories in South High Street.

The F. L. Chase Co., 390 North High Street, has taken the central Ohio agency for the Mac kand Saurer trucks.

The C. N. Bowen Motor Sales Co., 138 East Spring Street has taken the central Ohio agency for the Lexington.

C. E. Barr, one of the best-known automobile salesmen in central Ohio, has been made general manager of the Central West Motor Car Co., 80 North Fourth Street, agent for the Oakland.

The Campbell-Gilchrist Rubber Co. is the name of a new concern at 15 North Fourth Street, to handle Pennsylvania tires in Central Ohio.

The dealers in electrics in Columbus have united in a campaign of advertising to boost the sale of electrics at this time. Those who are participating in the campaign are Michael Abel, agent for the Baker, Rauch & Lang; F. E. Avery & Son, agent for the Detroit, and the Standard Motor Car Co., agent for the Milburn Electric.

The Willys-Overland Co., which will establish a Columbus branch June 1, has taken a lease on a large salesroom at Fourth and Gay Streets, which lies in the heart of the automobile district. The service station will remain at 933 East Gay Street, where the O. G. Roberts Co., former agents in central Ohio, was located. Samuel Isaacs, formerly with the Roberts company, will be in charge of the Columbus branch.

Power Barley District Sales Mgr.—Jos. R. Power has severed his connection with the Anderson Electric Car Co., Detroit, Mich., to accept a position as district sales manager with the Barley Mfg. Co., Streator, Ill., manufacturer of the Roamer car.

L. C. Mulford, who for a number of years has been identified with the automobile industry and who for the past 2 years has been traveling representative for the Barley Mfg. Co., Streator, Ill., has taken over the distribution in central Illinois of the Halladay models and the Roamer, which are the products of the Barley company. He will have headquarters in Streator.

Detroit Changes—A. A. Lehr, formerly assistant purchasing agent for the General Motors Co., and at one time connected with the purchasing department of the Studebaker Corp., has been appointed sales manager of the American Distributing Co., Detroit.

E. J. Curren, formerly assistant sales manager of the King Motor Car Co. and also of the Paige-Detroit Motor Car Co., has joined the sales promotion division of the Regal Motor Car Co.

New England Trade Items—An agency for the Lexington Six has been placed in Boston, Mass., with the Standard Automobile Co., that has the Standard Eight.

The Henshaw Motor Co., that has eastern Massachusetts for Dodge Bros. cars, has just opened a sub-agency at Brockton, and it has also leased a larger building for its Worcester branch. The company is planning a larger service station at Boston.

M. A. Potter, until recently with the New England branch of the Firestone Tire & Rubber Co., at Boston, has been appointed Eastern manager for the Werner-Lenz Co., Chicago.

G. H. Schuster, who won the New York to Paris race with the Thomas some years ago and who was with the Pierce-Arrow factory, has gone to Boston to take charge of the Dodge Bros. service station there and at Worcester. He will be supervisor of the stations in eastern Massachusetts.

J. S. Downey, who was prominent in motor racing circles some years ago, has bought an interest in the Massachusetts Storage Warehouse Co.

G. S. Whelan, formerly manager of the Grant car agency at Boston, has been placed in charge of the Munroe car agency just opened at that city.

C. W. Flynn, for some time manager of the Stamford, Conn., branch of the Chevrolet, has accepted a position as sales manager of the Inter-State Motor Co., Boston.

Scott Joins H. & N Carburetor—The H & N Carburetor Co., 1790 Broadway, New York City, announces the appointment of J. Arthur Scott as manager of its Pacific Coast branch.

Mr. Scott, who is well known to the trade as an expert gas engine man, held a similar position to that of his new appointment with the Master Carburetor Co.

The new branch office will be located at 617 South Olive Street, Los Angeles.

The AUTOMOBILE

Vol. XXXIV
No. 22

NEW YORK, JUNE 1, 1916

Ten cents a copy
Three dollars a year

Suggestion No. 20

Stewart

Vacuum System

$10

Cuts Gasoline Cost

IF you want to get a motorist's attention nowadays *tell* him a sure way to overcome all gasoline troubles including present high prices.

If you want to get his thanks, and his trade *sell* him a Stewart Vacuum System for $10-complete.

It's the one answer to every gasoline question.

"No car is better than its accessories"

The Stewart-Warner Speedometer Corp.
Chicago, Illinois, U. S. A.

Vol. XXXIV New York—Thursday, June 1, 1916—Chicago No. 22

The AUTOMOBILE

Resta Wins Sweepstakes

His Peugeot Covers 300-Mile Course on Indianapolis Speedway at 83.26 M.P.H. —D'Alene's Duesenberg Second at 83.15

Mulford's Peugeot Third and Christiaens' Sunbeam Is Fourth — Two Accidents

By J. Edward Schipper

DARIO RESTA, a native of Sunny Italy, and a citizen of the United States, flashes once more to the fore. To-day he added another jewel to his crown of speed by winning the 300-mile Indianapolis classic with his Peugeot. D'Alene, a Californian, driving a Duesenberg, took second place.

Resta's time was not as fast as that for the same distance of a year ago, when the race was 500 miles long, his average being 83.26 m.p.h. In 1915 Resta covered the distance at a speed of over 89 m.p.h.

Two accidents marred the afternoon. Tom Rooney, whose car blew a shoe on the back stretch, had his shoulder dislocated and his hip broken when his car rolled over. His mechanic, Jim McAllister, was badly bruised. Jack LeCain was injured more seriously when he also struck the retaining wall on the back stretch and sustained severe injuries. It is feared that his back may possibly be broken.

Good Generalship

The driving of Resta will be long remembered for the cool calculation displayed. He let the leaders who dashed to the front in the first few laps set the pace and then, when accidents had put them out, he continued to set a safe pace which was just sufficient to carry him across the finishing line by a little over 2 min. ahead of D'Alene. Resta only stopped once, when he changed his rear tires and put in gasoline and oil, the total time for this stop being 1 min. and 5 sec. It occurred in his sixth-ninth lap, and the time lost did not interfere with his lead.

Ten Cash Prizes

This year's purse includes ten positions. It totals $30,000 with $12,000 for first, $6,000 for second, $3,000 for third, fourth $2,000, fifth $1,700, sixth $1,400, seventh $1,200, eighth $1,000, ninth $900 and tenth $800.

At 12.30 the cars were lined up across the track in the order of start, which had been determined by the speeds made in the elimination trials. They were then sent around the track one at a time, while announcers introduced them to the crowd. After again getting into position the cars were paced a lap, led by Frank Smith in a white Premier, started and crossed the line for the beginning of the race almost on the tick of 1.30.

Around they circled, and almost immediately the parade of cars which had been four abreast began to string out in a line, so that, at the end of the first lap, the entire ellipse was doted with the flying speed creations.

Across the line they sped, with the cars that were to set the pace already in

THE WINNERS

Car	Driver	Time	M.P.H.	Prize
Peugeot	Resta	3:34:17	83.26	$12,000
Duesenberg	D'Alene	3:36:15	83.15	6,000
Peugeot	Mulford	3:37:56	82.6	3,000
Sunbeam	Christiaens	3:46:36	79.96	2,000
Delage	Oldfield	3:47:19	79.2	1,700
Maxwell	Henderson*	3:49:56	78.3	1,400
Premier	Wilcox	3:54:31	76.8	1,200
Crawford	Johnson	4:01:54	74.4	1,000
Crawford	Chandler	4:02:43	74.2	900
Osteweg	Haibe	4:03:10	74.0	800

*Rickenbacher driving at finish.

the lead. Eddie Rickenbacher in his Maxwell came first, followed by Aitken in a Peugeot and Resta in another Peugeot. Close behind came Anderson in a Premier, Rooney, his team-mate, in another, Merz in a Peugeot, Wilcox in another Premier, Arthur Chevrolet in a Frontenac and a scattered field trailing along behind.

Rickenbacher Leads

The second lap saw Rickenbacher opening a gap between himself and his pursuers. About 300 yards separated him from the nearer cars, foremost among whom were Aitken and Resta. The same order prevailed among the others except that Arthur Chevrolet had pulled up and was now in seventh place with his Frontenac. Merz was driving his Peugeot at a tremendous pace to force himself up among the leaders and was gradually gaining. At the end of the fifth lap Rickenbacher, who had now gained a lead of 1000 yd., lapped Johnson in his Crawford just in front of the stands, and a loud cheer went up, as the flying Maxwell began to pass car after car on the lap behind.

Aitken and Resta were running neck and neck at the end of the fifth lap and those in the pits and stands knew that it was not a question of driving, with these three leaders, so much as the ability to stand pace. The mass of steel that could endure the strain would win, as the pilots had even more power at their command then they could use, and it was not a matter of mere speed so much as of endurance and driving.

Rickenbacher Goes Out

Two cars rolled up to the pits in the sixth lap for spark plugs; these were Wilcox in the Premier and Gaston Chevrolet in the Frontenac. In both cases oil had passed the pistons and sooted the plugs. In the meantime, while these cars were at the pits, the procession was streaming by with Rickenbacher still far out in the lead until, at the end of the ninth lap, his white car dropped from the race, a broken steering knuckle rendering useless all the power and speed of driver and engine.


Ralph Mulford, whose Peugeot finished third in the 300-mile International Sweepstakes at Indianapolis

With Rickenbacher out, the lead passed to Aitken, and at the end of the twelfth lap he and Resta were closely grouped and a quarter of a lap ahead of Mulford in another Peugeot. The three Peugeots, the products of France, made the pace through many a mile with the others in an ever-lengthening string behind them.

Chandler had to bring his car to the pits in the eighth and again in the twelfth lap to renew the gasket on his gasoline tank. This bothered him all through the race and cost him a position up near the front in the early stages of the grind. Others also were beginning to pay visits to the pits by this time. Anderson had to change the plugs on his Premier in the fifteenth lap, and the Sunbeam, driven by Christiaens, came in for a new left rear tire in the sixteenth.

Resta snatched the lead from Aitken in the seventeenth lap, when Aitken stopped for 20 sec. to change his right rear wheel.

This made the order in the eighteenth lap: Resta first, Aitken second, Merz third and Henderson, in the Maxwell, fourth. D'Alene's Duesenberg was then running sixth and gradually working its way through the field.

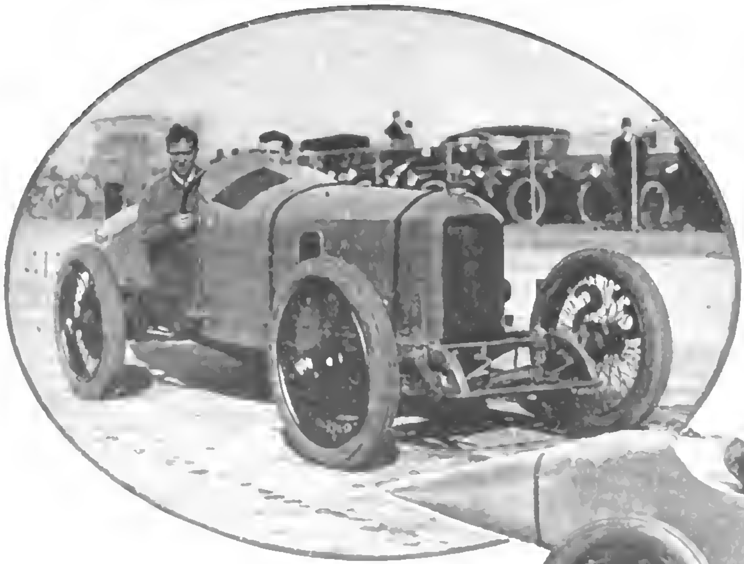
Aitken had to come in again in the twenty-fifth lap for another tire change. This was handled beautifully and he got away with a delay of but 22 sec. At the end of 50 miles, Aitken's two tire changes had left him in second place with Resta leading. Merz was a close third, Henderson fourth, Gaston Chevrolet fifth and D'Alene sixth.

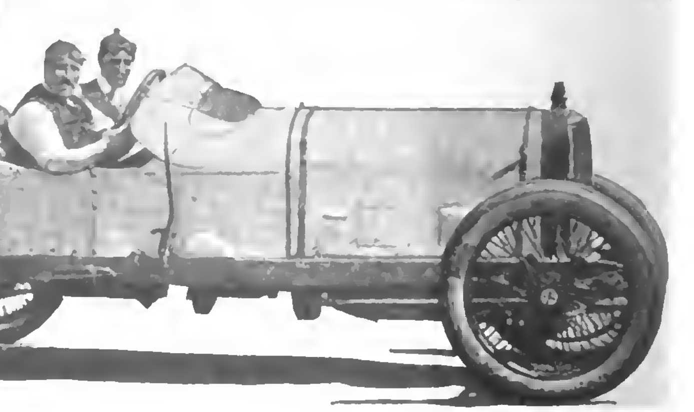
A Steady Grind

The race had now settled down to a steady grind. It was a question even at this stage, whether or not Resta would fail. If his car continued to run the way it was going, and he did not make a stop so that Aitken would catch him, the race was his. He was about a half lap in the lead at 75 miles with Gaston Chevrolet, who had been driving a game race, up in third position. D'Alene had now pushed his way to fourth and Henderson was fifth. The race all along the line was exceedingly close and a stop for a shoe meant the loss of position.

When the 100-mile stage was reached Resta still held his uncomfortable lead of half a lap. Aitken was still pursuing him and D'Alene had gained a firm hold on third position in one of the prettiest driving exhibitions seen for some time. Gaston Chevrolet was in fourth place and Henderson fifth. Ralph Mulford was working his way toward the front also, and now held sixth with Devigne seventh.

In the next 50 miles Ralph Mulford showed some of the best speed of the day.


Left — Dario Resta, winner of the Indianapolis 300-mile race, at the wheel of his Peugeot


Right—Joseph Christiaens in his Sunbeam, which he piloted to fourth place in the Indianapolis 300-mile speed battle

He passed D'Alene, Chevrolet and Henderson and put himself into third position by his fast sprint. Here he lay in wait for the leaders to break themselves up, Henderson being now fourth and D'Alene fifth. In the sixty-eighth lap, Aitken had to stop again. This time he changed plugs and the delay of just over a minute allowed the flying Resta to gain another mile and a half or more. Immediately after, however, Resta, on his sixty-ninth lap, had to stop for a right rear tire, gasoline and oil.

Aitken Succumbs

At the end of Aitken's sixty-ninth lap, the break came. Up to this time he always had a fighting chance, but a broken valve put him out of the running and left Resta safely up in front. Thus, at the end of the 200 miles Resta was far ahead, with Mulford second, Rickenbacher, who was now driving Henderson's Maxwell, in third place, D'Alene fourth, Anderson fifth and Christiaens sixth. The average for Resta at this time was 85.79 m.p.h., and he was driving very conservatively with 100 miles still to go.

A close fight for third position was now on. Resta held a substantial lead at the end of 225 miles, and Mulford seemed to have a firm grip on second place, but by forcing his car D'Alene passed Henderson and projected himself into third position. Anderson, who had been running fifth, went out with a broken rod in the seventy-fifth lap and that put Christiaens in his position.

Henderson's Maxwell, which finished in sixth position in the Indianapolis race, Rickenbacher driving, making fast time in a practice spin on the Hoosier speedway

John Aitken's Peugeot which made fast time up to the sixty-ninth lap of the race when a broken valve put him out of the running

D'Alene's Sprint

D'Alene, continuing his burst of speed, began to outdistance Mulford and, at the end of the 250 miles, was in second place. Mulford was then third with Christiaens fourth. Fifth place was held by Oldfield who had driven consistently throughout the entire race, and, as the leaders were eliminated, climbed higher and higher. Rickenbacher, in the Maxwell, was sixth, Haibe, in the Osteweg, seventh, Wilcox, in a Premier, eighth, Alley, in the Ogren, ninth and Johnson, in a Crawford, tenth.

This same order held at the end of the race, except that Wilcox succeeded in passing the Osteweg and Chandler in a Crawford managed to nose in ahead of Alley for seventh and ninth places respectively.

Resta flashed across the wire an easy winner. He had never really pushed his car during the race and the high safety factor under which he was working is shown by the fact that he only stopped once. His pit men had always kept him posted as to his lead since the early part of the race and he had never striven to put the lead up to more than enough to carry him through a safe winner.

The attendance at the race was estimated to total between 80,000 and 90,000, the usual proportion coming in their automobiles, while special trains to Indianapolis from Detroit, Chicago, Cleveland, New York and other large centers served their part in transporting speed-seeking motorists, near-motorists and members of the industry to the Hoosier saucer.

Arrangements at the track were excellent, the militia detachment guarding the course in accordance with the custom at previous Indianapolis classics keeping the best of order and preventing any untoward accidents to spectators.

Billy Chandler at the wheel of his Crawford Special, which captured ninth prize money in the Indianapolis race

Oldfield Breaks Record

Barney Oldfield, driving the front-drive Christie car, broke the lap record for Indianapolis speedway on May 28, when he covered the 2½-mile course at an average speed of 102.623 m.p.h. The previous record was made by Boillot, who was recently killed by German airmen while fighting in France. His time was 1:30.13. Oldfield covered the course in 1:27.70.

Times of Various Cars at Salient Points in the Indianapolis 300-Mil

AT 25 MILES

Driver	Car	Time
Rickenbacher	Maxwell	14:50
Aitken	Peugeot	15:11
Resta	Peugeot	15:12
Henderson	Maxwell	15:52
Merz	Peugeot	15:59
Anderson	Premier	15:59
Christiaens	Sunbeam	16:00
Rooney	Premier	16:01
D'Alene	Duesenberg	16:02
L. Chevrolet	Frontenac	16:12
Oldfield	Delage	16:24
LeCain	Delage	16:24
Mulford	Peugeot	16:43
Haibe	Osteweg	16:54
Alley	Ogren	17:04
Johnson	Crawford	17:44
Chandler	Crawford	18:42
Lewis	Crawford	19:52
Wilcox	Premier	22:31
A. Chevrolet	Frontenac	25:09
Franchi	Peusun	27:11

AT 50 MILES

Driver	Car	Time
Resta	Peugeot	32:17
Aitken	Peugeot	33:26
Henderson	Maxwell	33:52
Merz	Peugeot	33:53
D'Alene	Duesenberg	33:54
L. Chevrolet	Frontenac	33:54
Rooney	Premier	34:05
Le Cain	Delage	34:51
Christiaens	Sunbeam	35:07
Oldfield	Delage	35:26
Mulford	Peugeot	35:33
Alley	Ogren	35:39
Haibe	Osteweg	36:01
Anderson	Premier	38:39
Lewis	Crawford	38:40
Johnson	Crawford	39:02
Chandler	Crawford	40:44
A. Chevrolet	Frontenac	43:16
Wilcox	Premier	45:03

AT 100 MILES

Driver	Car	Time
Resta	Peugeot	1:07:20
L. Chevrolet	Frontenac	1:09:37
D'Alene	Duesenberg	1:09:37
Aitken	Peugeot	1:10:09
Henderson	Maxwell	1:10:21
Oldfield	Delage	1:11:47
Mulford	Peugeot	1:12:08
Le Cain	Delage	1:13:00
Christiaens	Sunbeam	1:14:25
Rooney	Premier	1:14:29
Anderson	Premier	1:14:34
Haibe	Osteweg	1:15:01
Alley	Ogren	1:16:44
Lewis	Crawford	1:19:09
Johnson	Crawford	1:19:13
Chandler	Crawford	1:19:43
A. Chevrolet	Frontenac	2:03:59

Pit Work Better Than in Other Recent Races

Tire Changes in Less Than 1 Min.—Pit Rules Rigidly Observed by All

INDIANAPOLIS, IND., May 30—On the whole the pit work was better than that shown at Sheepshead Bay, where it was somewhat ragged. At Indianapolis tires were changed in times that ranged between 20 and 40 sec., and there were very few that took over 1 min. At New York several of the changes occupied far longer than they should have done.

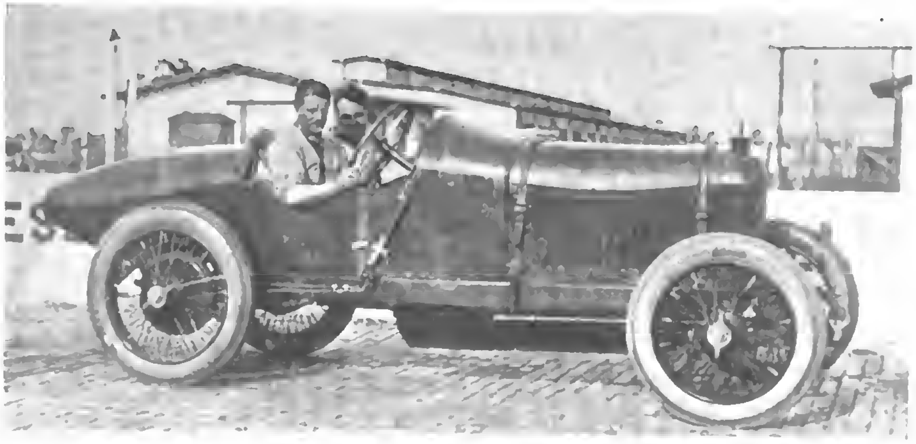
Some of the pits were in charge of ex-drivers who were thoroughly familiar with the work and saw to it that proper efficiency was shown in making changes or adjustments. The pit rules were rigidly adhered to by the attendants as well as the drivers and mechanics, and in no instance was there any tendency toward the infraction of the rule that allows only two men out of the pit at any time.

Tire inflations ranged on the average around 60 lb. Some of the drivers pump the tires to 100 lb. before starting the race, and then let the pressure down to the required amount. In this way any delay that may be caused by pumping is eliminated. The treads on the tires are not buffed off, as they have been on the faster tracks, because the centrifugal factor does not have to be reckoned with to such a degree. The tire changes are being made more often in all the races before the shoe blows. In that way it is possible to avoid limping around the track, and the danger of having a blowout on a bad turn, where there are a number of cars bunched, is averted.

The right rear shoe is, of course, the one most susceptible to wear and the left front is least in danger of giving out. There were no changes in the race of front lefts, although on more than one occasion the right front was blown. It is the tire that must be watched most carefully on this track. Eddie Rickenbacher blew a right front shoe in practice just before the race. The tire went over the roof on the grandstand and the car spun around three times before it was brought under control. If this had occurred in a race with the cars bunched the results would have been disastrous.

The 5-in. tires are hard to steer on this track and, although they wear better, are harder on the driver. In fact, the difference is so noticeable that only drivers of more than ordinarily powerful build would care to manage a car so equipped. The use of smaller tires in front than in rear is quite common here, as will be noticed from the equipment table, and the difference in ease of steering is quite noticeable with these smaller wheels. It may be that the gyroscopic action of the wheels has something to do with this. It seems quite possible that this is so, when it is remembered that the drivers could not manage cars equipped with disk wheels on this track at all.

(*Continued on page* 996)



Gil Anderson in his Premier, who was put out of the race by a broken connecting-rod on the seventy-fifth lap when running in fifth position

Sweepstakes Race Held on May 30

AT 200 MILES

Driver	Car	Time
Resta	Peugeot	2:18:03
Mulford	Peugeot	2:20:44
Henderson*	Maxwell	2:24:15
D'Alene	Duesenberg	2:24:39
Christiaens	Sunbeam	2:29:01
Oldfield	Delage	2:30:55
Haibe	Osteweg	2:34:19
Wilcox	Premier	2:38:45
Alley	Ogren	2:41:39
Chandler	Crawford	2:47:07
L. Chevrolet	Frontenac	2:54:19

*Rickenbacher was now driving this car.

TIME OF FINISH

Driver	Car	Time
Resta	Peugeot	3:34:17
D'Alene	Duesenberg	3:36:15
Mulford	Peugeot	3:37:56
Christiaens	Sunbeam	3:46:36
Oldfield	Delage	3:47:19
Henderson*	Maxwell	3:49:56
Wilcox	Premier	3:54:31
Johnson	Crawford	4:01:54
Chandler	Crawford	4:02:43
Haibe	Osteweg	4:03:10

Osteweg Makes Good Showing in Initial Race at Indianapolis

A Description of This Special Car—Details of Design of This Special Car Hitherto Unavailable

The Osteweg car is fitted with a Wisconsin power plant that has been developed very much along the lines of the Delage.

The engine is a four-cylinder, sixteen-valve design having a bore of 4 11-32 and a stroke of 5 in. The cylinder casting is vertical and the valves are carried on each side, operating horizontally. The motor as far as the camshaft layout is concerned is the same as a T-head job, as there are two shafts, one located on each side of the crankshaft. The camshafts are driven off the timing set at the front end of the motor.

The Valve Action

The cams actuate long vertical push rods, four of which are located on each side of the motor. Each push rod operates two valves simultaneously. The push rods on the right take care of the intake and those on the left the exhaust. The rods bear against Y-shaped rocker arms which are so curved as to transform the motion given to them in a vertical direction by the push rods to a horizontal motion. The vertical rods bear against the stems of the Y and at the end of each of the branches there is a bearing against the end of the valve stem. Thus each rocker arm takes care of the two intake or two exhaust valves for one cylinder.

Other than in the valve action there is nothing about the motor which would distinguish it greatly from any other power plant. The pistons are magnalite and the dimensions of the pistons, valves, etc., are not radical. The valves have a clear opening diameter of 1¾ in. and the lift is ⅜ in. In transmitting the motion to the valves the rods pass up through the casting which forms in one piece, the manifold header and valve cover plate.

The exhaust manifold is carried overhead, while the intake is on the side as indicated. The carbureter is carried on the right side of the engine, but the make is not fixed as it is desired to try out several at the track before deciding.

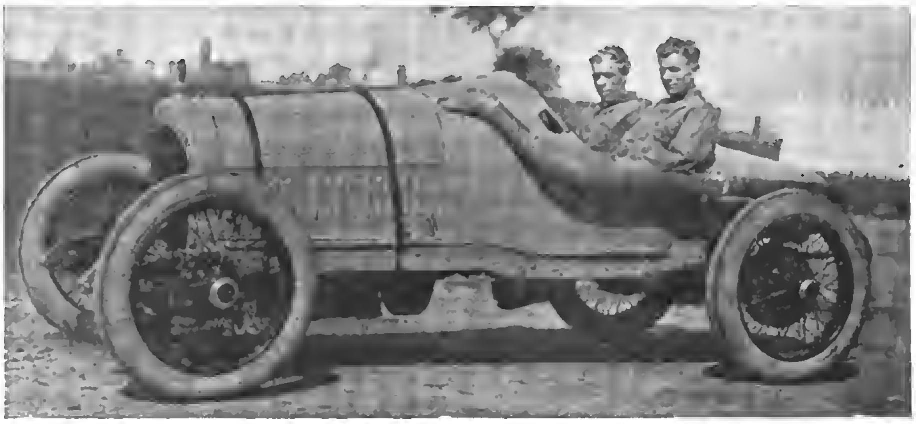
Three Main Bearings

Three main bearings are used on the crankshaft. These, unlike many of the racing cars, are plain babbitt lined bearings. The diameter of the crankshaft is 2 in. and the lengths of these bearings are 3¾ in. rear, 2½ in. front and 2 in. center.

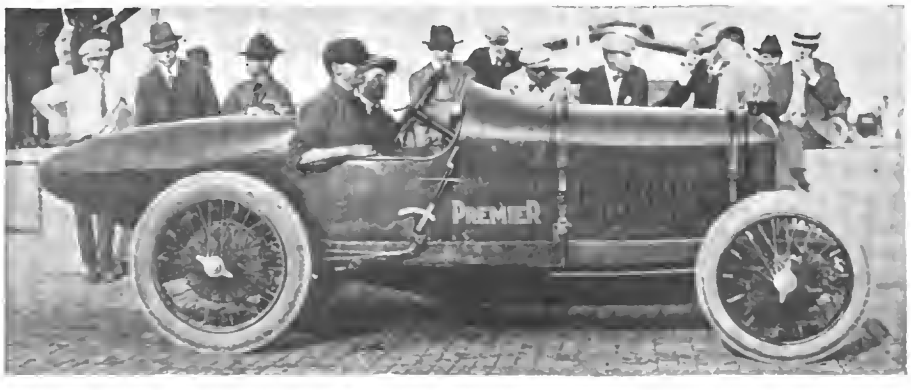
Standard design is used through the remainder of the chassis. The clutch is a cone and the gearset provides three speeds. Tires are Silvertown cords, 33 by 5 in. Springs are semi-elliptic and are used in conjunction with a Hotchkiss drive.

Oil and gasoline are carried in the tail of the car. The capacity of the gasoline tank is 25 gal. and that of the oil tank 7 gal. The tail piece is tapered off in a streamlike style, but does not extend back with a very extreme taper. The contour of the rear deck is flat compared to some of the other racing cars and the wheelbase is short, being but 102 in.

Ignition is by Bosch magneto, there is one set of plugs and the car carries Hartford shock absorbers all around.



Osteweg in the Osteweg Special, which, driven by Haibe, captured tenth prize money at Indianapolis



Tom Rooney in his Premier, which figured in one of the two accidents of the day, owing to the blowing of a shoe

Summing Up the Truck Final Drive Situation

Reasons for Using Different Forms for Different Purposes—Origin and Special Qualities of Gear and Worm Axles

By A. Ludlow Clayden

IN the development of the automobile there have been several periods during which vehement discussion raged concerning some particular feature of construction. In the early days of the passenger car there were bitter arguments between the protagonists of the sliding gear type of change speed which is now universal and of the theoretically far superior epicyclic mechanism. There were arguments concerning the proper place to locate the engine, whether it should be under the hood or somewhere beneath the body, whether accessibility or body space was the most important quality.

More recently we have had the battle of the cylinders, 1 vs. 2, 2 vs. 4, 4 vs. 6, and so on, right up to the present time when 12 vs. 16 looms in the offing.

It is not so very great a time since it appeared problematic as to whether steam or gasoline was to be the automobile motive power.

Looking back over some of these arguments it is interesting to observe how sometimes theory has triumphed and many times commerce has overmastered theory. In the question of sliding vs. constant mesh gearing, the exponents of the former type had nothing whatever to support their construction except simplicity. Every theoretical argument favored some other type of gearing.

To look at the other side, theory condemned the kind of simplicity which used to be typified by exposed unlubricated timing gears, non-automatic carbureters, etc. In these respects theory has been vindicated absolutely.

Practicability the Keynote

To-day engineers have come to realize that nearly every engineering problem in connection with automobile design construction resolves itself into a matter of *practicability*. Where alternative construction presents itself it is almost invariably found that one has advantages not possessed by the other, but also must own to especial disadvantages. Sometimes for some conditions of service one idea will be the best, on other occasions it may be the other construction which will strike the happiest medium.

It is easy in looking back over years to see how prominent men have changed their opinions, have in many cases eaten their own words as increasing experience has shown the truth to be different from their anticipation, but it is always possible in such a review of former happenings to notice that those who made mistakes made them because they overlooked some vital factor.

To-day there are still in progress very many arguments, but none of them so all-absorbing as were the particular ones cited above. Still the argument which circles about the final drive of the commercial vehicle has reached a pitch where it is not far behind the older controversies.

Conscious that I am treading upon dangerous ground, I propose briefly to review the developments of different types of truck axles, prefacing these remarks with the statement that there is no form of final drive for either a truck or a passenger car which is not a compromise. There is no form that does not possess disadvantages as well as advantages, and just as with everything else, a new sphere of action for the product demands a fresh examination of the whole subject to see how the balance of advantage and disadvantage may best be struck.

Early Forms of Drive

Again let us step back a few years to the time when all automobiles were, with very few exceptions, chain-driven. In those days we were still using extremely crude cars. The exposed timing gears above mentioned were still in vogue. Noise troubled us not at all and efficiency but little, therefore devices were adopted and used without protection and without special provision for lubrication.

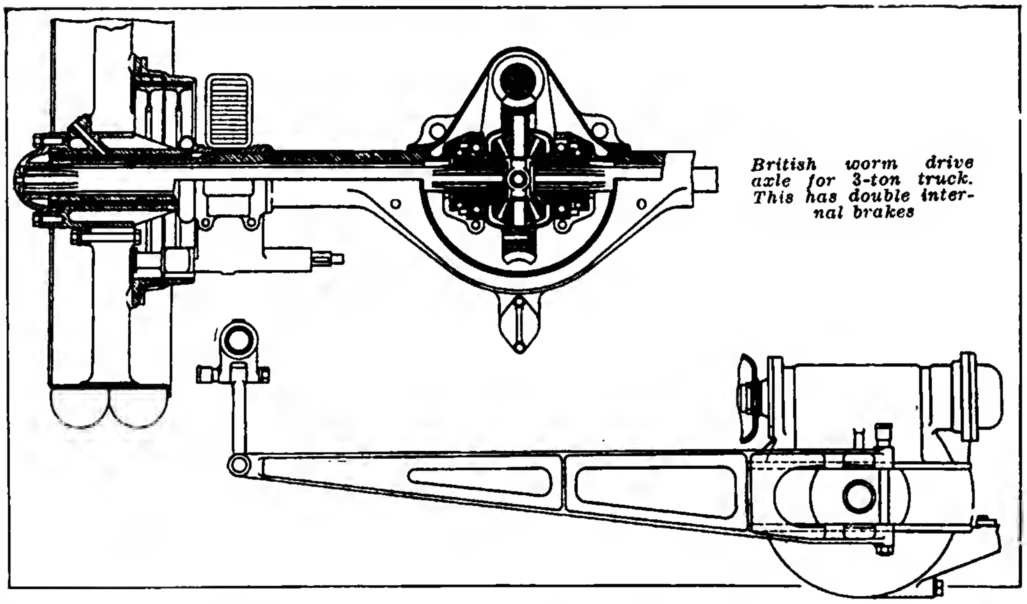
In considering the final drive, it must be remembered that a chain in those days was vastly inferior to the chain of to-day. The art of chain making was then in its infancy. The materials available were not of the same quality, and chain manufacturers were often unable to judge which was the best material to use, lacking almost all the experience they now possess. This situation created two schools of engineer: one adhered to the chain, improved it, devised cases and means for automatic lubrication; the other seeing that the chain run dry was in a way unsatisfactory, turned to some totally different types of mechanism; whereby the propeller shaft and live axle transmission was created. Once discovered, the live axle was cheaper than a chain drive with proper inclosure, and it required a little less attention, although the attention demanded by a properly protected chain is very small indeed.

Meanwhile, the commercial vehicle was developing. The earlier types, patterned upon the passenger car chassis, adopted the exposed chain drive. When the live axle was developed with the passenger machine, there were two things to prevent its adoption on a heavy vehicle; one was that it was impossible to house a bevel gear giving a sufficient reduction in an axle case of practical size, and the other was that the earlier live axles on passenger cars gave frequent trouble through lack of strength arising from the lack of experience of the designer.

Improvements in Chains

Chains all the time were being improved. The good chain or, alternatively, practical methods for inclosing the chain, arrived too late to compete seriously with the live axle for passenger cars. But they did not arrive too late to retard the development of live axles for commercial vehicles. In 1906, or thereabouts, chains were giving excellent service in commercial work, although they had been almost completely abandoned for passenger cars.

There is no question that a well-made chain running on well cut sprockets is an efficient method of transmitting power, and it is unfortunate from the chain viewpoint that a poorly-made chain on badly cut sprockets is still fairly efficient and will operate with moderate satisfaction. Had it been *essential* to make a chain well and mount it properly, had it been *impossible* to "get away" with a poor chain layout, this form of drive could never have been attacked on the score of noise or lack of durability when inclosed.

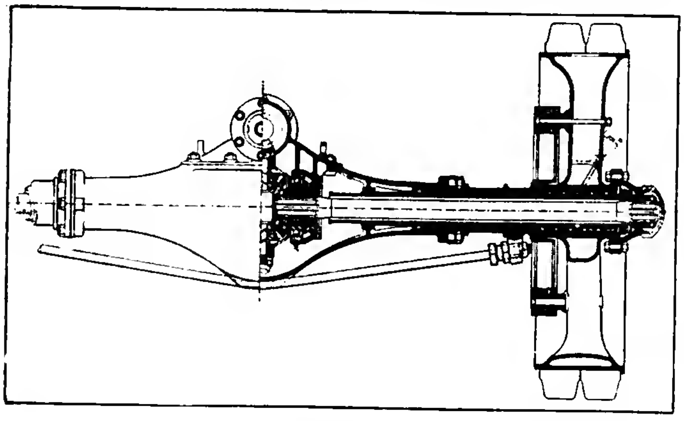


British worm drive axle for 3-ton truck. This has double internal brakes

The Internal Gear

The live axle took France and Germany by storm, so the French and German engineers turned at once to the development of something other than a chain drive when they started to make heavy vehicles. There is no need to recapitulate all the steps. Many different kinds of mechanism were tried, but the German Daimler company took up the already known principle of the internal gear drive and developed it so that it was very reliable. The same mistake was made as had been made with the chain, namely, the ring gear and pinion were run exposed and unprotected, so the transmission rapidly became noisy and it wore out with moderate rapidity. Still at that time the German Daimler company knew more about materials than any other automobile firm in the world, and for this reason their axle was able to give excellent service. It did not take long for other firms to see how greatly the Daimler axle could be improved by arranging for the inclosing and lubrication of the pinion and ring gear. The details have been worked out by many different firms in Europe and in America. There are all kinds of designs just as there are all kinds of automobiles. Some are elaborate, with the utmost regard paid to the perfection of every detail. Others are much simpler and sometimes less durable and less efficient.

Returning to the historical view, the noise created by the worn, unprotected Daimler axles had its effect in England and elsewhere. The British engineers preferred not to follow the lead of the continental men, that is to say, instead of taking the original Daimler axle and making the few necessary improvements, they commenced to evolve an entirely different sort of inclosed commercial vehicle axle. This produced a type rare in America but widely used in Europe to-day. This is the *double reduction axle* wherein a propellor shaft drives a bevel gear which operates a differential. This is mounted above the main driveshaft in an axle case, and from the differential the drive to the wheels passes through two pairs of spur gears, one on each side of the differential. The principle is another form of the internal gear, only instead of using pinions and a ring gear, two spur gears are used located in the center of the axle. The internal gear type has the weight carried on a dead axle and the power transmitted through a differential and driveshaft affixed to the dead axle. The double reduction type is essentially of live axle design, the weight being borne by the casing which incloses all the gearing.



A worm gear axle of British construction very like the London omnibus axle

The internal gear and the double reduction types of axle are alternative ways of doing precisely the same thing.

Taking some of the comparative points, the internal gear axle can be made to provide a somewhat greater road clearance at the center and probably, if the standard of engineering is equal, it should be a trifle lighter, owing to the fact that the rotating driving members turn at higher speed and therefore can be made smaller.

On the other hand, to take the question of brakes, it is immediately obvious that it is easier to accommodate wide internal brakes on the road wheels with a double reduction type of axle than with the internal gear drive, because of the space which must necessarily be occupied by the ring gear.

One could easily proceed along this line of analysis, going into very great detail, but sufficient has been said to show the choice between two forms is a question for the individual engineer. Some little thing in connection with the problem before him may cause him to decide in favor of one type more than the other. It may be that he requires an exceptional ground clearance or some other factor may be uppermost in his mind.

The Worm Gear Arrives

Nearly simultaneous with the above developments, we see the arrival of the worm gear. Owing to the noisiness of the early London omnibuses, both chain and internal gear driven, public clamor became so insistent that police regulations were adopted in which Scotland Yard was empowered to withdraw from service any omnibus which in the opinion of their inspectors was excessively noisy, requiring the car to be examined by their agents before again allowing it to run. Under these regulations enormous financial loss to the omnibus companies resulted owing to the difficulty of maintaining traffic. Matters finally reached so acute a point that any form of drive promising quietness was considered. One of the early English trucks, the Dennis, had for some years been worm driven and several of the omnibus companies replaced the final drive system on some of their omnibuses with Dennis worm drive axles. Whatever faults were dedeveloped that of noisiness, the most important of all, was eliminated and after trial the worm drive was adopted as the standard London omnibus final drive. Used by the omnibus companies, care naturally was taken in lubrication, gears were examined, bearings adjusted when necessary. Run under these conditions it soon became obvious that a worm drive would last for 30,000 or more miles, and it was argued that, despite the careful attention, bus service was particularly arduous in one respect, owing to the enormous amount of starting and stopping. Nearly simultaneously noise in the gearset was eliminated by means of a peculiar type of silent-chain jaw-clutch transmission. The modern London omnibus is thus a peculiar combination of all the elements wherein elimination of noise has been the dominating object.

With the enormous demand of the omnibus companies for ultra-quiet chassis, the British truck industry equipped itself to supply such vehicles and gradually developed the various peculiar elements to a high state of efficiency. It was, of course, natural that the same chassis should be utilized for freight haulage, especially since the road conditions in England do not demand the same ruggedness of chassis construction required in America.

Some Disadvantages

With the development of the worm for heavy passenger and freight haulage, it was quite natural that the silentness and smoothness of the worm should attract pleasure car designers and many British builders adopted the worm drive for their pleasure cars. The difficulty of obtaining clearance with the underslung worm and the necessity of placing an inconvenient tunnel in the floor boards of the rear seats with the overhung type, together with such engineering difficulties as were encountered by car builders improperly equipped to build good worm drives, caused some firms to return to bevel gears.

For reasons which need not be gone into here, the development in design of the commercial vehicle in America was much slower than its European development. The European truck industry was almost grown up when the American industry was in its infancy. Thus, at the time when the chain drive had given way to the internal gear in continental Europe, and to the worm or double reduction axle in England, it remained supreme in America. This means that when the American industry gave serious attention to the design of commercial vehicles, it found three distinct types of axles, each in a high state of development, from which to choose as an alternative to the chain, and, just as their European colleagues had done before them, the American engineers plunged for the new idea instead of taking the chain drive and giving it a proper chance by making it properly and applying it in accordance with correct principles.

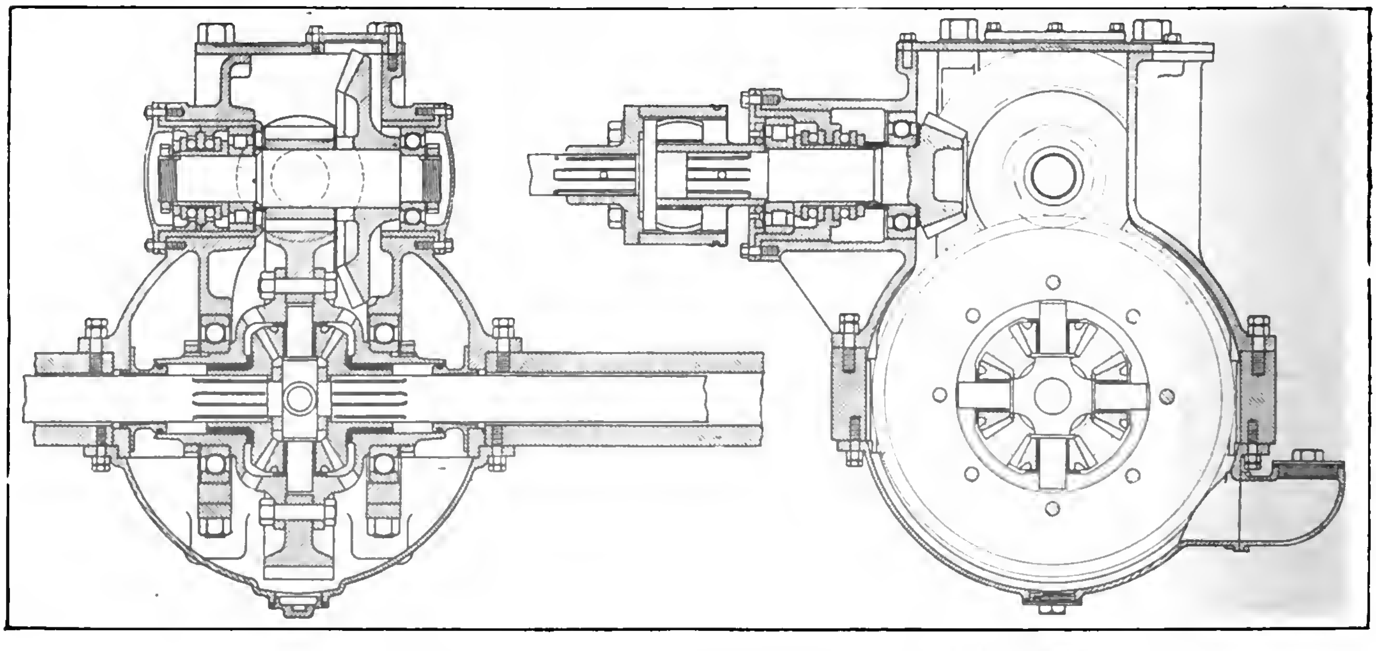
The Double-Reduction Axle

It is curious that the double-reduction axle is not used by more manufacturers in America to-day. Probably the explanation is psychological. Certain engineers thought they would be wisest if they were guided by the experiments of France or Germany, and studying their field, naturally it appeared that the internal gear drive was the predominant type. Others looked particularly to England, and these naturally received the impression that the worm gear or the double reduction axle was the best. Excellent arrangements were made by American firms with those who had developed the worm in England, so that, from the start of real activity in the commercial car field, American makers have been able to buy thoroughly good worm gears.

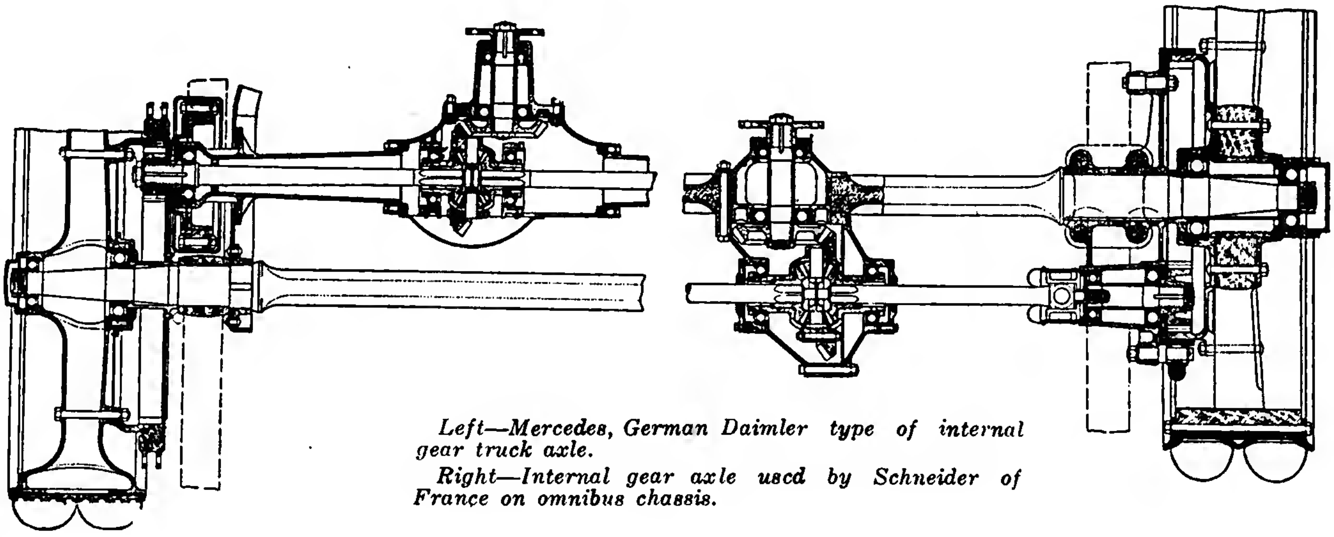
In this connection it is interesting to observe that the tendency in this country has been for the worm to be adopted for heavy vehicles and the internal gear axle for lighter types. The reason why the worm was taken up for the heavier machines when the point of discarding the chain had been reached was two-fold. Firstly, it so happened that the Pierce-Arrow company, owing to certain affiliations, was looking to *England* for the results of experience in commercial vehicles at that time. Secondly, it happened that the London omnibus was a 3-ton machine, so the enormous amount of data collected was a very direct value in applying the worm to a heavy truck.

Summing up: the worm axle has the advantages of permanent quietness, of oil bath lubrication for every part, and of every facility in brake application and design.

The introduction of the internal gear final drive unquestionably antedated the manufacture of commercial vehicles in the United States; thus it was the readiest idea to adopt at the time designers began to give serious thought to the problem of replacing the chain with shaft drive in truck use. Furthermore, live axles on passenger cars were still none too strong, and so the dead axle feature of the type was very attractive. It is also claimed with complete justification that



A typical British double reduction axle approved under the war subsidy scheme



Left—Mercedes, German Daimler type of internal gear truck axle.

Right—Internal gear axle used by Schneider of France on omnibus chassis.

ignorant adjustment or improper lubrication can do little harm to anything except easily renewable parts.

No Ultimate Form

The question as to what form of final drive will be eventually triumphant appears to be unimportant, since it will be settled by the law of supply and demand. Supply and demand for certain specialized qualities, i. e., quietness, brought the worm gear into existence as a factor in truck construction via the London omnibus. The law of supply and demand for other qualities brought the internal gear axle for light trucks on the American market—elimination of chain troubles. When, and as long as, worm axles and internal gear axles can be produced at about the same price, they will both continue in existence.

It is far from improbable that we shall see the introduction of the double-reduction design to America, for it has special points to recommend it. *None of the three types was chosen or will be chosen for its theoretical perfection.* Each came into existence because it seemed to certain engineers to be the best way of answering certain conditions and these conditions varied a little with the locality. They were different in England from what they were in Germany; different in America from what they are in Europe.

Thus, in the final analysis, it is well to remember that all engineering is a compromise. If it were possible to incorporate *all* the advantages of any unit in *one* special construction, it would be foolish for engineers to consider any other type whatever.

It is no more likely there will be a single, ultimate form of final drive than that there will be a single, ultimate design of engine.

Time-Saving in Assembling Chalmers Wheels

IN a factory that moves at top speed in every department, efficiency experts find that it pays to accelerate on the small jobs.

At the factory of the Chalmers Motor Co., Detroit, Mich., the method of placing the rims and tires on the wheels is an admirable illustration of time-saving. Four men in this department assemble wheels, tires and rims for an output running over 125 cars per day, everything possible being done to expedite the work and to make things convenient for the men performing it.

Separate racks contain the rims, wheels and tires with deflated tubes. The man at the left of the illustration operates a device which springs the rim open so that the tire can be placed in position. He then locks the rim and passes the job on to the next man. The tire is inflated and again passes to another man who places the rim on the wheel. The nuts holding the demountable rims in position are put on with the aid of a compressed-air wrench.

Industrial Preparedness

Howard Coffin Tells S. A. E. Reasons for Scheme—Part to Be Played by Automobile Industry Has Huge Importance

INDIANAPOLIS, IND., May 29—One of the most impressive of the race-time functions at Indianapolis was the preparedness dinner given by the Indiana section of the Society of Automobile Engineers at the Claypool Hotel Monday night. Howard Coffin, chairman of the Committee on Industrial Preparedness, a sub-division of the Naval Consulting Board, was the principal speaker.

The meeting was presided over by F. E. Moscovics, chairman of the Indiana section of the S. A. E.

S. A. E. to Have Important Rôle

Probably of the greatest interest to the automobile industry was the explanation by Mr. Coffin of why the Society of Automobile Engineers was not invited to join actively in the work of the industrial committee. He explained that this was due to the much more intimate part that the S. A. E. would be called upon to perform in handling the questions of motor transportation, which are of the first magnitude under present conditions of warfare. He stated that under pending legislation, particularly the Chamberlain bill, it is very well possible that the members of the S. A. E. will be organized into a highly-efficient transport group which will take care of the movements of motor trucks and passenger cars in army service.

Mr. Coffin's speech follows in part:

I have been asked to talk to you about preparedness, but I am going to deal with a kind of preparedness about which we have heard little. To most of us the word brings visions of marching soldiers and of battle-ships in fighting trim. We are all of us thrilled by sound of drum and fife, and interested in the saber-clanking kind of preparedness. This sort of thing appeals to our imagination and is in line with all the war stories we have read since we were children.

It is a matter of our common knowledge that we are not a militaristic nation. Saber-clanking is not in our line and never will be for any great length of time. It should be clear to us, therefore, that if we are to adopt any policy of preparedness—and expect it to be a consistent policy which can be maintained through the years of peace, as it must be if we are ever to be fitted to defend this country when war threatens—that policy must be one in keeping with the traditions and ideals of this nation.

It is this kind of preparedness about which I wish to talk to you. This *industrial preparedness is basic preparedness.* Two years of observation of the European war has taught us organized industry is the foundation upon which we must rest any and every plan for our military preparedness for defense.

Between 80 and 90 per cent of the manufacturing and producing resources of the European countries are engaged in the making of supplies for their armies. In the event that we are so unfortunate as to become involved in an argument with any first-class foreign power, an equal percentage of our manufacturing equipment will be needed in this same service.

Industrial preparedness is strictly in keeping with the natural tendencies and abilities of our people. It is the

Preparedness dinner given by the Indiana section of the S. A. E. at the Hotel Claypool in Indianapolis on May 29 cheapest form of preparedness. We already have the investments in plants, in tools, in machinery—and more important still, our investment in skilled workers. A soldier may be made in a year—it takes many years to make a toolmaker.

As I have said, we have all this equipment in our hands—but it is unorganized and uneducated for national services. All of us in this audience know that we cannot expect any big manufacturing plant to change over in less than one year's time from its usual commercial line, to a product with which its manufacturing departments have had no previous experience. And yet that is exactly what at least 80 per cent of our plants would be called upon to do in case of a real war.

In England the situation should be of particular interest to us for two reasons: Firstly her traditions, conditions and governmental methods are more nearly parallel our own. Secondly her policies—again probably paralleling our own under similar conditions—afford us a glaring example of what best not to do.

No record of skilled labor was available—and thousands upon thousands of skilled workers have been wasted at the front who would have been worth their weight in gold in the factories at home.

In the meanwhile some interesting things were happening in Germany. I cannot better illustrate than by quoting a true story told me by an eye witness. There is one big manufacturing plant in Germany well known to you all. A telegram announcing the declaration of war was received at 2 o'clock in the afternoon.

Bells rang throughout the plant and the men past their pay windows, receiving slips of paper which carried their instructions. One per cent of them left the plant at once on the way to their concentration points; others proceeded to the storerooms in which were kept the gages, jigs and tools for use in the production of that material of war for which that great plant, through careful prearrangement, was to be held responsible. Others of the workmen left at once to report as experts in matters of ignition on aeroplanes and motor vehicles.

The machinery scarcely even stopped. A few hours at most in shifting jigs and changing setups and the change from the commercial product to the war product had been made.

Here, in this simple story we find the meat of true preparedness. In this story we have illustrated the kind of preparedness which really appeals to us as of practical utility.

The United States has manufacturing facilities twice as great as those of any other nation. None can compete with us in this respect. It is this vast industrial resource that the Naval Consulting Board seeks to develop. This is a non-partisan body and among its sub-committees is that on industrial preparedness. This committee has spread beyond the confines of its original scope and, realizing the importance of industry in war, has set about to organize it so that it will be available instantly in time of need.

Mr. Coffin mentioned several striking examples of unpreparedness among the nations and contrasted them with conditions that existed in Germany just before the opening of the war. He stated that Germany had sixty thousand machine guns before the war. At the rate of manufacture in England after the war had run 6 months it would have taken 30 years to catch up with Germany, even neglecting the daily output in that country.

Example after example showing the astonishingly sudden change to chaotic conditions in our own and other nations after the opening of the war were mentioned by Mr. Coffin. He told how concerns were forced into bankruptcy due to rejected munitions and misfit parts.

The great work of the industrial preparedness committee in listing the different manufacturing concerns and determining just what work each would be fitted to do was one of the important parts of Mr. Coffin's talk. Every plant that has tool equipment is included in this and the scope of the plan covers every industry, every machine and every man as well as the plant itself. Those plants which do not fall into the scheme would be stripped of men in time of war.

In pointing out the great necessity of the assistance of the S. A. E., Mr. Coffin mentioned that in the United States in January, 1916, there were 2,400,000 cars as compared to 800,000 in the rest of the world. In this connection he also spoke of the immense value of the proposed road system on which $150,000,000 will be spent in the next five years.

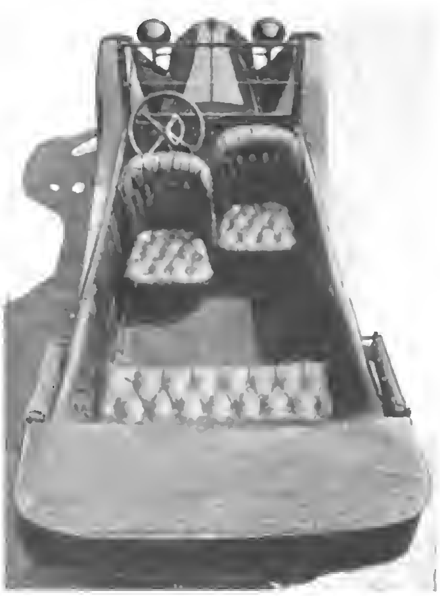
A brief review of the pending acts in the Legislature was given by Mr. Coffin, who announced himself as favoring very strongly the Chamberlain bill, which goes deeply into the measure of preparedness and clears the way for several steps which have heretofore been impossible on account of adverse laws. He stated that he believed this bill would become a law within 30 days. The creation of a $20,000,000 nitrate plant was also touched upon as an immediate need. The aim of the entire movement is to place the industries of this country upon a footing where they will be able to shift from a peace to a war basis without confusion in 30 days.

About 350 engineers and members of the industry and important clubs attended, and Mr. Coffin's speech was applauded with intense enthusiasm by the audience that had spent nearly 2 hr. in close attention.

Formula for Making Curing Acid

Nearly all repairmen will be interested in knowing the formula for making curing acid, as it is often inconvenient to have to obtain this acid from the manufacturers of the repair materials. The formula is as follows, according to directions given by the Goodyear Tire & Rubber Co., Akron, Ohio: Add 1.7 fluid oz. (5 centilitres) of sulphur chloride (S_2CL_2) to 1 gal. (3.79 liters) of carbon tetrachloride (CCL_4).

Studebaker Fits Flexible Seating



As an indication of what can be done in the way of pleasing and useful body construction even where a large output is the rule, the Studebaker body with its individual and movable front seats which is being fitted to the four- and six-cylinder chassis made by the Studebaker Corp. stands out strongly. It is surprising how useful such an arrangement is, for not only can each front passenger enjoy extreme riding comfort but the car may be utilized in a very sociable way by lifting these seats from their sockets in the car floor and turning them around. This feature lends itself admirably to picnics and camping expeditions, for the chairs can also be made to do duty on the ground as well. Not only are the seats removable, but they are adjustable as to leg room by moving them forward or back within a wide range.

Four-Cycle Engine—Two-Stroke Effect

Novel Design Gives Impulse Every Down Stroke in Each Cylinder—Piston Valves Employed

THERE have been very few attempts to design gasoline engines which will give an impulse every revolution in each cylinder, excepting two-stroke motors. The Strickland engine is a novel effort in this direction and possesses several points of interest. The system is explained almost completely by the illustrations.

First, there is a two-diameter piston, and the cylinder has the usual combustion space at the top. Midway of the cylinder length there is an annular space left when the piston is at the top dead center, and this forms a secondary combustion chamber. The idea is somewhat similar to the two-cycle wherein the lower part of the piston is used as a pump, but in this case both upper and lower parts are working pistons.

The action is as follows: As the piston descends under the impulse of a charge in the upper combustion chamber the lower part of the piston is drawing in gas from the carbureter.

On the reversal at the bottom of the stroke the upper piston commences its exhaust stroke and the lower part rises on the compression stroke.

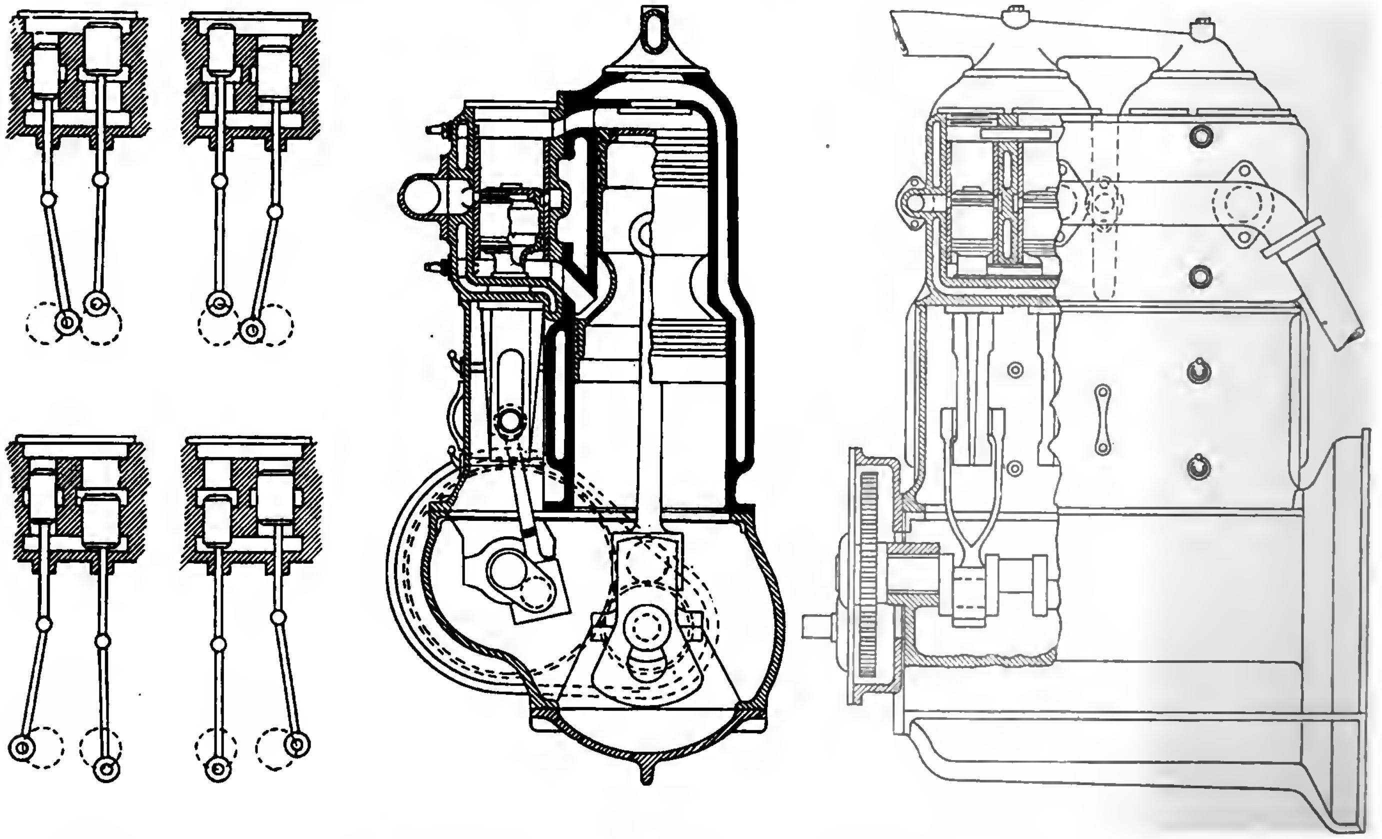
In the next stroke firing and expansion take place in the lower part and intake on the upper piston.

For the last stroke the upper part is compressing while the lower is exhausting.

Obviously it would need somewhat complicated mechanism to control the intake and exhaust with poppet valves, as two separate sets would be required, so the inventor has very ingeniously arranged a single pair of double-acting piston valves to control both the upper and the lower cycles. These are shown on the left of the engine in the illustration. Intake and exhaust take place through the two ports shown in the middle of each valve piston stroke. When the piston controlling the exhaust or intake is at the bottom of its stroke it uncovers the port so as to connect it with the upper combustion space. When the valve piston is at the top of a stroke, the same middle port is put into communication with the lower combustion space. There is a second crankshaft for operating the valves, this being driven by gear from the main crankshaft.

The exhaust parts are large enough to let off exhaust pressure quickly by the number of ports inserted in the circumference of the bushing. The inlet bushing has a lesser number of ports which are narrow and long and are gradually opened up in area as the main piston approaches the middle of the suction stroke, at which point occurs the greatest inrush of mixture.

During the exhaust stroke of the upper piston area the crank of the exhaust valve is moving across the lower dead center, during the suction stroke the exhaust piston is traveling upward in the bushing, during the compression stroke the crank of the exhaust valve is traveling across the upper dead center, and during the explosion stroke the exhaust valve or piston is traveling down a little in advance of the main piston.



Strickland double-acting, four-stroke engine. The successive positions of the two piston valves which control both the upper and lower combustion spaces are shown at the left to let the charge off before this piston arrives at the lower end of the stroke.

In like manner the inlet valve, which is adjacent to the exhaust, is going through similar operations in relation to the intake stroke of the main piston.

As the cycles of operation are plainly set forth in the diagram it is also seen and understood that each piston valve is alternately supplying and exhausting gas to the upper and lower area from the common inlet and exhaust passage or port located between the combustion chamber at the middle of the bushing.

The inlet valve is at the farthest point of travel during the explosion, thereby bringing all the rings on it into action to guard against leakage to the supply chamber.

The inlet valve and the main piston are also guarded against leakage to the opposite side by a vented groove between the inner set of rings.

The inventor lays particular stress on two points in connection with his design. The first is that the effect of the piston valves is to extend the indicator diagram, thus making for increased thermal efficiency. The reason for this is that the piston valves are near the top of their stroke during suction and descend during the firing stroke (and *vice versa* for the lower combustion space), thus having the effect of making the cylinder bigger during the expansion stroke than it is during the suction stroke. This follows the principle of the Atkinson cycle.

The other claim is, of course, that the space occupied is much smaller for a given power output than for a four-stroke engine of equivalent power. According to the drawings made for the two-cylinder design, the length is 0.7 the length of a four-cylinder engine of conventional design with equivalent piston displacement.

The inventor also points out that the weight of the double pistons is not excessive. Allowing for the weight of the connecting-rods, it is claimed that the compound pistons with their two rods weigh 35 per cent less than four pistons and four rods to give equivalent power with single action.

Testing for the Flash Point of Oils

THE Flash Point of Oils is the title of technical paper 49 of Petroleum Technology 10 issued by the Department of the Interior, Bureau of Mines, Washington, D. C. The paper goes into a consideration of the different methods of testing for flash point and in the conclusions makes the following statement:

Two Accurate Testers

"The most accurate tester and the tester that most nearly reproduces actual working conditions should be adopted for official tests. If all of the above factors be considered, it is believed that these two testers, the Abel-Pensky and the Pensky-Martens, as modified by the Bureau of Mines most nearly meet the desired conditions.

"The Bureau of Mines flash testers have been officially adopted by the National Fire Protection Assn. and the Independent Petroleum Marketers' Assn. of the United States.

The important factors to be considered in the construction and manipulation of an instrument for determining the flash point of an oil may be cited as follows:

1—The conditions under which the test vapors are generated should be as like as possible for the conditions found in practice.

2—Corrections should be made for variations from the normal barometric pressure.

3—The shape and dimensions of the cup should be definite.

4—The size, shape, depth of immersion and exposed part of the thermometer should be definite and the thermometer should always be calibrated. The thermometer should be calibrated when immersed to the collar, 60 mm. from its lower end.

5—The oil should never be exposed for any length of time at temperatures greatly higher or lower than the normal temperature.

6—The rate of heating on testing should be constant and at the rate of about 1 deg. C. per minute for lamp oils and 3 deg. to 5 deg. C. per minute for oils with a high flash point.

7—The oil being tested should be uniformly stirred during the test.

8—The test flame should be of definite size; it should be exposed at a fixed distance above the surface of the oil and for a definite length of time.

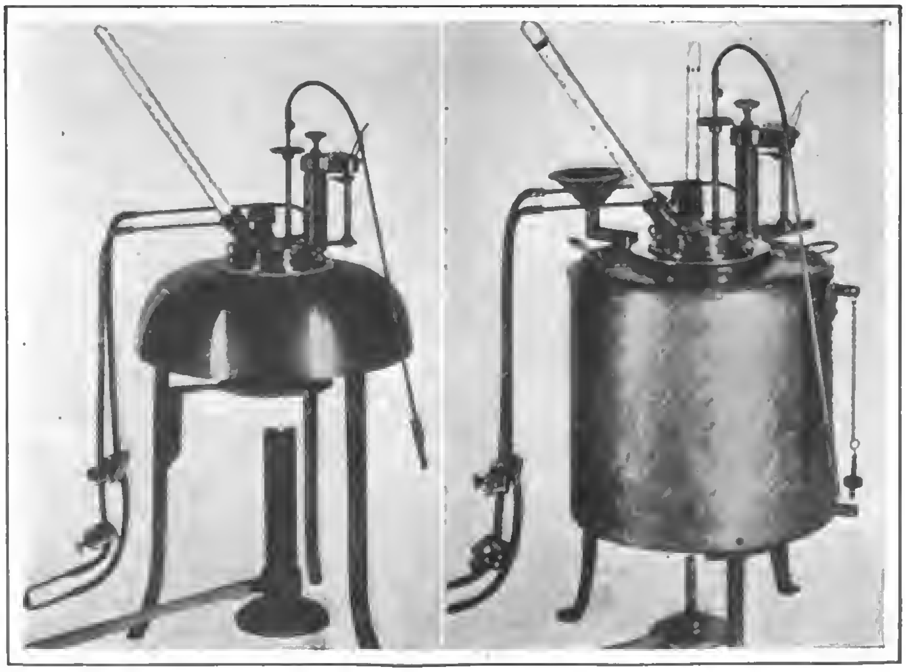
9—All water should be removed from the oil prior to testing.

10—In general testing, so far as possible, the personal equation of operators should be eliminated, and the manipulation of the tester made entirely mechanical and automatic.

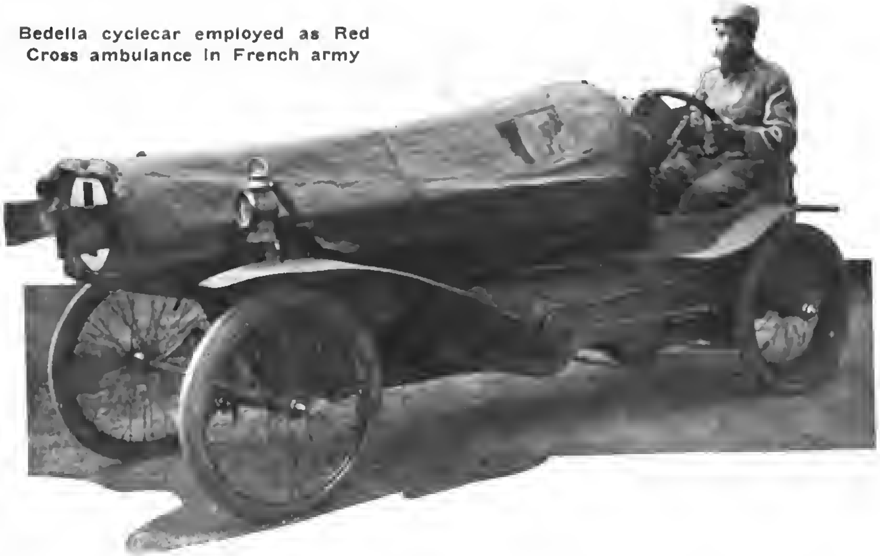
The booklet goes into an analysis of the different kinds of testing instruments, showing the defects of each classification and the manner in which tests should be made in each.

No attempt has been made in this paper to place a relative value on any of the conditions determining a fire hazard but the paper does describe attempts to definitely establish a method of determining a particular thing—the flashpoint —as one factor in the conditions governing the danger.

A requirement that an oil shall have the highest practicable flashpoint, as such a requirement tends to reduce the fire hazard to a minimum and is praiseworthy and humane. But to require too high a flashpoint may, in the case of a lamp oil, impair the burning qualities of the oil and also work a hardship on the refiner.



Abel-Pensky and the Pensky-Martens testers as modified by the Bureau of Mines



Bedelia cyclecar employed as Red Cross ambulance in French army

Cyclecars for Ambulances

Bedelias Reach Inaccessible Places—Propose Taylor System for Munitions Works

PARIS, May 5—Cyclecars are now being made use of in the French army as an auxiliary to the Red Cross service. The regulation automobile ambulance carrying four men lying are unable, owing to their size and weight, to get close to the first aid dressing stations. Thus wounded men have to be first brought to the rear on stretchers before they can be placed in the automobile ambulances. Experiments which have been carried out in the Soissons district with Bedelia twin-cylinder air-cooled cyclecars show that these machines can travel as far forward as the stretcher men can penetrate, and that they can bring wounded cases back much quicker than it is possible to do it by hand. As there is no fear of a machine getting into a position from which it cannot be extricated by a few willing helpers, the driver of a cyclecar does not hesitate to go forward where a motor ambulance driver would hold back.

One Man Carried

The machines are twin tandem seaters, with the motor in front and the driver at the rear. Only one wounded man is carried at a time. The stretcher is placed on the top of the body and attached to it by coil springs, so as to give additional comfort, the wounded man having his head toward the rear and his feet over the motor. When weather conditions require, he can be completely covered with a canvas top mounted on a rigid frame.

In the Vosges mountain district motorcycles and sidecars are made use of for bringing in wounded men from places inaccessible to the big automobile ambulances. On these mountain passes it is often necessary to travel over mule tracks where there is not sufficient width for an automobile and where the soft earth would not carry their weight. The motorcycles do this work efficiently. Although not an easy matter, means have been found to place a stretcher on the side car so as to handle serious cases.

To Increase Outputs

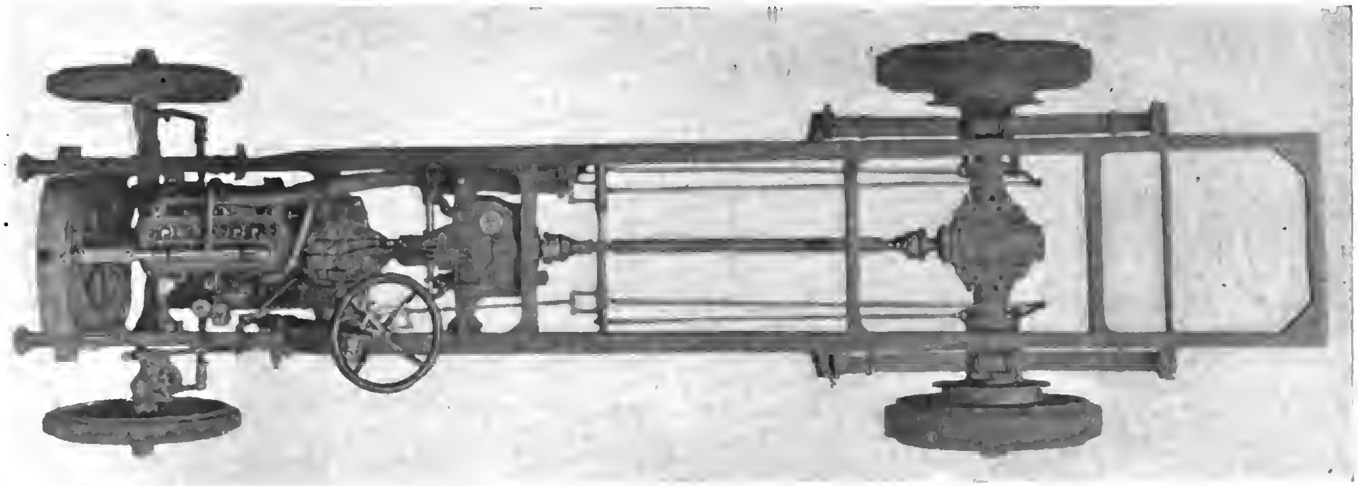
With a view to an increase of the output of all munition factories, the French artillery and munitions department has issued a circular showing how improvements can be made. These suggested reforms interest the automobile industry, for all the automobile factories of France are occupied on war material.

It is suggested that the Taylor system should be adopted as extensively as possible. This system is well known to French automobile manufacturers; when first attempts were made to adopt it, a few years ago, it met with opposition from the workers. Arrangements are now being made to place foreign labor at the disposal of the factories. It is suggested that this should be taken advantage of as fully as possible and that female labor should be employed. In certain special cases where new contracts are being given in France, one of the clauses is that no native labor shall be employed. No source of labor must be neglected, and every effort must be made to see that each man is doing the work for which he is best suited. If a man with military obligations cannot be employed to the best of his powers, he should be returned for active service in the army.

No automobile factories were able to produce forged shells until the war had been in progress for a considerable time. The installation of underground trolleys, endless traveling bands and light automobiles for moving shells from one part of the building to another, is also recommended as a saving of labor. In a large number of factories apprenticeship classes have been formed. While it is not expected that these will turn out highly skilled workers, the movement is to be recommended.

Above—Bringing in a wounded soldier on a cyclecar ambulance
Below—Showing control and driver's seat. Note belt drive

Kissel Brings Out New Two-Tonner



Plan of Kissel Two-Tonner chassis, showing the simplicity of the design and the substantial character of the various units

New Model Has a Four-Cylinder Block Motor 4¼ by 5½—Four-Speed Gearbox and Worm Drive Features

THE Kissel Two-Tonner recently announced by the Kissel Motor Car Co., Hartford, Wis., incorporates a number of improvements in design and construction over the preceding model of the same capacity, and the chassis sells for $1,875, or a reduction of $235. Specifications of the new model follow closely those of the previous 2-ton machine, the truck being a worm-drive, left-steer machine.

36.75 Hp. at 1200 R p.m.

A four-cylinder block cast motor of 4¼ in. bore and 5½ in. stroke and built in the Kissel factory is used, and is claimed to develop a brake test horsepower of 36.75 at 1200 r.p.m. The formula rating is 28.9 hp. The power plant drives through a leather-faced cone clutch, fitted with adjustable springs to insure gradual engagement with the flywheel, a four-speed selective gearbox, double Spicer universal and shaft to the worm and wheel rear axle.

The gray iron crankcase casting is divided on a line 2 in. below the crankshaft center, and is designed to insure great resistance to strains of all kinds. The crankshaft is drop-forged from 40 per cent carbon steel, and is suspended in three bearings constructed of babbitt poured into a steel skeleton. The camshaft, also suspended in reinforced babbitt bearings, is an integral forging. Wristpins are of 1⅛ in. diameter and are made of Shelby steel tubing, hardened and ground, working in Non-Gran bearings in the connecting-rods.

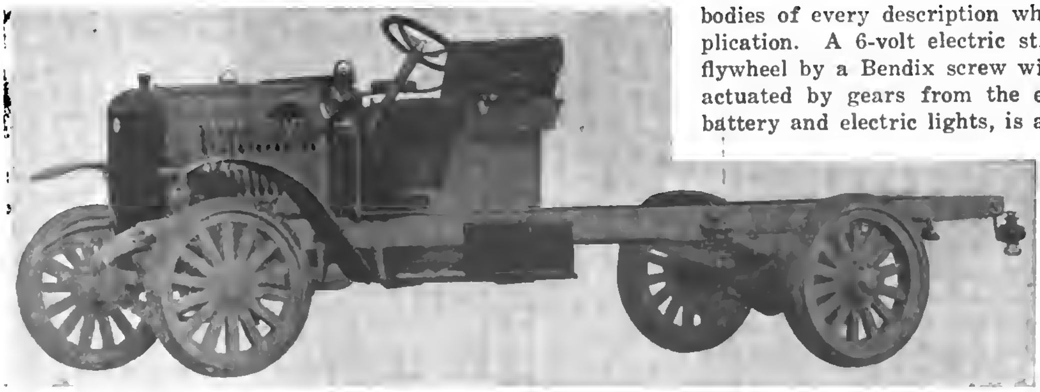
The motor is oiled by a splash system in combination with a positive action gear pump which forces oil through tubes to troughs under each of the connecting-rods. The carbureter is manufactured in accordance with Kissel design by Stromberg, and receives fuel from a Stewart-Warner vacuum tank which is attached to the motor.

The radiator is of the square tube type hung in a spring-suspended cradle designed to prevent weave and vibration on the radiator when traveling over rough roads. Cooling is by centrifugal pump circulation, with a water capacity of 5 gal. Maximum speeds are automatically regulated by a governor on the motor, which allows a maximum engine speed of 1295 r.p.m., permitting the truck to travel 14 m.p.h. on direct drive, 16 on fourth, 8 on second, and 4 on low. The wheelbase is 144 in. and the sizes of the solid rubber tires in the standard equipment are 34 by 3½ in. front and 36 by 6 in. rear.

The frame is of pressed steel 6 in. deep, ¼ in. gage, 34 in. wide and is suspended on semi-elliptical alloy steel springs measuring 38 by 2½ in. front and 54 by 3 rear.

Timken axles are used, the rear axle being floating with worm drive inclosed in a steel-cast housing. A turning radius of 25 ft. is obtained.

A standard stake body, painted Kissel blue with black chassis is furnished for $150 additional, or special bodies with increased wheelbase or length of frame upon specification. The factory has on file drawings and prices for special bodies of every description which may be secured upon application. A 6-volt electric starting motor driven from the flywheel by a Bendix screw with a 6-volt lighting generator actuated by gears from the engine, complete with storage battery and electric lights, is also offered at $150 additional.



The new Kissel Two-Tonner chassis selling for $1,875. Standard equipment includes two oil lamps, tail lamp, horn, jack, complete set of tools and steel channel bumper. Stake body is $150 extra

Adjustable Fulcrum for Cantilever Springs

Theory and Practical Solution for Springs of Variable Flexibility from the Point of View Rejecting Automatic Adjustment

DESIGN, construction and theory of the North system for varying the flexibility of cantilever springs are set forth and discussed in *The Automobile Engineer* for May, the views which led North to work out the system being first explained. With reference to practical results it is the reviewer's total impression that the subject which is here debated may be formulated in two simple questions: (1) If the anchored end of a cantilever spring is 30 inches long and the axle end is 24 inches long, or in similar proportions, can a considerable change in the flexibility of such a spring be effected by an adjustment which makes the anchored end 24 inches long and the free end 30 inches long, and will there be any unacceptable stresses due to adjustment for maximum flexibility? (2) Is the proposed mechanical arrangement for effecting such an adjustment adequate and acceptable?

The main points in the presentation of the subject are given in the following:

Objects and Requirements of the Construction

While the need for adjustability of the suspension is not great in large and heavy cars, where the load variation is relatively small, the increase of average comfort which results from adjustability of the suspension is very great in light touring cars, which may weigh only one ton and may carry loads varying from 200 to 1500 pounds.

It is useful to have an adjustment of sufficient range to cover the variation in weight of different styles of body mounted upon the same kind of chassis, and such an adjustment also meets the requirements for a vehicle which is used as a sporting car in the country, in which case stiffer springs than standard are needed, and also as a town car, for which purpose a very flexible springing is more suitable.

An adjustable spring should not weigh more than a non-adjustable spring of a capacity equal to its maximum. This is important to keep the total weight of the car down and practically excludes any device which stiffens a spring by clamping a portion of it down. Such a spring must either be very heavy or else it is overstressed when the work is severe. Similarly, it should be impossible to overstress material by incorrect adjustment.

Against Automatic Adjustment

Experience has shown, and theoretical considerations also indicate, that a spring which automatically becomes stiffer when the load is increased is not on the average as comfortable to ride on as the ordinary type. For instance, if the dead load deflection of a spring is 4½ inches, this may be momentarily increased to 7 inches or reduced to 2½ inches at high speeds. With a progressively-resisting spring, such a deflection of 7 inches would be reduced while the rebound would be increased, and the comfort would be lessened, the spring being evidently incapable of differentiating between an addition to the dead load and a brickbat lying in the track of the wheels.

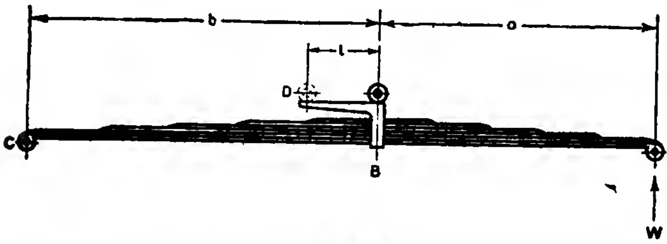


Fig. 1—Diagram of North cantilever spring with adjustable fulcrum

The following passage is quoted verbatim:

"For certain classes of vehicles in which the variations in loading are frequent and extreme, and where the driver cannot be expected to be continually adjusting the suspension, a 'compound' spring is of real advantage. Heavy motor lorries running on solid tyres form the best example of this class. The springs on a lorry have to absorb a great many of the small shocks set up by minor road inequalities, but in the case of a pleasure car these are smoothed out by the pneumatic tyres. These small shocks, causing small displacements of the axles, can be efficiently dealt with by a 'compound' spring, as the stiffness is approximately constant for movements of limited amplitude. At the same time it must be distinctly understood that even on a motor lorry a 'compound' spring will not give such smooth running as an ordinary spring of the correct stiffness for the particular load that happens to be on the vehicle at the time."

[These passages give the usually accepted argument against springs having a decreasing rate of flexibility with increasing deflection, and therefore the main argument for electing to vary the flexibility by adjustment. It may be shown, however, that this argument loses in force if suitable rebound checks are employed and the range of action for the spring is fairly ample. This opposite view, on the subject of springs with variable flexibility, will be briefly presented and illustrated another week.—M. C. K.]

The North adjustable cantilever spring has a uniform stiffness over the whole range of its deflection with a given setting. By a simple operation, taking a few seconds only, the stiffness can be altered to any desired degree within the limits provided for; and these can be for touring cars 1.8 to 1 or even 2 to 1.

The mathematical demonstration runs as follows, comment by the reviewer being inserted in brackets:

For a spring having a given number of leaves of equal thickness and stepped off evenly to the ends, the deflection of one end under a given load applied at the end is proportional to the cube of its length, therefore denoting the length *AB* by a and length *BC* by b; and, assuming that the deflection of the portion *AB* under a load W applied at *A* is x, then the deflection of the portion *BC* under a load W applied at *C* would be $x \left(\frac{b}{a}\right)^3$. It will be observed that we are now considering the spring as two separate portions, and this must be borne in mind throughout. Any alteration in the position of the fulcrum makes no difference to the deflection under load of the portion *AB*.

[This assumption seems unsafe. The portion *AB* does not exist separately when the fulcrum is moved from vertically above *B* toward *D*. The arrangement provides a new mechanical condition in which the fact that a point directly above *B* WAS a fulcrum is of no consequence. Also, to CONSIDER the spring as two separate portions does not justify mathematical deductions for a spring that IS NOT in two separate portions. Further, as is done in the rest of the demonstration, to figure the reaction at *C* from the load-action at *A*, calculate the deflection which this reaction WOULD cause at *C* if *C* could move (downward), and then from this supposed deflection assume that the bending movement of *CB* which is possible MUST cause such an additional deflection at *A* as would be caused if the deflection of *C* were real, does not seem like self-evident mathematical reasoning (though it

When the adjustment is set for the heaviest load, the fulcrum is on the center line of the clip, and the behavior is that of an ordinary cantilever spring. The thickness, width and number of leaves are calculated for this position, and the maximum stress for any other setting cannot exceed the maximum calculated for the "stiff" position. The requirement is therefore met that the spring shall be no heavier than a non-adjustable spring for the same maximum load.

By providing bumpers, the second requirement is met; namely, that the spring cannot be overstressed by incorrect adjustment.

Below there is given a mathematical investigation of the properties of the system, the latter being represented diagrammatically in Fig. 1. The width of the clip is, however, disregarded, this causing an error of 1½ to 2 per cent only for a clip of small width, as shown, and springs of the preferred length.

Most Suitable Length of Springs

With regard to the length of the spring and the relative lengths of its two portions, it is noted that so long as the proportions in these dimensions are the same the variations produced by adjustment will be identical. In the example calculated below, AB is 24 inches and BC 30, and a displacement of the fulcrum of 6 inches gives an increase of deflection of 80 per cent. Similarly a displacement of the fulcrum of 3 inches would give 80 per cent of variation in flexibility if AB were 12 inches long and BC 15 inches long. Such a shorter spring could be made to do the same work as the longer one, but would have thinner leaves and a great many more of them, since the weight of the short spring would have to be the same as for a longer one (to do the same work without increased fiber stress) and, the leaves being so thin, the spring eyes would be weak and liable to fracture. Moreover, it is more expensive to work up, say, 20 thin and short leaves than 5 leaves twice as thick and long and of the same width. Other objections to very short springs are that, for the same initial camber, the curvature of the short spring when unloaded must be much sharper, and the horizontal displacement of the rear eye, as it is deflected, is much greater. This means a larger angular movement and wear of pins and bushes as well as troubles in using the springs for taking braking or driving thrusts. Particularly for an adjustable spring there is an objection to the very short springs in that the fulcrum would be situated in an inaccessible position behind the wheel.

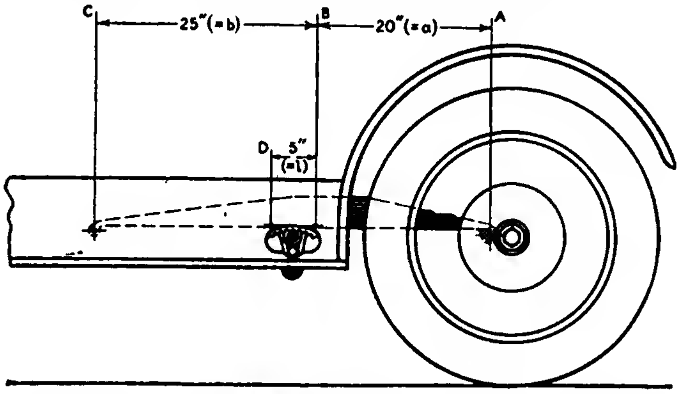


Fig. 2—General arrangement of construction shown in Figs. 3 and 4

The main objection to very long springs is that the displacement of the fulcrum for a given variation in stiffness would be increased, making the adjustment device heavy and clumsy. On general grounds, a very low spring is either unnecessarily heavy or must consist of a few thick leaves.

As small cars do not require much shorter springs than a large car, if equal deflections and equal comfort are to be obtained, the proportions of the adjustment device can be almost alike for all.

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may be approximately correct in practice), but is on the contrary a fine example of *petitio principii*, or reasoning in a circle, against which all logicians and authorities on mathematics have warned us.]

A load W applied at A causes a deflection x of the portion AB. When the fulcrum is at B, the load W at A sets up a vertical reaction at C equal to $W\frac{AB}{BC}$ or $W\frac{a}{b}$.

The deflection of the portion BC under this reaction is

$$\frac{W\frac{a}{b}}{W}\cdot x\left(\frac{b}{a}\right)^3=\frac{a}{b}\cdot x\left(\frac{b}{a}\right)^3=x\left(\frac{b}{a}\right)^2$$

Now, the deflection of the portion CB does not manifest itself as an upward movement of point C, but as an angular displacement of the clip round the fulcrum at B.

This causes an upward displacement of point A additional to that caused by the deflection of the portion AB.

The upward displacement of A due to deflection of portion CB is [objected to, above]:

$$\text{(deflection of } CB \text{ at } C)\ x\frac{a}{b}=x\left(\frac{b}{a}\right)^2\cdot\frac{a}{b}=x\frac{b}{a}.$$

The total deflection of the spring for a load W applied at A is therefore:

$$x+x\frac{b}{a}=x\left(1+\frac{b}{a}\right)$$

Behavior of Spring Adjusted to Higher Flexibility

Let D indicate the new position of the fulcrum (Fig. 1), and let this point be at a distance l from B.

Then for a load W applied at A the deflection of the portion AB is the same as before [objected to, above], *i.e.* $= x$.

But the reaction at C is changed owing to the altered position of the fulcrum. Taking moments about the new fulcrum point [which, however is a new kind of fulcrum, when flexions of the beam are the main consideration] we get:

$$\text{Reaction at } C=W\frac{AD}{DC}=W\frac{a+l}{b-l}$$

Hence the deflection of portion CB measured at C will be

$$\frac{W\frac{a+l}{b-l}}{W}\cdot x\left(\frac{b}{a}\right)^3=x\frac{a+l}{b-l}\cdot\left(\frac{b}{a}\right)^3$$

And the upward displacement of A due to deflection of portion CB

$$=x\frac{a+l}{b-l}\cdot\left(\frac{b}{a}\right)^3\cdot\frac{a+l}{b-l}$$

And total deflection of spring

$$=x\left(1+\frac{(a+l)^2}{(b-l)^2}\left(\frac{b}{a}\right)^3\right)$$

And the ratio of the deflections for the two settings

$$=\frac{1+\frac{b}{a}}{1+\frac{(a+l)^2}{(b-l)^2}\cdot\left(\frac{b}{a}\right)^3}$$

Example in Figures

Taking an actual example, let us suppose a spring in which $a=24$ inches, $b=30$ inches, $l=6$ inches (in the position of greatest flexibility). Then the ratio of the least and greatest deflections will be:

$$\frac{1+\frac{30}{24}}{1+\left(\frac{30}{24}\right)^2\cdot\left(\frac{30}{24}\right)^3}=\frac{2.25}{1+\left(\frac{30}{24}\right)^5}=\frac{2.25}{4.052}$$

that is, the deflection for a given load when the adjustment is set for maximum flexibility is 1.8 times that obtained with the adjustment at its stiffest.

[There follows in the original a similar mathematical demonstration with regard to the stresses at the two settings, but it rests on the same assumptions as are employed above and is therefore here omitted, so much more as it seems evident in advance that the stresses in the lengthened free end of the spring must be lowered, and also that the reactions from them upon the shortened anchored end cannot be much greater than those to which the short free end is exposed at the stiffest setting].

An almost infinite number of methods can be used for effecting a displacement of the fulcrum. One of the first designs was based on the arrangement indicated in Fig. 1. A roller turning on ball bearings formed the fulcrum of the spring, and the pin on which the roller turned was carried in a bracket with a longitudinal slot on each side of the spring leaves. The pin was formed with knuckle teeth at each end, and these engaged with rack teeth cast on the upper side of the slots. By applying a box spanner to the hexagon end of the pin it could be rotated and moved along the racks. A spring-loaded clip was provided to prevent accidental displacement of the pin when the load was momentarily removed from the spring, and pads, suitably lubricated, were arranged to take the lateral forces acting on the spring. But this arrangement was costly and had a clumsy appearance.

The final design is illustrated in Figs. 3 and 4, while Fig. 5 shows the actual adjustment mechanism provided for a Straker-Squire ambulance used by the London Asylums Board. Fig. 4, it will be noticed, shows the dimensions of only 20 and 25 inches for the two portions of the cantilever spring and a displacement of 5 inches. A quadrant A is clipped to the spring by setscrews or wedges and is gripped by the two grooved lugs B and C, the latter being integral with shackle pin D, which passes through B and also through the shackle E, which turns on a trunnion F. The curved rails of the quadrant are struck with F for center.

The forward end of the spring is anchored to the frame, and when the shackle E is in an oblique position the horizontal component of the diagonal reaction along DF appears as a thrust or pull, as the case may be, along the lower leaf of the spring. The virtual center about which the spring may be said to turn is situated at the point where DF prolonged meets the neutral axis of the bottom leaf of the spring, which is assumed to be flat in the mean position. Thus when GH=5 inches the displacement of the fulcrum is 5 inches between the two extremes.

In order to prevent the clips from slipping along the quadrant, they are drawn together by the nut I, which when tightened up forces the clip B along the pin.

As a safeguard against forgetfulness, a collar J is screwed and pinned to D immediately behind the nut I, so that if the driver omits to tighten up the latter nor harm can be done since the nut and the clip B cannot slack more than 1/32 of an inch.

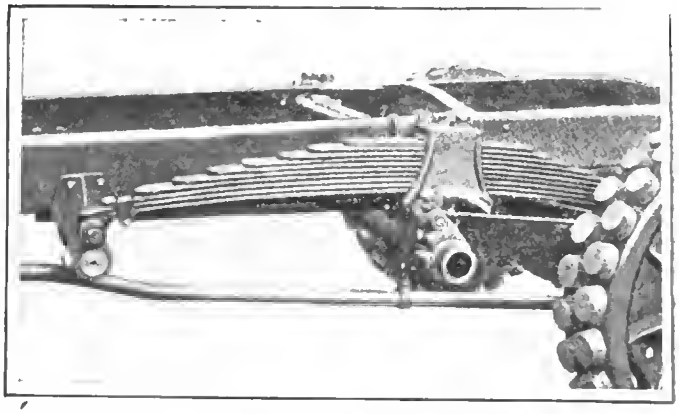


Fig. 5—North spring applied to ambulance chassis

When adjusting the spring a special spanner K is used. It has keyways broached in it, and these engage with the castellated exterior of the nut I, which is slacked back half a turn or so. The spanner is then pushed further in, disengaging itself from the nut. A series of teeth cut on the boss of the spanner then engage with internal teeth cut in the edge of the stamping L, which it attached to the quadrant casting, and forms a dust cover for the curved guide strips.

The boss of the spanner then acts as a pinion engaging a rack, and, since a leverage of about 4 to 1 is provided, a spanner 11 inches long is amply sufficient to move the clips along the quadrant, even when the springs are carrying a load of 1,600 to 1,700 pounds.

After moving the clips to the desired position the spanner is withdrawn from the rack, and is engaged with the nut again; this is tightened up, and the spanner then withdrawn completely.

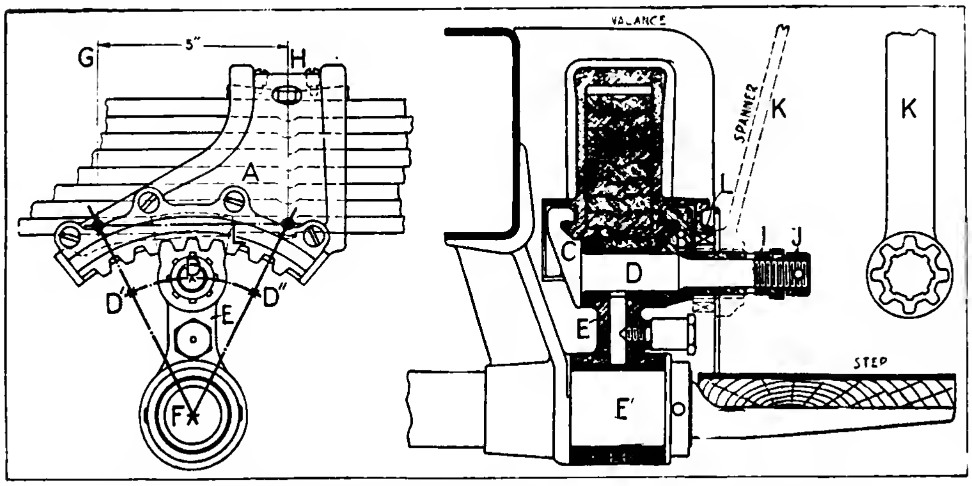
The design here described is a slight improvement on the design illustrated in Fig 5. Here a long lever acting directly on the link was used to adjust the spring, a construction which would be inadmissible on a touring car, owing to the position of the running boards.

The springs fitted to the Asylums Board ambulance were designed to take a maximum load of 2,800 pounds, which is, of course, very much more than the springs of the average touring car have to carry. The design in Figs. 3 and 4 is for a medium weight five-seated car, and the drawings are to scale. The springs are calculated for a load of 1,700 pounds maximum, and have an adjustment ratio of 1.8 to 1.

Paragraphs on Current Topics

By Marius C. Krarup

Motto: Radical Thought. Conservative Action.



Figs. 3 and 4—Final construction of North adjustable fulcrum for cantilever springs

Motorized is Mobilized. Which accounts for the legend that Paris taxicabs saved the Marne. They didn't, but they contributed.

* * *

"Americans think through their interests," said the late Professor Gunter, not quite in reproof. Such thinking is more reliable and to the point, when it is finally pooled from all sides, than academic idealism in behalf of the supposed interests of all. With this preface, the automobile industry can afford to admit, if so disposed, that Preparedness on land, and largely by motor power, looks more attractive and necessary than a navy just big enough to get decisively licked under adverse conditions; and nothing bigger or better has been proposed. The best logic for all is on the same side as the interests of the automobile industry.

* * *

To repeat and amplify: A great invincible navy for an empire of islands and colonies, which can keep it busy and modern. But for this continental republic, mainly a motorized army and navy staff of 100,000 officers and engineers, all of them practical and working scientists; a motorized people of gunners and mechanics owning a fair share of the soil and civilization for which they may be asked to fight. Fifty more paragraphs on these lines would make a program for a self-supporting, profitable and efficient preparedness made to measure for Uncle Sam, but unfortunately common opinion accepts more readily the hackneyed idea which sums up the requirements as "a few more battle cruisers and super-dreadnoughts, more aeroplanes, more soldiers, more militia, more coast defense ordnance, more summer training in bivouac, more industrial organization for rapid production of munitions and ammunition." This amateurish hodge-podge of good and bad spells militarism without efficiency, bluff without a punch behind it, cost without returns. Automobile manufacturers, the best trained all-around thinkers in the world of to-day, can lend their voices to something far better, by organized effort, and the incidental advantages for the industry should not close their mouths in modesty, considering especially that those who are licensed to speak most loudly on the subject, with the megaphone voice of the daily press, have less special competence.

* * *

Frank Crane, D.D., of the New York *Globe*, has found 72 unfamiliar words, more or less closely related to automobiles, and he presents them to his public in wonderment, and for wonderment. Will somebody be kind enough to send him one of the many automobile glossaries, for reviewing? He is short 3000 or 4000 perfectly good words in his accounts. If he is clever, he can then discourse upon the hollowness of the knowledge which is familiar with even all of these words, but not with the things and the laws which they represent. Wordless engineering is a fascinating theme which still awaits a sympathetic and capable interpreter, though it peeps out from unmentioned shapes, dimensions, proportions, dispositions and omissions in every manufactured thing of complex mechanical organization.

* * *

As soon as the rear drive is placed in the frame of the chassis, on some plan such as De Dion's, Jakobsen's or Christie's, the allowable 6-inch amplitude of spring deflection, for touring cars, is suddenly doubled without raising the height of seats—even if a plain axle remains to connect the wheels—and the main industrial hindrance to improvement of spring suspensions is removed. Some car owners remove this hindrance more nonchalantly by disregarding it when fitting auxiliary spring appliances; in all of which there is any moral that one chooses to deduce from it.

* * *

Were a little unknown experimenter to produce an aeroplane of modest dimensions, equipped with a motor of no extraordinary power, reliability or lightness, and his unpretentious craft could fly no faster than 50 m.p.h. in calm weather but could start from the ground at a standstill or with a five foot run, could start from a ship without the aid of a catapult, and could hover in the air over any given spot of the earth, or could come near doing this, it would not be guilty of breaking any laws of man or nature, but it would be the greatest and most sensational and epoch-making thing that has yet appeared in aeronautics, aerostatics or aerodynamics. On the other hand it would not have the shadow of a chance for competing and winning in the great contest for aeroplanes which is to take place in this country in September and for which valuable prizes and trophies are offered. The event is framed to stimulate progress on obvious and imitative lines only. And, for a beginning, this may be the part of wisdom. But soon better may be done, for aviation motors and automobile motors are converging more and more toward the same ideal, automobile builders are becoming interested in aviation, and, this done, it should not take them long to discover that there is room for systematic experimentation with some of the fundamentals in aviation. Then for real progress and contests bearing on those points in design which are not yet popularized and do not take care of themselves.

* * *

We are intent on selling cars to ourselves just now and glory in the hustling activities of the dealers, but the deeper current of thought is a resolve to make and sell cars and motor trucks to the world at large ever hereafter, and all leaders have realized that, to reach this pinnacle of commercial accomplishment, we must create an unshakable foundation for our industrial advantages. Dr. Fleming has stirred England to appreciate the need of organizing science to co-operate with industry and of ceasing to rely on foreign research work. On a similar plan, since the automobile industry roots deeply and broadly in the scientific work concerned with the production of its raw materials, the American automobile industry could afford to take in hand a hundred vigorous and promising young chaps and give them the most thorough scientific and practical schooling in all sorts of knowledge ultimately bearing on design, construction, production and world-marketing of motor vehicles and agricultural tractors. Supposing it cost $200,000 per year for seven years! The world will probably stand that long, and the cost would come back whether the acquired knowledge would have to be bought from its new possessors at the market price or not.

* * *

In Italy, automobiles are now prohibited from approaching within several miles of the Swiss frontier. In this manner the frontier itself can be watched and guarded most effectively. Here an analogy suggests itself in connection with the expansion of professional work which will be necessary to strengthen the hold of American industry in the markets of the world. Such work should be singularly free from deception and trickery. If we guarded the approaches to our professions, by insisting on cultural requirements extending back to boyhood and wholly of record, not only crimes *à la* Dr. Waite and the similar ones which escape detection but also multitudes of minor slips from grace, would be less liable to occur. Preparatory education in set forms sifts out the unsafe characters and protects the public and employers better than mere final examinations and diplomas.

* * *

As to that mooted distinction between invention and new construction, there is a new version: Inventors create inducements for departing from current practice, while constructors create new inducements for adhering to it. In either case, full knowledge of current practice would seem to be at a premium.

* * *

A national subscription to defray the cost of advertising Electric Lighting is under way, the medium proposed being the Statue of Liberty in New York's harbor. An excellent and business-like plan! A huge new companion statue, in steel and armored cement, representing the "Internal Combustion Motor Moving the World" might also be in order; with self-starter accessory conspicuously displayed on the pedestal.

Factors in Universal Joint Design*

Part II

Type with Independent Case Worked Well in Experiments but Was Clumsy and Awkward To Assemble—A Review of European Designs—Future Possibilities

By A. Ludlow Clayden

**Paper read at Cleveland section S.A.E. meeting, May 19.*

IN independent case designs the case was supplied with oil from the gearset and the mouth of the case was closed by a leather tube having a slip ring which was a free fit on the shaft. The device worked very well, but it was clumsy, heavy and very awkward in assembly. There was also some trouble to insure sufficient oil without permitting the passage of too much. A modification which resulted in considerable improvement was to abandon the oil feed from the gearbox and substitute a copper pipe leading to an oil cup on the side of the chassis frame. This provided an easy way to charge the case with oil, but the user of the car still had no way of telling whether he was putting in enough till it began to overflow.

Some European Types

It is perhaps interesting to examine some of the typical European joint designs very briefly.

One of the most difficult types of universal to make so that it will be satisfactory under all conditions, is that which includes a sliding joint. Probably the originators of the combined universal and telescopic coupling were the DeDion company who were compelled to use a joint of this nature in connection with their axle. The old DeDion cars had the transmission and differential in a unit which was attached to the rear of the frame. The wheels were carried on a tubular axle which was slightly dropped, and the drive from the sprung differential to the wheels was made by a pair of short propeller shafts with universal joints at each end. For this purpose the familiar type of cylindrical outer casing was used, this having two deep grooves internally: The shaft had a cross pin on which were fitted square nuts of phosphor bronze, free to turn on the pin and with the tops rounded. There is a fundamental difficulty in lubricating this type of joint with grease, this being the pumping action which tends to pull the lubricant outward. The difficulty can be overcome by careful inclosure and a great many ingenious devices have been evolved with this end in view.

Another drawback to a joint of this design is the double wearing surface. There is opportunity for looseness to develop between the sliding nuts and the outer case, while wear also takes place on the pin and on the bore of the nut which bears against the pin. This gives no trouble, however, if the parts are made of the right material and if the mounting is such that the telescopic action is not excessive.

An alternative design which is very greatly used both in America and abroad is the spline coupling where one end of the propeller shaft is splined and the fork of the universal joint at that end grooved to correspond. This makes a very good telescopic joint if there is ample length of bearing but,

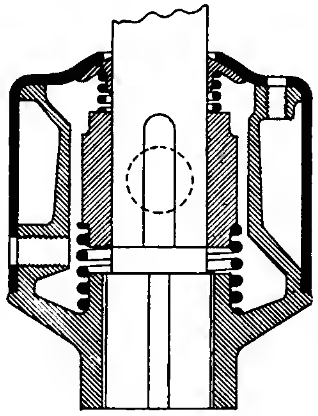


Fig. 10—A neat method for inclosing a joint of the De Dion pattern

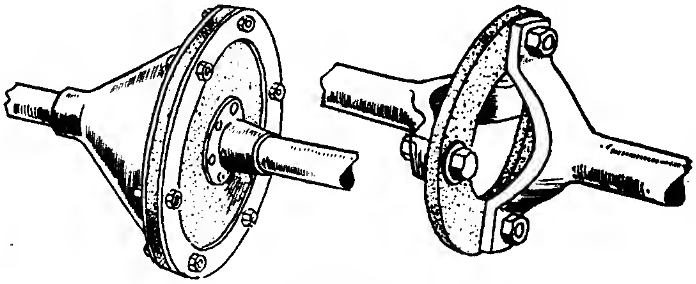


Fig. 12—Two varieties of leather coupling. Left—The original which stressed the leather highly, and Right—The modern design in which there is only direct tension on the leather

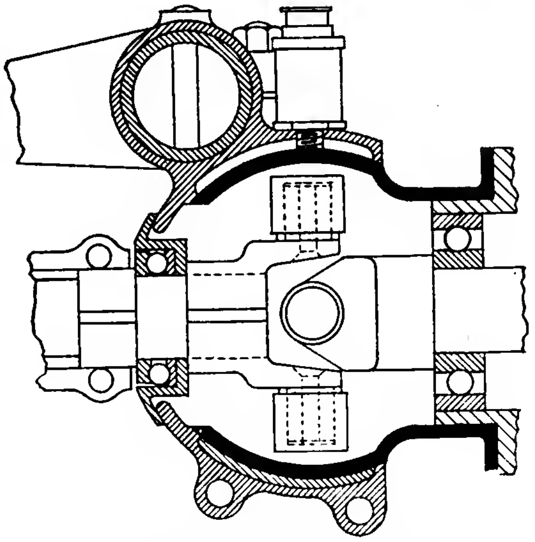


Fig. 11—A typical ball joint inclosure at the front end of a torque tube

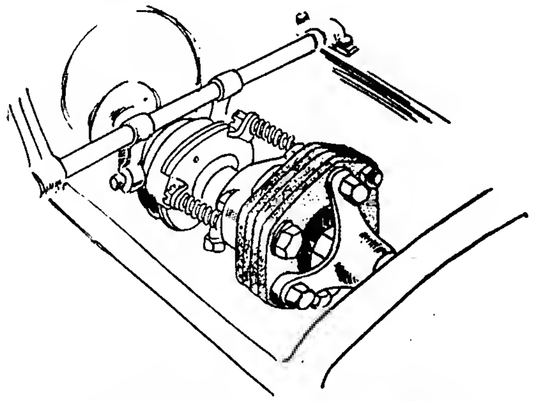


Fig. 13—Leather joint used on the Jeffery car between the clutch and gearbox

owing to the necessarily small radius, it requires no calculation to show that the pressure on the surface is very high. If ample length is not provided it will be impossible to retain grease between the splines and as soon as the lubricant is squeezed out wear will be very rapid.

At the present time there seems every reason to believe that the Hotchkiss drive will shortly be conventional practice and attention may be drawn to the fact that a rear spring which is normally nearly flat provides the ideal form for Hotchkiss drive from the viewpoint of universal joints; since with a flat spring the fore and aft movement of the rear axle will be at a minimum. There are some designs in which the amount of slide on the universal joint from one extreme of spring motion to the other is less than half an inch. This means that in ordinary running the movement is so slight as to be almost negligible.

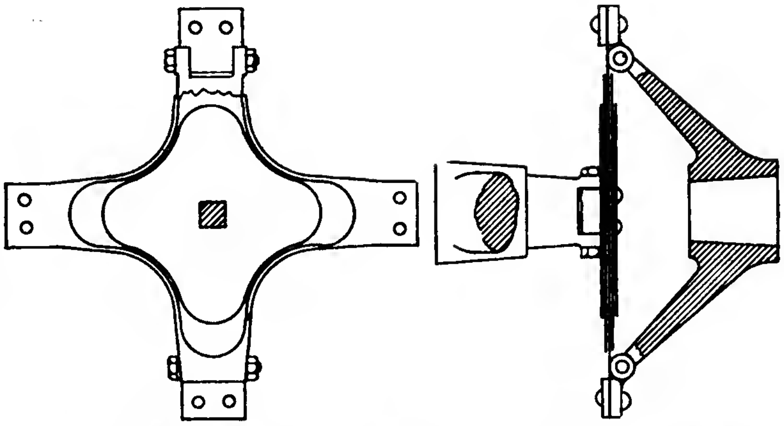


Fig. 14—Patented design for a universal joint made entirely of spring steel. The center leaf with shackled end takes all the drive, the other plates being added to stiffen the whole

A rather curious type of telescopic joints, shown in Fig. 4, has been used considerably on British commercial vehicles with better durability than the DeDion type of sliding joint. This consists of a small pinion on the end of the propeller shaft having the tops of the teeth cut to a curve with the center of the pinion as radius. The teeth slide in grooves cut in a cylinder case which is attached to the final drive pinion just like the outer part of the DeDion joint. It is claimed that this design allows a larger area with less weight, and it also eliminates the necessity for the cross pin used to carry the nuts in the DeDion joint.

A very different type of combined universal and sliding joint which is still used on the Lanchester car is the simplest of all. In this the end of the propeller shaft carries a block of steel about 3 in. square in end elevation. The block is about 1¼ in. wide and the edges are all curved. On the gear shaft is a steel cup of square section into which the block on the end of the propeller shaft fits snugly. Unless very carefully made it is almost impossible to eliminate rattle from this type of joint but, as made by the Lanchester company, it has been very successful and has been adhered to by that concern for nearly 10 years. See Fig. 5.

There have been many freak universal joints, some of which possess special merit. One, used by several British firms, notably the Rover company, is illustrated in Fig. 6. As will be seen, there are two flat forks and connection between them is made by a steel ball with two grooves cut in at right angles. This same joint was used in one instance for driving an overhead camshaft, where its facility for being taken apart is advantageous. It is a joint permitting very neat inclosure but it is rather difficult to keep down the bearing pressures without using large and heavy parts in its construction.

In Fig. 7 is shown a joint which has been used by the Wolseley company for some 7 or 8 years. The outer ring is split transversely and each of the pins is bushed. Thin grease or heavy oil can be supplied through a screw in the outer case and it will be noticed that the universal ring is integral with the cap. A more usual construction for what is commonly called a ring joint, is shown in Fig. 8, this being typical of a great many continental designs. Here the ring is split in a horizontal plane and it is not usual to find this type of ring made integral with any part of the inclosure.

With Stationary Cover

Fig. 9 shows the inclosing scheme adopted for a well-known British car which is an example of the stationary type of cover. This differs somewhat from the stationary case described previously, in that the brass cone seen on the propeller shaft is fixed to the latter and there is no connection between it and the stationary brass case inclosing the joint. The purpose of the part on the propeller shaft is to protect the opening to the main case. This eliminates the necessity for a slip ring on the propeller shaft and has worked out very well in practice, the cone protecting the opening into the main case sufficiently to exclude practically all dirt and water.

Fig. 10 shows a rather ingenious way of inclosing a DeDion type of telescopic joint. This idea has been developed in many different ways, the illustration being taken from a drawing of a British light car.

The Need of Compromise

The consideration of universal joints, and their inclosure, shows up the need for compromise so often found in automobile construction. From the viewpoint of the universal joint there is no better inclosure than is provided by a torque tube with a single joint at the front end of the propeller shaft contained within a spherical housing formed on the end of the torque tube and set into a corresponding socket on the back of the gearbox. A construction of this sort, as Fig. 11, allows copious lubrication from the gearset and, in practice, appears to insure an almost everlasting universal if all the details are carried out well.

Against this design, however, we have the velocity variations caused by the action of a single joint, and we also have the weight and cost of the torque tube construction. At present it appears that the simplicity and lightness of the Hotchkiss drive, or at least of a double jointed shaft with a light torque stay, more than outweigh the better protection of the torque tube. There is no easy way of lubricating universals on an open type shaft except by periodical grease packing. Thus it is up to automobile designers to choose joints of such a size that they will not be overloaded and will contain a good supply of lubricant. Picking the smallest size of joint that the manufacturer will guarantee for the car is poor policy, as it means poor durability in any case and very poor service indeed if the owner of the car neglects to grease up frequently; and he usually neglects the universals more than any other point on the chassis.

Future of Flexible Material

A type of joint which has tempted inventors for ten years and more is that in which there is no bearing; no working surface whatever. Instead of a joint a sheet or ring of flexible material is employed, the natural elasticity of the substance being used to give the necessary movement.

The most common coupling of this sort is the leather disk so often used for driving magnetos or other engine accessories. Leather ring couplings like Fig. 12 are commonly used between the clutch and the gearset in European designs, and on some American cars, notably the Jeffery, Fig. 13, and they have been tried for the propeller shaft. There is at present no American car with propeller shaft joints of this character, but there were several on the European market just before the war.

The heaviest service to which leather ring joints have ever been put is on the omnibuses in London. Owing to variations in the load the universals on an omnibus see heavy service and the noise of a worn pin joint is very objectionable. At first the leather joints seemed to be ideal. They lasted for a good many thousand miles, were cheap and more easy to replace and were always quite quiet. However, the latest advices from London are that the leather is being abandoned in favor of joints with ball bearing or roller bearing pins, as these appear to last forever without wear, maintaining the quietness of leather without the need for periodical renewal.

This is on very heavy service though, and it seems possible that we have not yet heard the last of flexible ring joints for passenger car transmission. Leather rings will take all the drive a passenger car engine can supply, and their drawback is mainly their liability to deterioration by the action of grease and water which slowly rot the material. To overcome this difficulty, disks are now being made of oilproof and waterproof substances like woven asbestos, and the trials are very encouraging, though it is early yet for predictions.

Yet another style which has never been developed to the full in actual practice is the joint which uses spring steel instead of leather or fabric. Such joints usually consist of a series of very thin spring steel rings clipped together and mounted exactly like a leather ring. In this form they have proved excellent for clutch couplings, but are probably no better than leather while being considerably more costly. Also a good large leather joint will permit sufficient end displacement to allow for clutch withdrawal without the provision of a metallic sliding joint, while the spring steel ring will hardly do this.

There have been several patents taken out for special designs using thin steel leaves to give freedom both axially and angularly, some of them appearing very promising on paper, but it is only hard service that can decide their merits and, if they are developed, it is likely to be in the future.

The purpose of this discussion is not to suggest that the universals we have to-day are other than excellent for their purpose. On the contrary, considering how bad universal joints were a short time ago and how little trouble they give in a modern car; and still more, considering the price at which they are sold, the modern joint of proprietary make is usually wonderfully good.

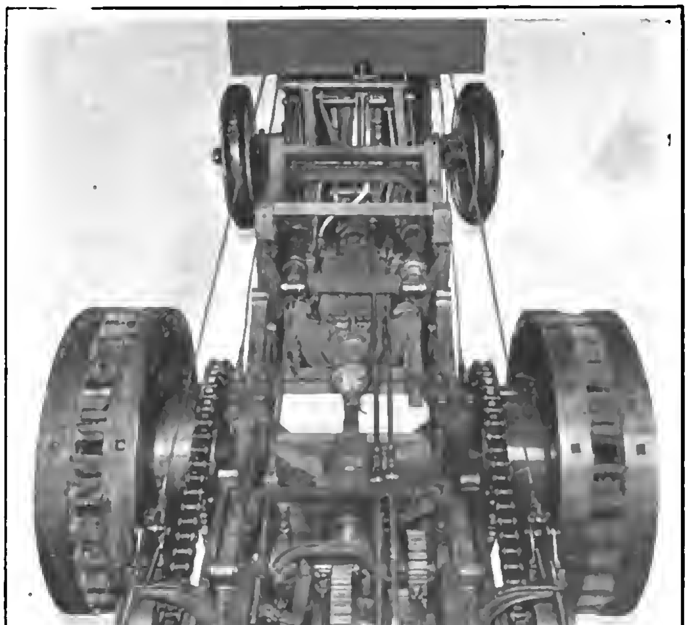
Like all other parts of an automobile, however, there is no reason to suppose that we shall *never* have anything better, and this brief examination of the subject will have served its purpose if it draws attention to some of the problems connected with the provision of an efficient, silent, and durable universal construction that will maintain itself without attention from the driver of the vehicle. It appears to the author that the American automobile engineer owes a great debt of gratitude to the specialists who have taken upon themselves the task of caring for a part of the chassis which has been quite troublesome to foreign engineers.

The Bulkley-Rider Road Locomotive

LOS ANGELES, CAL., May 27—The Bulkley-Rider Tractor Corp., this city, has perfected the Bulkley-Rider Road Locomotive, the tractor which the engineers of the corporation have been working on for more than 3 years.

The tractor is equipped with a 90-hp. Wisconsin motor. There is a first transmission and a reduction transmission, which is the foundation of the tractor. The road locomotive has six speeds forward, and when running in the unreduced high gear, has a speed of 20 m.p.h. When running in the reduced low, there is a total leverage of 96 to 1. Easy riding is secured by a double set of springs. The chassis springs are entirely independent of the load springs. All road shocks are provided for by these load springs and a pair of plungers which act as shock absorbers for all jars coming from the rear caused by ruts in the road. A winch is fitted which will pull a 28,000-lb. load on a cable at the speed of 70 ft. per min. With this equipment, the tractor can pull out of any hole or up the side of the steepest bank, pulling the load after it.

The tractor has a patent hydraulic jack which supports two extra wheels equipped with metal pedal pads. By releasing this jack, these wheels drop into place and the tractor becomes a four-wheel-drive machine.



Chassis of Bulkley-Rider Road Locomotive. Note strong construction

For service where the roads are fair or boulevards prevail, these extra wheels are not included in the equipment, but the regular wheels are equipped with patented paddle wheel rims which are detachable. When the tractor is to run on boulevards this metal paddle wheel is removed and replaced with the solid rubber tire.

The first of these Road Locomotives was built for the Yuma Consolidated Mines, Quartzsite, Ariz., and was recently accepted by officers of the company upon the showing made in its official trial trip which was for the purpose of demonstrating its pulling powers and general efficiency. This trip was from the harbor to the center of the city, a distance of 23 miles, a load of 45 tons being hauled with trailers. The entire trip was made in 2 hr. and 22 min.

It is claimed that this tractor will be of great service for military purposes as it is built for traveling over all sorts of ground and under all conditions and its weight is well distributed.

The FORVM

Engine Utilizes Principle of Gradual Combustion

A CONSTRUCTION APPROACHING THE DIESEL ENGINE BUT SUITABLE FOR AUTOMOBILE PURPOSES AND EMPLOYING TO A DEGREE THE PRINCIPLE OF THE NAVAL GUN

By James McIntosh

THE more I read J. E. Schipper's article on "Are Other Cycles Possible?" and notably in regard to the variable cutoff constant pressure means of control so am I convinced you agree with my theory; in fact, you so closely conform and the import of my patent claims seems to be in accord with your views that I have decided to disclose one phase that is covered but not hinted at in my specification, but well within the scope of my basic principle. Claim No. 2 of Patent No. 1,113,456 has this clause, "a valve" (broad term) "*for admitting air to the passage in position to precede a charge of mixture*, means for varying the quantity of air admitted." You will notice the "a valve" is not patentable as a valve or is the "means," as both are as old as the hills, but the function they perform is new. As to the italicized quotation there is no question as to what is meant. As to its application as a means of control, let us see what that means. I do not specify as to what volume the air must be, and the fact my claims refer to a means for varying the quantity of air I intend to use it as a means of control. Suppose I decide to call it a Volume Ratio control and decide to control the air only, and let that volume—be it large or small—determine what the charge is to be, let us consider pure air has no energy due to ignition and that a volume of mixture expands due to ignition 4 to 1, also that an equal volume of air and mixture at the point of contact has half that value, or 2 to 1. Assume that the total volume taken into the crankcase or pumping chamber is constant and at low speeds the volumetric filling will be more complete, this will tend to aid matters for light loads and also be beneficial in presenting pre-ignition with full loads.

Suppose I admit a 90 per cent volume of air (in position, etc.), the charge of mixture must be 10 per cent; again if the air be 10 per cent the mixture is 90 per cent. To better illustrate my point, I will assume 50 per cent of pure air is in position to precede a 50 per cent volume of constant mixture and at the point where the two volumes come in contact there is a 5 and 5 per cent combination.

Assuming Fig. 1, to represent the combustion chamber and three layers with values, as above cited, the correct mixture and compression to be ideal for firing and the 10 per cent combination is too lean to ignite at the compression used we may expect after the mixture fires the rise in pressure and temperature will cause a second firing or we may assume there is a graded or tapering energy charge that will fire as the column heat and pressure rises, due to the correct mixture located at the spark plug. This is what I anticipate regardless of the volumes used. How far that eliminates initial shock due to a homogeneous charge fired instantly is very evident. As a means of control, assuming clean cut volumes, let us assume, say, three ratios:

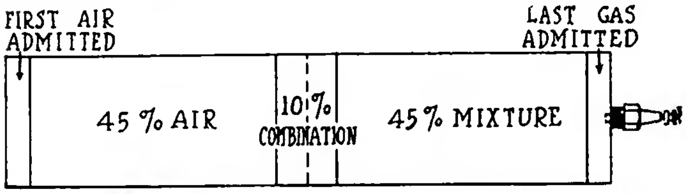


Fig. 1—Diagram of combustion chamber with layers of air, constant mixture and a mingling of the two

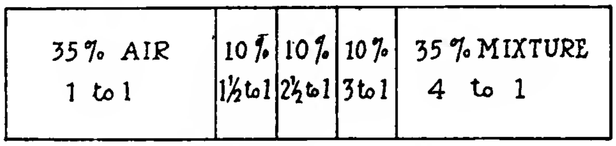


Fig. 2—With five layers of mixture, to fire in succession

%		%	%		%	%		%
90	of air......	90	10	of air......	10	50	of air......	50
10	of mixture..	40	90	of mixture..	360	50	of mixture..	200
100		130	100		370	100		250

As a matter of interest let us take the 50 per cent and 50 per cent fired progressively in two distinct explosions:

%		%	%		%
45	air............	45	45	air............	45
10	compression....	10	10	compression....	20
45	mixture........	180	45	mixture........	180
100		235	100		245

Again assume five layers as below and the first to fire the second, second the third, third the fourth and the fifth to retain its volume only.

First	Second	Third	Final Volume
35- 35	35- 35	35- 35	35- 35
10- 10	10- 10	10- 10	10- 15
10- 10	10- 10	10- 25	10- 25
10- 10	10- 30	10- 30	10- 30
35-140	35-140	35-140	35-140
100-205	100-225	100-240	100-245

This condition may be expected in action, although I do not care to predict just how many distinct impulses occur. I prefer to assume there is a gradual increase in pressure which will eliminate initial shocks on a crankpin and the increase in volume will act as a follow-up, the piston effect resolving into a flatted peak on an indicator diagram and approaching that of an engine using a constant pressure cycle and similar in action to that of a Diesel engine where the fuel is injected and time elapses before the full charge is utilized. In this respect I approach the Diesel, which is far removed from automobile engine practice, using a homogeneous charge with high initial pressures and bearings to absorb same and at a time when the crankpin is not in a position to get the full benefit. How near this conforms to theory may also be of interest, in a modern rifle or naval gun where they use slow burning cordite in blocks too big for instantaneous combustion and yet fire an energy that if fired along automobile engine lines would simply burst the gun before the projectile got started.

The History of the Pneumatic Tire—5

An Attempt at Wheel Elasticity in 1875—A D-Shaped Solid Rubber Tire — Pioneer Carriage and Bicycle Types — The Carmont Solid Clincher Tire Patent

The History of the American Automobile Industry—32

By David Beecroft

PROGRESS in tires was not rapid for some years, doubtless because the panic of 1873 made the purchasers feel poor; but in 1874 A. Wietlisbach of Newark, N. J., brought out a rubber tubing tire held to the rim by wire passing through the hole. A similar device using a right-and-left threaded turnbuckle on the wire ends was proposed by George Selden, but his patent application was abandoned. A disk wheel composed of two sheets of steel artistically perforated for lightness and bolted together at the felloe gripping a tire of rubber of circular or rectangular section, as preferred, was patented by L. W. Coe in 1872.

The circular section came into use on bicycles about this time or shortly after in England, and was quickly transferred to America, where it remained in use until displaced by the pneumatic tire about 1890.

In January, 1875, an attempt at wheel elasticity was made by the Rubber Cushioned Axle Co., which brought out its wheel in which the bearing box was set in a cushion of rubber inside the hub, and continued this on the market as late as 1880. Many similar attempts have been since made, but the results are not satisfactory because of the leverage to which the hub is exposed and the increased service that the small amount of rubber at this point is obliged to give.

A D-Shaped Solid Tire

In 1883 a D-shaped solid rubber tire was shown in an American publication as a British product, with the edges of the rim turned inward slightly to grip the widened base of the tire. It closely resembled the Cheever tire of 1869, but was of greater depth. In March, 1884, Peter Gendron of Toledo, Ohio, patented his baby-carriage tire, which consisted of a soft tread and hard base of rubber set into the rim and held there by having the edges rolled inward.

A cycle-wheeled buggy with rubber tires was shown at a British bicycle show in February, 1886, thus indicating that the rubber tire was beginning to find commercial use.

An Early Bicycle Type

About 1883 or 1884 the Star bicycle, built in Smithville, N. J., with sandy roads all around its factory, was fitted with a rubber tire of considerable width, but to save weight and cost the rubber depth was not very great and the center was slightly higher than the sides. This tire, like other bicycle tires of that date, was cemented into the rim and not wired or clinched.

About this time, 1884, Charles E. Duryea applied for a patent on a velocipede and included in this application what seems to be the first of the afterward well-known clincher tire. This device was not permitted to be covered by the claims on the vehicle itself, and so was stricken out of the case and no new application filed for lack of funds. The patent was issued on Feb. 15, 1887, and shows a rubber tire of greater diameter than the rim width, hollow and open on the base. The rim was made with inturned edges which entered grooves formed between the tire beads and the body portion, and thus held the tire in place. The open base permitted accurate molding, so that any desired thickness could be given the tire with the assurance that it would be equally thick all around.

A Tubular Cushion with Wire

Soon after, a patent to E. C. Otto shows a tubular cushion tire secured by a wire passed through the central hole. This tube was made rather long so as to put the rubber under compression, and the wire was corrugated so as to insure a constant pressure of the tire against the rim. This form of tire has never been real successful, because the holding wire was so far above the rim that it worked or moved under the action of the tire and eventually chafed and cut its way through. It has seemed necessary that the holding wires should be below the top of the rim so that they might be undisturbed and therefore not destroy the rubber.

A Modification with Steel Jacket

A modification was a wired method patented in this same year, in which the round rubber cord or tire was held in place by a sheet steel jacket, which jacket had ears that extended radially alongside the felloe, and were provided with slots and pins, by which they were held to the felloe, but permitted movement as the rubber under the jacket compressed. This construction was very impractical and did not appear on the market.

The Rostrum

Why Wire Wheel Hubs Are Offset

EDITOR THE AUTOMOBILE:—Kindly give me full explanation of the principle involved in the manufacture of the wire wheel that necessitates the offsetting of the hub on the outside of the hub as now practiced by the wheel manufacturers. Is this done for looks only or is there a principle of angle levers that makes the construction more solid?

Atlanta, Ga. P. F. L'E.

—The reason for offsetting the hub of the wire wheel is to permit the use of the standard tread in conjunction with a wide base for the spokes. If you imagine a section through the wheel each pair of spokes form a triangle with the width of the hub as the base and the rigidity of the wheel is increased by increasing the width of the hub. If the spokes made equal angles with the hub on the same width of base so that the tire came central with respect to the hub the tread of the car would be increased by fitting such wheels in place of the ordinary wheels.

Another reason for using wire wheels of the offset type is to bring the plane of the tire closer to the plane of the steering knuckle so that even if special axles were designed for wire wheel cars there would still be an advantage in the use of offset construction.

Cause of Popping in Carbureter

Editor THE AUTOMOBILE:—What causes the popping in a carbureter when the mixture is too thin? Is it because of overlap in the exhaust and inlet valve, so that there is a free passage from the carbureter to the burning gases in the exhaust manifold? Would it stop popping to turn back the camshaft one or two teeth so that the valves no longer overlap?

North Cohasset, Mass. H. W. H.

—Popping in the carbureter if the mixture is too thin is not caused by overlap. The speed with which a mixture of gasoline and air burns when ignited depends upon the richness. A weak mixture can be ignited by an electric spark but will burn very slowly, thus at the end of the firing stroke the mixture if very lean will still be alight. It can remain lit throughout the exhaust stroke so that when the inlet valve opens for the next suction there is still burning gas inside the cylinder. This flame immediately flashes back through the manifold into the carbureter.

Information on 1913 Buick 30

Editor THE AUTOMOBILE:—What is the weight of the 1913 Buick model 30?

2—What is the wheelbase of this model and miles per gallon of gasoline claimed?

3—The gasoline tank is 15 in. deep, 38 in. long and 46 in. in circumference. Can you tell me how to find out how much gas there is in there with a rule? For example, when the rule measures 6 in. there is 5 gal.; 11 in., 10 gal., etc.

Haverhill, Mass. J. B.

—The shipping weight of the model 30 was 2750 lb., this weight, of course, being exclusive of water, gasoline, spare tire and passenger load.

2—The wheelbase of this car is 108 in.

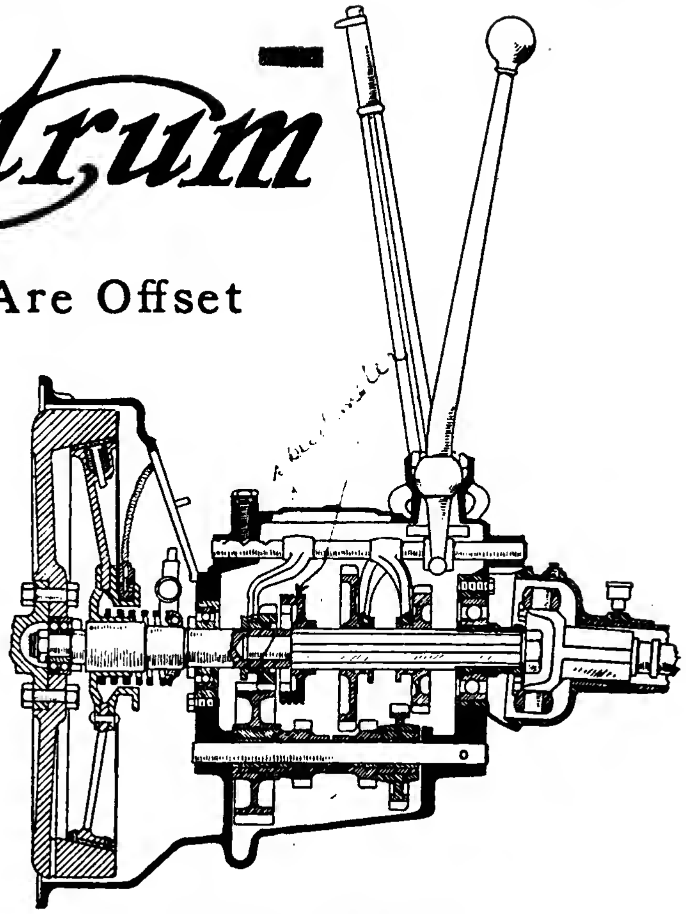


Fig. 1—Section through Dodge gearbox assembly

3—The easiest way to make a gage for the round gasoline tanks used on these cars is to take a stick 24 in. long, and mark off the first 15 in. into ten equal spaces, 1½ in. apart, beginning with the end of the stick. These marks, when numbered from the end of the stick upward, will then indicate the following amounts of gasoline in the tank:

Div.	Gals.	Div.	Gals.
1	1.3	6	15.6
2	3.5	7	18.7
3	6.3	8	21.5
4	9.3	9	23.7
5	12.5	10	25.0

Ammeter Not Advisable on Dodge

Editor THE AUTOMOBILE:—Kindly publish the power curve of the engine used in the Dodge car.

2—What is this car geared on first, second, third and reverse?

3—Publish diagram of electric starting and lighting.

4—Publish diagram of ignition.

5—Show drawing of transmission.

6—How could an ammeter be applied to this car?

Newark, N. J. E. C. McC.

—The power curve of the Dodge car is not available. The peak of the curve is given by the manufacturers at 2000 r.p.m. at which point the engine develops 35 hp.

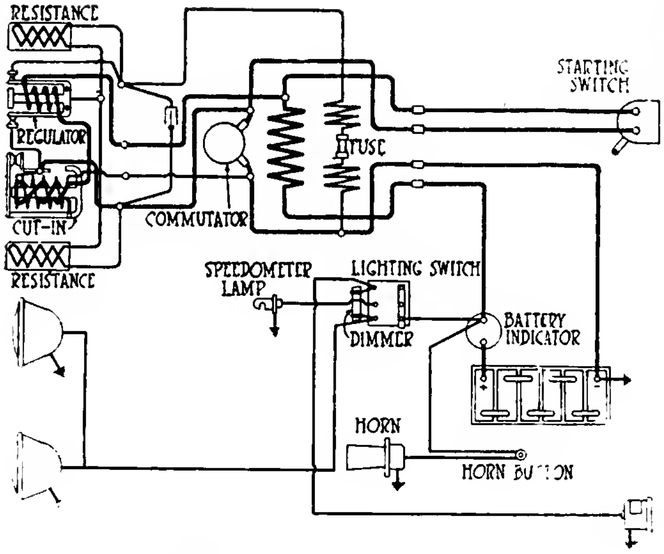
2—The standard gear ratio on high is 3.615 to 1, the driving pinion having thirteen teeth and the driven gear forty-seven teeth. On intermediate the gear ratio is 6.93 to 1 and on low and reverse 16.87 to 1.

3—A wiring diagram and a diagram of circuits are given in Figs. 3 and 2, respectively.

4—Answered under question 3.

5—The transmission is illustrated in Fig. 1.

6—The Dodge company states that it does not advise the



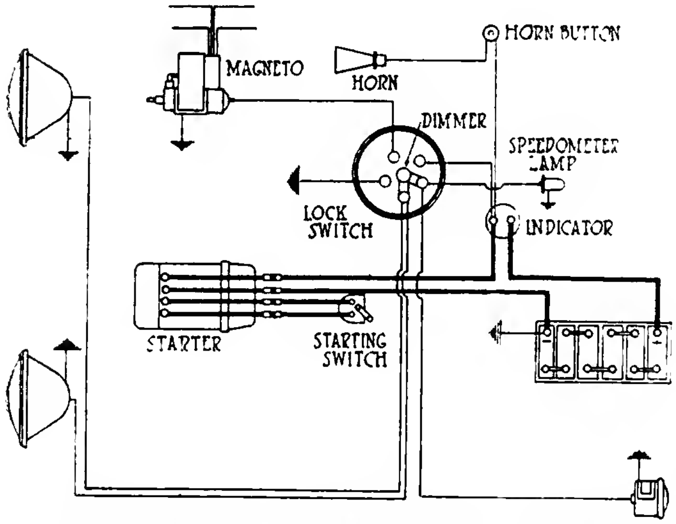


Fig. 2—Above—Diagram of electric circuits on Dodge car
Fig. 3—Below—Wiring diagram of electric system on Dodge

installation of an ammeter on the car as in starting the starter uses about 200 amp. An ammeter installed in the main line would necessitate the use of a shunt winding to prevent it from being burned out the first time the starter was used.

Fitting Magneto to Rambler 45

Editor The Automobile:—Could a high-tension magneto be put on a Rambler model 45 so as to do away with the timer driven by the cam gears and the vibrating coils? If so, what make would be advisable?

2—Would a new carbureter and vacuum system be of any advantage on this car?

3—What power will it develop at 1000 r.p.m.?

4—What speed will the car attain when in good working order? It has 37 by 5-in. wheels.

5—If rebuilt into a truck what would be its maximum capacity?

Thomasboro, Ill. F. Bros.

—A high-tension magneto could be satisfactorily used on a model 45 and we see no reason why any standard make could not be used satisfactorily.

2—We do not believe that a new carbureter would result in a great deal of improvement in the running of the car, but, on the other hand, would suggest repairing the old one as the carbureter with which the car is equipped at present is no doubt the one which was originally placed on the car when it left the factory. Therefore, it has been tested out with this particular motor. The vacuum system is, of course, an advantage in the securing of an even-running motor. The expense of placing it on a model 45 would be considerable, however, as the tank would have to be designed differently and located in a different place, it now being under the seat.

3—This engine develops 45 hp. and 32 hp. at approximately 1000 r.p.m.

4—When the motor is working satisfactorily the car should show a speed of approximately 45 m.p.h.

5—The maximum load that it would be safe to carry would be 1500 lb.

Changing Mitchell S to Fast Roadster

Editor The Automobile:—I have a Mitchell six, model S, that is equipped with a toy tonneau body. What is the gear ratio of each speed of this car?

2—Brake horsepower of the motor?

3—What is the maximum speed of the motor and at what speed does it develop the most power?

4—What is the valve timing?

5—Approximate car speed when new?

6—Is the regrinding of the cylinders and the fitting of new aluminum pistons in a motor of this type and age advisable?

7—I want to fit a speedster body to this car. What suggestions would you make in order to get more speed out of it?

8—Would increasing the compression, timing valves differently, or changing the gear ratio be advisable?

New York City. P. C. D.

—The gear ratios are as follows:

Third speed—direct.
Second speed—1.547 to 1.
Third speed—2.750 to 1.
Reverse—3.850 to 1.

2—The brake horsepower is 43.

3—The greatest power is developed at 1200 r.p.m.

4—Inlet opens 15 deg. past top center, closes 20 deg. past bottom center. Exhaust opens 35 deg. before bottom center and closes 10 deg. after top center.

5—The approximate car speed when new is 55 m.p.h.

6—Yes.

7—Should you decide to fit new pistons, raise the compression to 75 or 80 lb., change axle ratio to 2¼ or 3 to 1, close intake 35 deg. instead of 20, open exhaust at 45 deg. instead of 35.

8—Yes.

Adjusting Oldsmobile 27 Carbureter

Editor The Automobile:—Please publish instructions for adjusting the carbureter furnished as standard equipment on the Oldsmobile Autocrat model 27.

Waynesboro, Pa. J. E. O.

—The carbureter is of the Oldsmobile type, especially designed to meet the requirements of the motor. There are only two adjustments to be made under any circumstances—on the needle valve, affecting the flow of gasoline, and on the auxiliary air valve, controlling the admission of the auxiliary air supply. The constricted passage up the center is known as the venturi tube and supplies sufficient air to mix with the proper quantity of gasoline when starting the motor, and for low speeds. At increased speeds the auxiliary valve operates to supply more air to mix with the increased flow of gasoline which is turned on as the throttle is opened.

To describe these features in detail, attention is called first to the throttle and needle valve mechanism. The throttle lever on the steering column, and the accelerator on the foot board operate a butterfly valve known as the throttle. The throttle valve shaft extends clear through the neck of the carbureter and ends in a fixed cam which works directly on the needle valve, opening and closing it as the throttle opens and closes. Just below the fixed cam is an adjusting nut for the control of the opening or closing of the hole in the needle valve. Turn to the right to decrease, and to the left to increase the flow of gasoline. The throttle is prevented from closing completely by an adjusting thumb-screw on the throttle lever at the carbureter. By adjusting the screw the motor may be throttled down as low as desirable.

The auxiliary air supply, as stated, is furnished by the auxiliary air valve. The valve proper and the spring which regulates it are connected by a lever provided by an ingenious contrivance which may be described as a graduating fulcrum. By this method the single coil spring is used at varying degrees of tension automatically and according to the varying requirements of the motor. At moderate speeds the spring is sensitive and permits the valve to supply additional air at the slightest impulse, while at increased speeds the spring tension is correspondingly increased to compensate for the greater suction of the motor at higher speeds.

A drain cock is provided at the bottom of the carbureter to permit occasional cleaning of the float chamber; in doing this, it is necessary to shut off the main supply valve in the gasoline line. Afterward, flood a little gasoline through, to insure a good flushing, by opening the supply valve.

The Oldsmobile carbureter is waterjacketed so that it may be piped with warm water from the cooling system, to provide a higher temperature in the interior of the carbureter as an aid to the vaporization of the gasoline and the maximum expansion of the gas so formed.

On the lower end of the auxiliary valve stem is a lever which locks the valve shut. This is called the air cut-off and is for ease in starting the motor, i.e., through shutting off all the air except that which is supplied through the venturi tube, a rich mixture is assured.

Tire Cost Chart Issued by Goodyear

Editor THE AUTOMOBILE:—Some time ago one of the tire companies published a chart by which it is possible to figure the cost per mile, knowing the amount paid for the tire and the distance it has run. Would you kindly illustrate this chart?

Brooklyn, N. Y. L. M. H.

—The chart you describe was published by the Goodyear Tire & Rubber Co. It is illustrated in Fig. 4. Placing a straight edge across the chart with one side at the tire mileage and the other at the initial tire cost, the reading on the center column B will give the cost per mile.

Resetting Ford Magnets Usually Recharging

Editor THE AUTOMOBILE:—Is there such a thing as setting the magnets up on a Ford?

2—If so, what does this work consist of?

3—Do all Fords have a certain point on the spark sector (when using the magneto for ignition) where it does not give good ignition?

4—If not all, what is the cause and the remedy for such trouble?

5—As spark plugs will often spark when unscrewed from the cylinders, isn't there some known amount of resistance that could be placed between the points of the plug to equal the pressure of a common motor such as, for example, a piece of notepaper?

6—How can it be told that the magnets in any ignition system are in good condition?

7—Will they show up well at low speed and not at high?

Olmstead, N. D. E. F. F.

—Setting the magnetos up on a Ford generally refers to recharging the magnets.

2—This work consists in recharging by means of special coils.

3—The Ford magneto should give good ignition throughout the entire range of advance.

4—The probabilities are that if firing is weak at one point on the center that the trouble is not in the ignition but in carburetion. If the spark is good at one point there is no reason why it should not be good at a more advanced or retarded point.

5—A known amount of resistance may be placed between the points of the plugs to equal the pressure in a motor. This has never been worked out, however, in terms of thickness of paper so far as THE AUTOMOBILE has any record.

6—When the magnets of a magneto are in good condition good sparks will be given at low speeds.

7—If they give good sparks at low speed they certainly should give at least as good at high.

Knock Probably Due to Carbon

Editor THE AUTOMOBILE:—Will you kindly explain what a spark knock is, how it is caused, and how to remedy it? I have a 1916 Overland which has been run less than 5000 miles and has developed quite a decided knock when accelerating or on hard pulls. The local garagemen say it is a spark knock but cannot be remedied.

Detroit, Mich. G. H. S.

—If the charge is exploded before the piston has quite reached the top of the compression stroke it may produce a knock. Thus if you advance the spark when the engine is running slowly the advanced spark can cause the explosion to take place too quickly.

In the case you mention the knock is almost certainly due to carbon in the cylinders or on the piston heads. A spark knock can always be cured by retarding the spark but if the knock has developed only recently it is absolute proof that it is due to carbon.

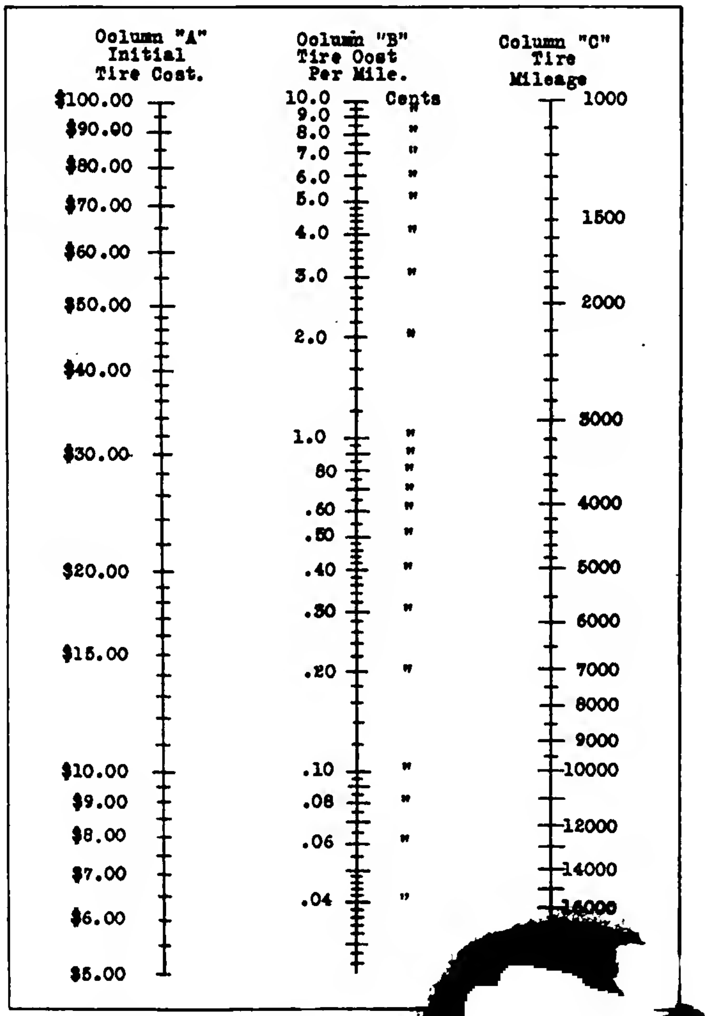


Fig. 4—Tire cost chart published by Go

ACCESSORIES

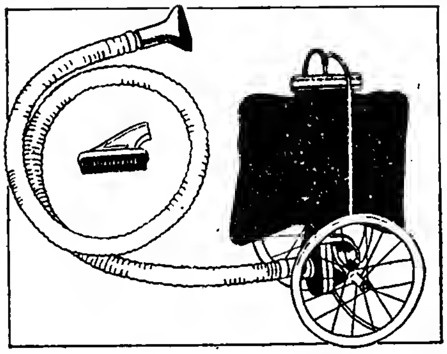
Warner Prairie Schooner

THE equipment of this camping trailer comprises a folding tent of heavy waterproof khaki duck, two folding Pullman beds, 4 by 6 ft., with non-sag springs, including two mattresses, compartment curtains for each bed, an ice chest, a folding table and a folding camp stove. There is also room in the box of the trailer for steamer trunks, blanket rolls, camping supplies, etc., when the tent and beds are folded. The trailer with equipment weighs about 750 lb. and is built to carry 1500 lb. Fitted with pneumatic tires, its speed capacity is 50 m.p.h. and with solid tires 15 m.p.h.

The trailer is built on automobile lines and is highly finished to harmonize with the car and the trailer tongue is adjustable so that the box of the trailer is always level, irrespective of the make of car to which it is attached. The tent used when opened is 7½ by 14 ft., the eight legs supporting the beds and the tent being adjustable so that the beds can be made level on uneven ground. The beds are 4 ft. above the ground, the trailer body forming the floor of the tent. Stakes and guy ropes are included. The entire outfit can be opened and arranged in 10 min. by one man. In 20 min. the equipment can be removed from the Prairie Schooner which can then be used as a commercial trailer. With 30 by 3-in. pneumatic tires the Prairie Schooner sells for $200 f.o.b. Beloit, Wis. With solid tires it is $175 f.o.b. Beloit.—Warner Mfg. Co., Beloit, Wis.

Sterling Utility Cleaner

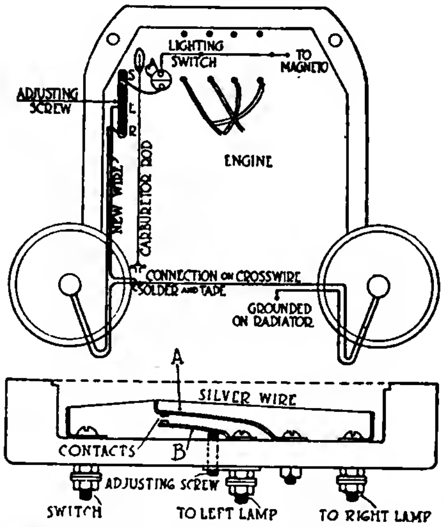
The Sterling is a small portable vacuum cleaner mounted on light rubber tired wire wheels and fills the need for such a cleaner for car upholstery and for other purposes around the sales-room or garage, besides being a suction machine it can be converted into a blower in 30 sec. by removing the bag and inserting the hose in its place. The complete outfit weighs 15 lb. and includes a cast aluminum fan 20 ft. of flexible cord, 8 ft. of 1½ in. hose for suction and blowing, specially designed toothed nozzle, brush for cushions, etc. Price $29.50.—Sterling Sales Co., Chicago, Ill.



Sterling utility vacuum cleaner

Van Sicklen Headlight Concentrator

This device for Ford cars is designed to furnish a bright headlight when the car is traveling slowly, and this is done by cutting out one bulb and sending the full voltage to the other when the speed drops below 15 m.p.h. It is merely an automatic switch of small size, which is mounted on the front of the dash. When the voltage of the magneto drops to 9 volts, the device short-circuits one lamp, the full voltage passing through the other. This voltage is sufficient to give full brilliancy. Above 15 m.p.h. current passes through both lamps and the voltage is sufficient to give a good light in both. A fine silver wire is strung between two terminals of the device, one running to the switch and the other to the right lamp. This wire holds down the flat spring *A* which is in contact with the shorter spring *B* as long as the silver wire is cool and unexpanded. This holds for speeds below 15 m.p.h., when all the current which passes through the switch terminal flows through the springs mentioned into the left headlight. Above this speed, the current passing through the wire is sufficient to heat it until it slackens enough to allow spring *A* to move away from *B*, thus breaking the circuit, so that the right lamp is no longer shorted, and the voltage of the magneto now passes through both headlights in series.—Van Sicklen Co., Elgin, Ill.



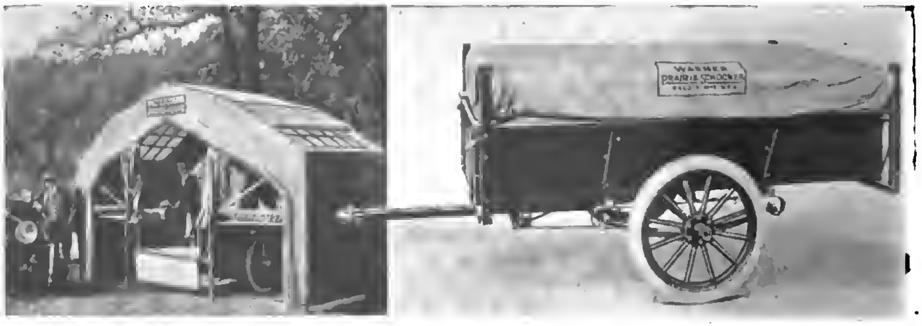
Van Sicklen headlight concentrator for Ford cars

H$_2$O Vaporizer

This vaporizer, which was described and illustrated on page 864 of THE AUTOMOBILE for May 11, under the name of the Weco vaporizer, is designed to supply a small quantity of steam to the motor with the fuel mixture, a 2½-qt. copper tank being located on the exhaust pipe where the heat from the exhaust heats the water. A small tube leads the steam to the intake manifold above the carbureter. Better vaporization, lower fuel consumption and absence of carbon deposits are claimed to result from the use of the device. The Weco Mfg. Co., Boston, Mass., was formerly the New England distributor for this device, which is manufactured and sold by the H$_2$O Mfg. Co., Cambridge, Mass.

Graham Exhaust Ventilator

Small ventilating hoods, installed at the top of the motor hood, have air passages so arranged that the air currents produce a strong vacuum which exhausts the hot air from the engine space. The makers state that the device is capable of exhausting 25,000 cu. ft. of air per hour when the car is moving at an ordinary speed, but that it also operates when the car is standing. The raising of the hood is not interfered with, there are no parts which can get out of order and rain cannot get through. A special type is made for trucks with motors under floors.—Ross-Wortham Co., Chicago, Ill.



Warner Prairie Schooner, with tent opened and as a trailer

The Automobile

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Cutting the Pace

ALTHOUGH visitors to Indianapolis last Tuesday saw a fine race, as was assured beforehand by the many fast cars entered, it will have been something of a disappointment to some that the speed fell short of what was done last year. Reflection, however, shows that it is really a cause for congratulation that so manifestly excellent a race can be run without breaking any speed records. Racing is interesting because it is a contest; it is also exciting largely for the same reason; the excitement natural to the occasion of a contest is merely enhanced by very high speed and not dependent upon it.

The automobile racing of the old type was to open out everything fully and hope that the car would hold together. To-day we are getting such immense power that this practice cannot be followed, the car must be held in check to some extent lest it pound itself to pieces, so the best speed at which to win a race is that speed which will just, and only just, suffice to win.

Another strong impression gained by seeing the 1916 Indianapolis speedway race, after having witnessed several events on the board tracks, is that the old course is of a far more sporting character. There the skill of the driver in taking the turns is ever being called upon to manifest itself in some new way, for with a big bunch running it is often impossible to take a turn in just the same way on each circuit. That the board speedways are faster is not likely to upset the popularity of Indianapolis as long as we have the drivers to put up such a splendid spectacle as that provided on Decoration Day, 1916.

Industrial Warriors

NOT a man who heard Howard E. Coffin's speech on Monday night could have failed to be convinced of the absolute common sense of the program which the industrial preparedness committee has before it. All in the automobile industry should respond to the appeal as one man, for they all know and appreciate the ability and the creative power of the man at the head of affairs. As long as Howard Coffin holds the wheel and has his foot on the accelerator, the work will go ahead quickly and certainly.

Truck Transmission

IN the evolution of all kinds of machinery the time always arrives when compromise has to be struck, and the automobile is by far the greatest example of compromise which it would be possible to find.

For example, we all know that it is a vicious thing, mechanically speaking, to take power around a corner. We all know that it is possible to build a chassis so that the crankshaft is parallel with the axles, and we also know that such cars are not built because the drawbacks of the construction more than outweigh the theoretical advantages.

For this reason it is never either safe or right to base an argument about any detail of automobile construction solely upon theoretical grounds. Theory must take its place, should be the basis of nearly all good mechanical controversy, but it must be backed up or compared with a proper balancing of the *practical.*

A machine is made for the purpose of performing certain work. A motor truck is made to carry goods. If all motor trucks had to carry the same goods in the same loads over the same roads, it might be easy to find a single ideal design, but so long as everything from the selling price to the nationality of the driver affects the conditions of service, so must the design be a matter of compromise.

Now, when a dozen different men start work independently upon the same problem and that problem is hedged with practical difficulties, they are certain to work out a dozen different solutions. They may all be correct solutions, but more likely they will all be incorrect, some approaching nearer to the right answer than others.

There are scores of different ways of getting power from the engine to the road wheels of a truck, and we are using about six of them to-day. In 3 years we may be using six more as electric and hydraulic schemes are brought to perfection. Thus it is much more probable that more study will produce more types of drive than that it will reduce them, and it is beyond belief that there will be one final system within the present century at any rate.

Macauley to Succeed H. B. Joy

To Be Packard President—Joy Remains Chairman of Directors' Board

DETROIT, MICH., May 31—Alvan Macauley, vice-president and general manager of the Packard Motor Car Co., is soon to be given the title of president in recognition of his service in the affairs of the company. H. B. Joy, now president, will remain actively connected with the organization as chairman of the board of directors.

Mr. Macauley has virtually been president of the Packard company for the past 2 years and the upbuilding of that organization is in his hands and the responsibility also is his. Mr. Joy has been working toward the end of broadening and strengthening the organization to meet the conditions of its very much enlarged business conditions, thus requiring more help at the top. As a result the title of president of the company will be conferred on Mr. Macauley in the near future at the request of Mr. Joy and with the approval of the directors as a well merited recognition of Mr. Macauley's ability.

The change in titles of the officials of the company will not change the conditions which have been in effect for much more than a year.

Hayes to Make Wire Wheels

JACKSON, MICH., May 29—To meet the demand for wire wheels as well as the wood type, the Hayes Wheel Co. has decided to manufacture the wire type along with its wood wheel production. General selling agent for the Hayes wire wheel will be the Castle & Kyte Co., 872 Woodward Avenue, Detroit. The latter is a new organization, composed of F. E. Castle, well known in the trade as the head of the F. E. Castle Co., and H. W. Kyte, former assistant general manager of the Houk Mfg. Co., Buffalo.

Packard Plans Stock Increase

DETROIT, MICH., May 29—P. H. McMillan, secretary and treasurer of the Packard Motor Car Co., has called a special meeting of the stockholders for June 3, at which time action will be taken on a proposal to increase the capital stock of the company from $8,000,000 common stock to $13,000,000 authorized. At the present time there is outstanding $7,065,300 in common stock, $934,700 of that at present authorized being unissued. The $8,000,000 authorized preferred stock will be changed. There is outstanding $5,000,000 of this, the remaining $3,000,000 being retained in the treasury.

It is not stated at this time just what disposition will be made of the new funds resulting from this stock issue, if approved, but with the earnings running very high, it is probable that it will be devoted to plant extensions and a still further strengthening of the Packard's financial position. At the present time Packard is earning approximately 60 per cent on the present common stock for the current fiscal year, after charging off $1,700,000 for depreciation.

1917 Moon Little Changed

ST. LOUIS, MO., May 27—For the first time in the history of the Moon Motor Car Co., this city, there will be no radical changes in Moon cars for the 1917 season.

Because of the congested condition of the material market, the rush to keep ahead of the demand, it is necessary to place orders for parts 6 to 8 months in advance.

This condition prompts the company to hold to the lines of its 1916 models to a large extent for 1917. In order to be ready to put out radically different models in July, it would be necessary this year for the manufacturer to place his orders for parts in December or January, too early to determine definitely what changes were desirable.

It means, too, that the Moon factory will run 100 per cent capacity during June and July. In other words, there will be no lapse in the manufacturing end at all between the end of the 1916 season and the opening of the 1917 season.

Mid-West S. A. E. Meets June 2

CHICAGO, ILL., May 31—"Art and the Motor Car," by W. B. Stout of the Scripps-Booth Co., is one of the papers to be read at the June 2 meeting of the Mid-West Section of the Society of Automobile Engineers. Another paper will be "Problems Involved in the Choice of Motor Truck," by Henry Farrington of the Thomas B. Jeffery Co.

Carter Heads Philadelphia Engineers

PHILADELPHIA, PA., May 27—At the annual meeting of the Engineers' Club of Philadelphia, with which is affiliated the Pennsylvania section of the S. A. E., the following officers were elected: President, E. B. Carter; vice-president, J. H. M. Andrews; secretary, Robert H. Fernald; treasurer, William M. Irish.

Argo Receives French Order

JACKSON, MICH., May 29—The Argo Motor Co., this city, has received an order of 250 cars from the Exporters of Manufacturers' Products of France.

Aluminum Motor for Premier

New Model to Have Electric Gearshift — Thermostatic Water Cooling Control

INDIANAPOLIS, IND., May 25.—Details on the new Premier, which will be put on the market within the next few months by the Premier Motor Corp., are just beginning to be known to the industry. The present organization which has taken over the huge plant of the T. B. Laycock Co., manufacturer of bed springs, is ready to begin operations as soon as the machinery which has been ordered is installed and started on production.

Modern ideas are incorporated throughout the chassis which has an aluminum motor with cast iron cylinder sleeves. The entire cylinder and crankcase is a unit casting of Lynite and the motor dimensions are 3⅜ by 5½. According to present plans the motor will have overhead valves carried in a separate valve head casting. Aluminum pistons, counterbalanced crankshaft and helical camshaft drive are other features.

Among the other important specifications of the car are thermostatic water cooling control, unit power plant, single plate clutch, Cutler-Hammer electric gearshift, Timken spiral bevel axle, sheet steel body and a deep frame, scientific chassis design. Collins curtains that open with the door will be used. The price will be, according to present plans, $1,685 for a seven-passenger touring model.

This concern is now occupying an ideal plant covering a tract of 40 acres and having a floorspace of about 327,000 sq. ft. It is capitalized at $2,500,000.

Denby Truck Prices and Load Capacities Revised

DETROIT, MICH., May 29—The Denby Motor Truck Co. has revised the prices of its several models as follows: Type R, 1-ton capacity, $1,020; type G, 1½-ton capacity, $1,575; type H, 2-ton capacity, $1,790, and type K, 2½-ton capacity, $2,090. It is explained that while these new prices seem higher, they are in reality little changed over the old figures, inasmuch as the Denby trucks have been underrated heretofore and, while they were amply able to carry larger loads, it is only now that they have been given a revised and greater load rating. The new prices, therefore, are simply commensurate with the added capacity. Of course, in making these changes in load ratings, certain alterations have been made in the chassis to take care of all contingencies with the heavier loads, making the vehicles in every sense capable of the work they do.

Ward Leonard Co. in New Plant

Occupies Factory with 50% Larger Manufacturing Facilities in Mt. Vernon

MOUNT VERNON, N. Y., May 26.—The Ward Leonard Electric Co. has moved into its new building in this city. The need of more space and labor operators was the reason for the company moving from Bronxville. The floor space has been increased approximately 50 per cent.

The Ward Leonard Electric Co. started manufacturing electric controlling devices in Bridgeport, Conn., in 1892. After 2 years in Bridgeport, and 3 years in Hoboken, N. J., it moved to Bronxville, N. Y., and has been manufacturing in Bronxville since 1897, or for the past 19 years. The new location is nearer New York.

A 6-Weeks Engineering Course

DENVER, COL., May 26—A short course in automobile and tractor engineering will be given this summer by the Colorado Agricultural College, at Fort Collins. The special course will start June 19 and continue 6 weeks. It will be a practical course for garagemen, car owners, farmers, chauffeurs, threshermen, farming contractors and car and tractor salesmen.

S. C. Johnson & Son Raise Wages 10 Per Cent., Due to Prosperity

RACINE, WIS., May 27.—S. C. Johnson & Son, manufacturing Johnson's prepared wax and cleanser, gave their entire force of employees an agreeable surprise on the last pay-day by adding 10 per cent to their checks and announcing that all wages will be 10 per cent higher in the future. The company employs about 200 men and the wage increase means an additional outlay of $15,000 annually. The action was taken to carry out the wishes of S. C. Johnson and Herbert F. Johnson, owners of the concern that the employees share in the prosperous condition of the business.

Martin V. Kelley Co. Opens Branch in New York

NEW YORK CITY, May 31.—The local branch of the Martin V. Kelley Co., Toledo, Ohio, will be opened to-morrow. The New York City office of this advertising concern will be at 171 Madison Avenue. The company's invasion of this city is due to the purchase by Mr. Kelley of the entire business of Bromfield & Field, Inc., New York.

The new accounts taken over by the Kelley company include the Fisk Rubber Co., Chicopee Falls, Mass.; Ajax Rubber Co., Trenton, N. J.; Mercer Automobile Co., Trenton; F. I. A. T., Poughkeepsie, and the Boston Woven Hose & Rubber Co. The Toledo office includes among its accounts fourteen companies in the automobile field. In taking over the local concern R. A. Field, treasurer of the firm, has been retained and also becomes a vice-president.

Goodman Sets Up For Himself

NEW YORK CITY, May 29—Henry Goodman, who has managed the New York office of the Springfield Metal Body Co. for 2 years, has incorporated the Goodman Auto Body Co. and will handle the Springfield business in eastern territory, the change taking effect June 1. He will continue the office at 1737 Broadway.

Mr. Goodman, who is president of the new company, was connected with the Pope Mfg. Co. for 18 years.

Allen's 300 per Cent Dealer Gain

FOSTORIA, OHIO, May 27.—The Allen Motor Co., this city, reports an increase of 300 per cent in the number of its dealers during the past year. The company's production of cars has tripled in the past 11 months and the dealers' orders exceed the factory's capacity by 50 per cent.

Premier Appoints District Managers

INDIANAPOLIS, IND., May 24.—The Premier Motor Corp., this city, has appointed the following district managers: In the East, H. C. Arnold, formerly with the Hudson Company in Chicago; West, H. L. Pelton, formerly with the Chalmers company; Southwest, A. G. Dale, formerly selling Chandler cars; Northwest, R. S. Ellis, formerly with the Winton company in Detroit; Pacific Coast, P. A. Berry, formerly distributor of the Packard and Hudson in Tacoma, Wash.

Duluth Jitney Ordinance Upheld

DULUTH, MINN., May 27.—The Supreme Court of the state has upheld the jitney ordinance of this city. Police are notifying jitney operators to take out licenses at once. They must pay a wheelage tax also. The law provides strict regulations and the filing of accident bonds. The ordinance was passed in May, 1915. Before effective a referendum petition was filed against it. It was agreed with jitney operators certain provisions would be withdrawn. The ordinance was repealed. Some jitney men refused to abide by the agreement as to the second ordinance. One driver offered himself as test. The court held that the second ordinance differed in important particulars from the first and that the evidence did not show the council acted in bad faith.

DeLaski Loses Tire Core Suit

Decision in Favor of U. S. Tire Co. Upheld by Circuit Court of Appeals

NEW YORK CITY, May 27.—The decision by Judge Hand in the United States District Court in favor of the United States Tire Co., last December, in a suit brought against it by the De Laski & Thropp Circular Woven Tire Co., has been upheld by the United States Circuit Court of Appeals in New York. The case was an effort on the part of the De Laski & Thropp company to secure the upholding of its tire core patent by means of new testimony, following a decision of the Circuit Court of Appeals, holding the patent invalid because anticipated.

The patent in question covered molds used in the manufacture of tires by practically the entire industry, and if upheld would have given a practical monopoly to the owner.

The lower court held the patent invalid through having been anticipated by the B. F. Goodrich Co.

Maryland Jitneys Under P. S. C.

BALTIMORE, MD., May 29.—Beginning July 1 all jitney buses operated in Maryland must have permission from the Public Service Commission. Under the provisions of a law enacted by the General Assembly the Commission must approve the lines before the proprietors will be able to secure licenses from the Automobile Commissioner.

To Test Duluth Wheel Tax

DULUTH, MINN., May 27.—Under the auspices of the Automobile club a move has begun to test the city wheelage tax in the courts. At a meeting of 500 car owners President J. D. Park of the club was authorized to appoint a committee of seven to take the steps. Seventy-five new members were added to take part in the campaign. The tax is held unjust in addition to the personal property tax on automobiles. The law went into effect in July, 1910. The tax is 50 cents per horsepower for cars and $10 per ton for trucks.

Open Motor Demonstration Field

SAN DIEGO, CAL., May 22.—The motor demonstration field at the Panama-California Exposition was opened last Saturday, May 20. The opening celebration was in charge of the San Diego Automobile Dealers' Assn. On Saturday the dealers engaged in a gymkana on the field and the following day a provisional company of the California Section, Automobile Reserve Corps maneuvered on the field with the Twenty-eighth Company, Coast Artillery Corps, United States Army. The cars were driven from Los Angeles by members of the Automobile Reserve Corps and the command returned to Los Angeles as soon as the maneuvers at the exposition were over and the U. S. regulars had been transported back to Fort Rosecrans, where they are stationed. The run was the longest of any yet attempted by a large fleet of cars under the colors of the A. R. C. Of the twenty or more cars in the line, not one suffered from mechanical or tire trouble on the entire trip and the entire command rolled into San Diego just as it left Los Angeles and returned the same way.

Buick Ambulance Sent to France by Wilmington

WILMINGTON, DEL., May 29—As the result of a campaign which has been carried on in this city for the collection of funds to aid in French army relief, a model field ambulance has just been completed in this city and will be shipped in a few days. The car was built by the Wilmington Automobile Co. It is mounted on a Buick chassis, has heavy-duty tires and all parts of the sub-construction are suitable for the strenuous service it undoubtedly will undergo.

Canadian Market for English Cars

MONTREAL, QUE., May 29—The English automobile manufacturer is going to invade the Dominion as soon as the war is over, and will establish agencies in all the provincial cities and towns throughout Canada. The English manufacturer will especially feature light cars, and there is a large field in this country for the cars the English manufacturers are turning out. There are a few light cars of English make in this city at present, and several of a French make. The cars are complete in every detail, are moderate in price and the cost of upkeep is very small.

American Brass Co. To Expand

Plans Expenditure of $1,600,000 to $2,000,000 in Enlarging Its Plant

KENOSHA, WIS., May 27.—The American Brass Co., Waterbury, Conn., operating a large rolling mill and brass foundry at Kenosha, Wis., has made public plans for improvements at Kenosha to cost between $1,600,000 and $2,000,000, which will make the local works the largest of the kind in the country. At the same time about $400,000 will be expended in enlarging the Waterbury works. At Kenosha the brass mill will be enlarged by an addition, 320 by 225 feet, and the foundry by an addition of 320 by 200 feet. A new administration building is included in the plans, which will require about 2 years to carry out.

Emerson Plans $10,000,000 Plant

PHILADELPHIA, PA., May 30—The Emerson Motor Car Mfg. Co., recently formed to build the S. S. E. car, will build a $10,000,000 plant in this city. The buildings and equipment will cost between $2,000,000 and 3,000,000.

The concern is composed of New York City and Chicago capitalists and has a capital of $10,000,000, which is stated to be all paid in.

Gasoline Lower in Oklahoma — Unchanged in Eastern States

NEW YORK CITY, May 29.—Gasoline prices in this city continue unchanged. So far, dealers say, none of the large refineries have indicated their intention of advancing the wholesale charge, which continues at 24 cents a gal., in this city and 23 cents in New Jersey.

Retailers in this city are asking from 27 cents to 31 cents a gal. In New Jersey, some of the dealers are selling at 24 cents a gal.

Oklahoma gasoline prices were reduced last week 2 cents a gal. to 23 cents tank wagon basis.

The active season for gasoline is near at hand, and it is predicted that the chances for a downward revision in prices are not promising. In fact, higher prices are looked for when the consumption of gasoline is at its maximum.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge
Aluminum, lb.	.58	.58	.58	.58	.58	...
Antimony, lb.	.28	.27	.26½	.25	.25	— .03
Steel Beams and Channels, 100 lbs.	2.77	2.77	2.77	2.77	2.77	...
Steel Bessemer, ton	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.29¼	.29	.28½	.28	.28	— .01¼
Copper, Lake, lb.	.29¼	.29	.28½	.28	.28	— .01¼
Oil, Cottonseed, bbl.	10.85	10.85	10.80	10.70	10.70	— .15
Oil, Fish, Menhaden, Brown, gal.	.55	.55	.55	.55	.55	...
Oil, Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	...
Oil, Lard, prime, gal.	1.10	1.10	1.10	1.10	1.10	...
Lead, 100 lbs.	7.25	7.25	7.25	7.25	7.25	...
Oil, Linseed	.70	.70	.70	.70	.70	...
Steel, Open-Hearth, ton	42.00	42.00	42.00	42.00	42.00	...
Oil, Petroleum, bbl., Kans., crude	1.55	1.55	1.55	1.55	1.55	...
Oil, Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Oil, Rapeseed, refined, gal.	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para., lb.	.68	.67½	.67½	.67	.67	— .01
Rubber, Ceylon, First Latex	.70	.70	.70	.70	.70	...
Sulphuric Acid, 60 Baume, 100 lb.	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	48.00	47.50	47.50	47.50	47.50	— .50
Tire Scrap, lb.	.05¼	.05¼	.05¼	.05¼	.05¼	...

Now Durston Gear Co.

SYRACUSE, N. Y., May 29.—The Durston Gear Co., this city, has been incorporated to carry on the business of the Lefever Arms Co., whose corporate existence has ceased. During the past few years the business of the gear department of the Lefever company has taxed the entire space of its factory, requiring the entire attention of the company. As a result the assets, other than the factory and machinery of the gun department were sold. The proceeds of this sale were transferred to the gear department. The management, ownership and the financial responsibility of the new company remains the same as the old company.

Electric Taxicabs for Chicago

CHICAGO, ILL., May 29.—Guy Woods, the owner of the American Motor Livery Co. of Chicago, has recently placed an order with the Milburn Wagon Co. for twelve specially built electric town cars to be especially equipped. The new electric cab will be of the limousine type and will accommodate five passengers.

Electric taxicabs have for some time past successfully operated in Detroit. The Detroit Taxicab & Transfer Co. now operates a fleet of fifteen electric cabs.

Chevrolet Exports to Australia

NEW YORK CITY, May 29—The Chevrolet Motor Co., this city, is exporting 384 cars to-day for ports of Australia and New Zealand, and has a rush order for 900 more. The steamship *Florence Luckenbach*, which will carry the cars, is taking the largest single export shipment of passenger cars ever leaving an American port.

Olds Doubles Production

LANSING, MICH., May 29—The production of Oldsmobiles, already well beyond the 10,000 mark per annum, is to be raised to 20,000 cars next season.

Materials Market Steady

NEW YORK CITY, May 29—With the exception of a further drop in copper prices, the materials markets on the whole were steady. Both electrolytic and lake coppers dropped 1¼ cents a lb. to 28 cents. The copper market was dull due to sharp breaks at London, indirectly affecting the market. There is little forward buying now in evidence.

Para rubber has dropped to 67 cents a lb. with an easy market in both that grade and Ceylon. The last name has been shown very little interest lately and quotations have been maintained steadily at 70. Mail advices from London state in their explanation of the present low rubber prices that considerable quantities in the warehouses there have been sold, the shipment of which to America has been rather seriously delayed through the difficulty in getting permits.

Goodyear Capital Increased $18,000,000

AKRON, OHIO, May 29.—The Goodyear Tire & Rubber Co., Akron, has filed papers with the Secretary of State increasing its preferred stock from $7,000,000 to $25,000,000. The common stock of the company already amounts to $25,000,000, making a total capital of $50,000,000.

Dividends Declared

Yale & Towne Mfg. Co., quarterly of 1¾ per cent, payable July 1 to stock of record June 23 and an extra dividend of 10 per cent, payable June 7 to stock of record May 31.

Chandler Motor Car Co.; quarterly of 2 per cent and extra dividend of ½ per cent, payable July 1, 1916, to stock of record.

Packard Motor Car Co.; quarterly of 1¾ per cent on preferred, payable June 15 to stock of record May 31. Books do not close.

Record Prices for Securities

General Motors Rises 84 Points —Chevrolet Up 11—Activity and Strength

NEW YORK CITY, May 29.—Another period of activity and strength among the automobile and accessory shares has set in. The motor market was featured by United Motors Corp., selling on a when issued basis. Sales in this security alone totalled 150,500 shares. From an opening of 64½ points, the stock advanced to 78 on Saturday. The movement in United Motors was responded to by a 20-point rise in Perlman Rim Corp. stock, which is to be a part of the United Motors Corp.

On Thursday Chevrolet opened at 249, a new high level. General Motors has advanced to 515 or 115 points higher than its low cost this year. Rumors had it that a special cash disbursement of $100 might be made at the end of the current fiscal year. Earnings for the year, it was said, would probably approximate $25,000,000, which after payment of the preferred dividend would leave around 150 per cent on the common. Chandler Motors was another strong feature of the motor group, with a rise of 5½ points. This company is reported to be earning at the rate of 20 per cent a year. It is expected that the present 6 per cent dividend rate will be placed higher at the coming directors' meeting.

Peerless Truck went up 5½ points to 102. Net earnings of this corporation in April were approximately $200,000, or at the rate of $2,400,000 annually. This has been the monthly average since the first of the year.

Saxon stock went up to 83, a gain of 9½ points. This company inaugurated dividends recently by paying $1.50 a share, thus placing the stock on a $6 a year basis. The stock is soon to be placed on the New York Stock Exchange.

Splitdorf magneto fractional stock is being bought and sold by Kidder, Peabody & Co., in order to make full shares, on the basis of $95 a share for the preferred and $75 a share for the common. As the dividend to Torrington common shares amounts to 7-100 of a share of Splitdorf preferred and 1-10 share of common, the total value of the dividend is about $14.15.

80% Paige-Detroit Stock Dividend Approved by Stockholders

DETROIT, MICH., May 26—Stockholders of the Paige-Detroit Motor Car Co. at a special meeting Wednesday in the company's general offices gave their approval to the recommendation by the company's directors that a stock dividend of 80 per cent of the par value of $400,000 be distributed pro rata to the stockholders of record May 13.

Approval was given also to the directors' recommendations that the authorized capital stock of the company be increased from $1,000,000 to $2,000,000 and that the par value of the stock be cut down from $100 to $10 a share.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	66½	68	+ ½
Aluminum Castings pfd	98	100	..	..	..
J. I. Case pfd	..	..	86	90	..
Chalmers Motor Co. com	89	91	170	180	+10
Chalmers Motor Co. pfd	95	97	97	101	+1
Chevrolet Motor Co	..	..	242	244	+11
Chandler Motor Car Co	..	..	102	103	+5½
Electric Storage Battery Co	..	..	62	64	+2
Firestone Tire & Rubber Co. com	475	480	840	860	+10
Firestone Tire & Rubber Co. pfd	110	112½	113	114	..
General Motors Co. com	135	136¼	515	525	+84
General Motors Co. pfd	98	100	116	117	— ½
B. F. Goodrich Co. com	43	45	75¾	76½	..
B. F. Goodrich Co. pfd	101¼	102	115	115½	..
Goodyear Tire & Rubber Co. com	240	..	392	396	+12
Goodyear Tire & Rubber Co. pfd	105	106	105	106	..
Grant Motor Car Co	..	..	11½	12½	+ ½
Gray & Davis, Inc., pfd	..	..	..	..	..
International Motor Co. com	14	15	10	14	..
International Motor Co. pfd	34	38	22	30	..
Kelly-Springfield Tire Co. com	127	130	72	73	+2
Kelly-Springfield Tire Co. 1st pfd	82½	85	95	99	—1
Kelly-Springfield Tire Co. 2d pfd	115	135	..	..	..
Maxwell Motor Co. com	42½	44	85½	86½	+ ½
Maxwell Motor Co. 1st pfd	86	87½	89	91	+ ½
Maxwell Motor Co. 2d pfd	37	38¾	57	59	— ½
Miller Rubber Co. com	180	185	300	..	..
Miller Rubber Co. pfd	104	105	115	..	..
New Departure Mfg. Co. com	136	141	275	285	—2
New Departure Mfg. Co. pfd	106	..	113	..	..
Packard Motor Car Co. com	..	104½	225	..	+21
Packard Motor Car Co. pfd	..	100½	100	105	..
Paige-Detroit Motor Car (new)	..	..	45	60	..
Peerless Motor & Truck Corp	..	..	25½	26	+5½
Perlman Rim Corp	..	..	148	150	+20
Portage Rubber Co. com	35	38	85	88	..
Portage Rubber Co. pfd	85	88	107½	108½	..
Regal Motor Co. pfd	..	..	20	30	..
*Reo Motor Truck Co	14⅞	15½	38	38¾	+1
*Reo Motor Car Co	32¾	33½	42	42¾	—2½
Saxon Motor Car Co	..	..	83	85	+9½
Splitdorf Electric Co. pfd	..	..	..	..	..
Standard Motor Co	..	..	8	8½	..
Stewart-Warner Speed. Corp. com	64	67	88½	89½	+ ½
Stewart-Warner Speed. Corp. pfd	103	105	109	..	..
Studebaker Corp. com	67	69	137	139	— ½
Studebaker Corp. pfd	97½	99½	107	111	—2
Swinehart Tire & Rubber Co	80	90	83	84	..
Texas Company	123½	125	192	194	+1
United Motor Corp	..	..	78	78½	+14½
U. S. Rubber Co. com	62	64	55¼	56	+ ½
U. S. Rubber Co. pfd	105	107	109	110	..
Vacuum Oil Co	200	205	249	252	+6
White Motor Co. (new)	..	..	50½	50¾	—1
Willys-Overland Co. com	114½	116½	265	275	—6
Willys-Overland Co. pfd	100	103	106	107	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co	..	..	34½	..	..
Chalmers Motor Co. com	88	91	179	..	+16½
Chalmers Motor Co. pfd	94	97	96	100½	..
Continental Motor Co. com	175	185	37¾	38¾	+ ¼
Continental Motor Co. pfd	84	86	9½	10⅛	..
Ford Motor Co. of Canada	950	1000	..	400	..
General Motors Co. com	135	140	430	525	..
General Motors Co. pfd	98	99	115	119	+1
Maxwell Motor Co. com	41½	43½	84½	87½	— ½
Maxwell Motor Co. 1st pfd	85½	87½	88½	91½	— ½
Maxwell Motor Co. 2d pfd	36½	38½	57½	60	+2½
Packard Motor Car Co. com	102	104	230	240	+24
Packard Motor Car Co. pfd	99	..	101	104	..
†Paige-Detroit Motor Car Co	..	..	55	..	..
*W. K. Prudden Co	19½	21	..	47	..
*Reo Motor Car Co	32¾	33¾	42	43	—2½
*Reo Motor Truck Co	14¾	15⅝	37½	38½	+1½
Studebaker Corp. com	66	68	136½	139½	+1½
Studebaker Corp. pfd	..	99	110	..	+2

INACTIVE STOCKS

*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	200	..	..	350	..
Regal Motor Car Co. pfd	..	25	17	..	+1

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*Par value $10. †New stock.

Cars Are Faster Than Their Drivers

Indianapolis Produces Opposite Effect to That on Board Speedways Where Drivers Are Speedier Than Cars—Cooling Engines and Tires—Carburetion and Lubrication

(Continued from page 966)

INDIANAPOLIS, IND., May 30—The Indianapolis contest is more of a race of drivers than is Sheepshead Bay or Chicago; the whole situation is summed up in the statement that on the board speedway the drivers are faster than their cars, while at Indianapolis the cars are faster than the drivers. The turns must be coasted and hence speed is lost twice in every lap.

Owing to the necessity for reducing the speed the cars that have the greater acceleration possess a great advantage. This quality of acceleration means that reserve power must be on tap. The engine must be ready to carry the speed back to the highest safe maximum and must be able to hold it there. This condition makes for circumstances that are much more difficult for the engine to meet.

It is this shutting down that causes so many oiling troubles on the Indianapolis track. The closing of the throttle allows the oil to accumulate and it is forced up into the combustion chamber, with the result that the plugs are fouled and have to be frequently renewed. Indianapolis is the hardest speedway on spark plugs in the country, for this reason.

Carburetion Important

Carburetion on the Indianapolis speedway is one of the points which must be watched carefully as the tendency for the driver to step down hard upon the accelerator pedal in coming out of the turns, puts the hardest kind of service up to the carbureter. The tendency is toward a failure to supply sufficient gasoline quickly in order to meet the demands of the wide open throttle. The multi-jet carbureter has been found to work out very well in this respect, because the gasoline has the tendency to collect in the jet wells when the throttle is closed and then to be available immediately upon opening the throttle.

A study of the pit stops does not reveal any definite weakness, unless it be in the tendency to short-circuit the plugs, due to accumulation of oil. It naturally gives rise to the thought that the clearances with the aluminum pistons may be too high. This seemed to be shown particularly in the Frontenac cars, which were in and out of the pits many times, for the purpose of changing plugs. The space before the Frontenac pit was covered with oil and it seemed to show that a great excess was reaching the combustion chamber because the number of plugs that were cleaned and renewed

Details and Equipment of Cars in the Indianapolis 300-Mile Race

No.	Car	Driver	Cyl.	Bore	Stroke	Carb.	Plugs	Pistons	Valves	Oil	Wheels	Tires	Front	Rear	Wheel-base
1	**Duesenberg**	**D'Alene**	4	3.9	6	Miller	Rajah	Levett	8	Oilzum	Rudge	Silvertown.	32x4½	33x5	106
4	**Maxwell**	**Henderson**	4	3.75	6.75	Miller	Rajah	Levett	16	Oilzum	Houk	Silvertown.	34x4½	35x5	106
5	**Maxwell**	**Rickenbacher**	4	3.75	6.75	Miller	K.L.G	Levett	16	Oilzum	Houk	Silvertown.	34x4½	35x5	106
6	**Frontenac**	**L. Chevrolet**	4	3.87	6.375	Zenith	Rajah	Alum.	16	Monogram	Rudge	Silvertown.	33x4½	33x4½	104
7	**Frontenac**	**A. Chevrolet**	4	3.87	6.375	Zenith	Rajah	Alum.	16	Monogram	Rudge	Silvertown.	33x4½	33x4½	101
8	**Frontenac**	**G. Chevrolet**	4	3.87	6.375	Zenith	Rajah	Alum	16	Monogram	Rudge	Silvertown.	33x4½	33x4½	104
9	**Osteweg**	**Haibe**	4	4.35	5	Miller	Answer	Levett	16	Castor	Houk	Silvertown.	32x4½	33x5	102
10	**Peugeot**	**Mulford**	4	3.662	6.625	Zenith	Rajah	Levett	16	Oilzum	Rudge	Silvertown.	34x4½	35x5	110
12	**Ogren**	**Alley**	4	3.989	6	Miller	Rajah	Levett	8	Castor	Houk	Nassau	......	......	106
14	**Sunbeam**	**Christiaens***	6	3.213	6.25	Miller**	Champion.	Steel	24	Mixed	Rudge	Firestone	35x5	35x5	113
15	**Delage**	**Oldfield**	4	3.726	6.31	Miller**	Rajah	Levett	16	Oilzum	Rudge	Firestone	34x4½	35x5	104
17	**Peugeot**	**Resta**	4	3.655	6.6	Miller	K.L.G	Levett	16	Oilzum	Rudge	Silvertown.	34x4½	35x5	106
18	**Peugeot**	**Aitken**	4	3.655	6.6	Zenith	K.L.G	Levett	16	Oilzum	Rudge	Silvertown.	34x4½	35x5	100
19	**Peugeot**	**Merz**	4	3.655	6.6	Zenith	K.L.G	Levett	16	Oilzum	Rudge	Silvertown.	34x4½	35x5	106
21	**Delage**	**Devigne**	4	3.70	6.31	Miller***	K.L.G	Levett	16	Castor	Rudge	Silvertown.	33x4½	33x5	106
22	**Delage**	**LeCain**	4	3.70	6.31	Miller	......	Levett	16	Castor	Rudge	Silvertown.	......	......	106
23	**Peusun**	**Franchi**	4	3.706	6.31	Miller	K.L.G	Steel	16	Oilzum	Rudge	Silvertown.	34x4	35x5	106
24	**Crawford**	**Chandler**	4	3.75	6.75	Miller	Rajah	Levett	16	Oilzum	Rudge	Nassau	32x4½	34x4½	106
25	**Crawford**	**Lewis**	4	3.75	6.75	Miller	Rajah	Levett	16	Oilzum	Rudge	Nassau	32x4½	34x4½	106
26	**Crawford**	**Johnson**	4	3.75	6.75	Miller	Rajah	Levett	16	Oilzum	Houk	Nassau	32x4½	33x4½	106
27	**Premier**	**Rooney**	4	3.66	6.656	Zenith	K.L.G	Levett	16	Oilzum	Rudge	Silvertown.	32x4½	35x5	105
28	**Premier**	**Anderson**	4	3.66	6.656	Zenith	K.L.G	Levett	16	Oilzum	Rudge	Silvertown.	32x4½	35x5	105
29	**Premier**	**Wilcox**	4	3.66	6.656	Zenith	K.L.G	Levett	16	Oilzum	Rudge	Silvertown.	32x4½	35x5	105

*Six cylinders, all others are fours.
**Two carbureters.
***Two duplex carbureters giving four mixing chambers.

All cars in the race used Bosch Magnetos, Dixon's Graphite, Motometers and Hartford Shock Absorbers.

was excessive. An examination of the plugs that were used showed that they were not burnt out or destroyed but simply fouled by excessive lubricant.

Motometer readings do not indicate any overheating. It seems that racing cars are now more effectively cooled than ever before. The waterjacketing spaces on all the cars that are now racing are generous, and the seizing of pistons was very conspicuous by its absence. Of course, with the shutting off on the turns, seized pistons are not to be expected as often as at New York where there is no shutting down and the speeds range almost 20 m.p.h. faster.

Difficulty in starting means the loss of many seconds and may sometimes cause the loss of a position. The two Maxwells required vigorous efforts to crank them and the Crawford driven by Johnson lost half a lap at the very start of the race because it could not be started until five or six men pushed it. This may seem a trifling matter, but in a race where 15 sec. counted for perhaps $5,000, it may become a very important detail.

A leaky gasket on the Crawford driven by Chandler caused a considerable amount of trouble. This was replaced twice, but the tank could not be kept sealed due to some defect in the filler cap attachment. This was one of the exceptional cases where details bothered the drivers. The race was particularly free from the small troubles which generally cause a great many delays. There was more tire trouble than would have been expected in the light of the good performances in recent races, but the sun was warm and the vitrified brick of the track was hot to the touch.

A Tire-Cooler

Eddie Rickenbacher had an attachment on his car that he seemed to be a little sensitive about. At any rate, he kept it covered with a pair of overalls before starting. This was eventually discovered to be a tire-cooling attachment. In the tail a quantity of water was contained and leads were taken to each wheel ending in spray nozzles by which the water can be thrown on the tires. It is said to operate under about 4 lb. air pressure, the controlling valve being handled by the mechanic.

England Buys Plant Site

DETROIT, MICH., May 29—The England Mfg. Co., making a specialty of pressed steel door panels for automobiles, and at present located in a factory at Jefferson and Campbell Streets, this city, has acquired a 3-acre factory site adjoining the plants of the Federal Motor Truck Co., and contemplates building a plant comprising 54,000 sq. ft. of floorspace to enlarge its business in its specialty. The plant is to be ready for occupancy in 60 days.

The Record of Pit Stops

Duesenberg—D'Alene—One stop.
Lap 52; 1 min. 35 sec.
Changed right rear tire; took on gas and oil.

Maxwell—Henderson—Four stops.
Lap 53; 1 min. 18 sec.
Rickenbacher relieved Henderson; changed right rear tire; took on gas and oil.
Lap 72; 1 min. 10 sec.
Changed right front.
Lap 82; 40 sec.
Changed right rear and took on oil.
Lap 90; 5 min. 20 sec.
Oil lead broken from oil tank.

Frontenac—A. Chevrolet—Seven stops.
Lap 7; 8 sec.
Took on water.
Lap 19; 20 min. 30 sec.
Changed plugs; took on water and oil; leaking oil.
Lap 23; 19 min. 26 sec.
Changed eight plugs; took on water and oil; tightened crankcase, poured water on the brakes; leaking oil.
Lap 29; 2 min. 20 sec.
Took on water; tightened crankcase.
Lap 33; 4 min. 13 sec.
Took on gasoline; changed plugs.
Lap 40; 20 min.
Changed plugs; took on oil; magneto trouble.
Lap 41; 48 min.
Fouled plugs; magneto trouble; took on water and oil; changed magneto.

Frontenac—G. Chevrolet—Seven stops.
Lap 41; 2 min.
Consultation; oil trouble.
Lap 42; 7 min. 20 sec.
Changed plugs.
Lap 45; 35 min.
Valve bent; changed plugs; Joe Boyers took over wheel.
Lap 53; 5 min.
Fastened under pan; instructions; water leak.
Lap 73; 1 min. 18 sec.
Arranged right front and right rear tire; took on water.
Lap 78; 12 min. 10 sec.
Oil line broken; loose steering post.
Lap 83; out.
Burned out rod.

Osteweg—Halbe—Four stops.
Lap 57; 3 min. 30 sec.
Changed both rear tires; gas and oil.
Lap 91; 2 min.
Changed right rear tire; took on gas.
Lap 98;
Broken oxhaust pipe.
Lap 103; 1 min.
Changed mechanic and driver.

Peugeot—Mulford—One stop.
Lap 72; 33 sec.
Changed right rear tire; took on gas.

Ogren—Alley—Three stops.
Lap 37; 40 sec.
Exhaust pipe broken off.
Lap 55; 7 min.
Bolt in radiator stay rod; changed right front tire; water.
Lap 100; 1 min. 20 sec.
Right rear and water.

Sunbeam—Christiaens—One stop.
Lap 16; 30 sec.
Changed left rear tire.

Peugeot—Resta—One stop.
Lap 70; 1 min. 4 sec.
Changed right rear tire; took on gas.

Delage—Oldfield—Four stops.
Lap 9; 40 sec.
Changed right front tire.
Lap 40; 1 min. 19 sec.
Changed right rear tire; gas and oil.
Lap 72; 1 min.
Changed left rear tire; took on gas.
Lap 103; 23 sec.
Changed right front tire.

Peugeot—Aitken—Six stops.
Lap 18; 1 min.
Changed right rear tire.
Lap 25; 12 min.
Changed left rear tire.
Lap 50; 30 sec.
Changed right rear tire; took on gas.
Lnp 66; 51 sec.
Changed right rear tire.
Lap 68; 4 min.
Oil on plugs.
Lap 69; out.
Broken valve.

Peusun—Franchi—One stop.
Lap 9; 8 min. 37 sec.
Changed plugs.

Crawford—Lewis—Five stops.
Lap 6; 2 min.
Fixed gasoline tank gasket.
Lap 24; 2 min.
Changed hoth rear tires; examined plugs.
Lap 58; 2 min.
Changed both rear tires.
Lap 67; 3 min.
Gas tank loose.
Lap 70; out.
Loose gas tank.

Crawford—Johnson—Six stops.
Lap 15;
Information.
Lap 16; 22 sec.
Changed left rear tire.
Lap 26; 22 sec.
Changed right rear tire.
Lap 54;
Information.
Lap 55; 2 min. 20 sec.
Changed both rear tires; adjusted brake.
Lap 90; 2 min. 20 sec.
Took on gas; adjusted carbureter.

Premier—Rooney—Two stops.
Lap 23; 5 min.
Changed plugs.
Lap 38; 12 sec.
Le Cain relieved Devigne.

Premier—Anderson—Two stops.
Lap 15; 26 min.
Changed plugs.
Lap 25; out.
Broken connecting-rod.

Premier—Wilcox—Five stops.
Lap 4; 6 min.
Changed spark plugs.
Lap 14; 4 min. 6 sec.
Changed spark plugs.
Lap 41;
Gas and water.
Lap 45; 37 sec.
Changed right rear tire.
Lap 72; 3 min. 45 sec.
Took on water, gas and oil; engine boiling.

Crawford—Chandler—Six stops.
Lap 7;
New gas tank cover.
Lap 11;
Information.
Lap 12;
Gasket on tank.
Lap 40;
Changed drivers.
Lap 71;
Changed left rear tire; took on gas.
Lap 74;
Changed plugs.

1917 Model Six-Cylinder Grant Is $30 Higher in Price

CLEVELAND, OHIO, May 30—The Grant Motor Corp., this city, has announced its 1917 six-cylinder model which sells at $825 or $30 more than the 1916 model. The three- and five-passenger models will sell at $825, while the three-passenger cabriolet will cost $1,050.

Though the size of the motor remains the same, 3 by 4¼, several other changes have been made. The 1917 model has a Wagner two-unit starting and lighting system and Remy ignition. The valve rocker cover on the motor has been removed and the gasoline tank has been removed from the cowl to the back of the car. The Stewart vacuum feed system has been installed. The Stromberg carbureter has also been introduced.

Best Mfg. Co. Formed

LOUISVILLE, KY., May 26—The Best Mfg. Co., this city, has been formed with a capital of $100,000 to make electrical devices for automobiles. The incorporators are G. H. Turner, A. T. Burgevin and S. S. Fitzpatrick.

A temporary plant will be rented, which will be equipped and ready for operation by June 1. Later a plant will be erected and the business conducted on a large scale.

15,000 See Races at Twin Cities

Fords, Duesenberg, Buick and Velie Share Honors in Several Events

MINNEAPOLIS, MINN., May 30—Special *Telegram*—Fifteen thousand people witnessed the Twin City speedway races to-day at Fort Snelling, the entries being amateur drivers with the exception of Lee Oldfield in an Oldfield car. The 2-mile concrete track was in fair condition. Twenty-one entries participated in the four automobile events. Time was ordinary, and the only exciting moment was when C. W. Jewett in a Jewett car, an overhauled Ford, crossed the wire 1/5 sec. ahead of C. J. Gilbert's Mercer after a neck-and-neck race for the five laps in the 10-mile handicap, which was won by M. Sorenson in a Duesenberg in 8:35 2/5. Choates in a Carnation was fourth in 10:21. The purse was $300.

Fifteen entries were made in the 50-mile race, which was run in two sections, the total purse being $2,000. A Duesenberg won in 40:56, a Mercer was second in 40:32 3/5, H. C. Feichtinger's Marquette Buick third in 41:40 2/5 and Jewett fourth in 49:41 3/5.

Jewett won the first 10-mile event in 9:33, with Clyde Mohrs, in a Buick, second. There were five entries in this event in class C, division V, non-stock up to 230 cu. in., the prizes amounting to $300.

An interesting event was a non-stock race in the same division and class, 231 to 300 cu. in., 20 miles, for $300, with four entries. This race was won by a Mercer in 17:56. J. B. Defea's Velie was second in 18:50 2/5 and R. Douglas' Corbin was third in 23:32 1/5.

The Twin City trophy race for owners and drivers of the Twin Cities was eliminated by sundown. Two motorcycle events were run, and Ruth Law in an aeroplane beat an automobile for two laps of the track.

Engine troubles were the main causes of frequent failures to finish. The cars were prepared and entered by amateur drivers and, with the exception of the Jewett, were mainly local. Mr. Jewett is State president of the retail automobile dealers, and drove himself.

Although the race lacked the glamor of world-famous drivers who took part in the initial 500-mile event last September, the attendance was as large.

J. J. R. Features Newark Races

NEWARK, N. J., May 30—Bert Watson in a J. J. R. Special featured in to-day's automobile races at the Olympic Park ½-mile dirt track. J. W. Dickinson in a Stutz Special won the 5-mile Australian pursuit race and a 3-mile handicap event.

The J. J. R. made the best time for ½ mile, negotiating the distance in 38 2/5 sec. Its time in a 3-mile event was 4:29 1/5. In another 3-miler, there was a pretty race between the J. J. R. and Dickinson's Stutz Special. The J. J. R.'s time was 3:54 2/5 and the Stutz, 3:56.

A 5-mile free-for-all was also won by the J. J. R. with Dickinson's Stutz a close second. The latter car won the Australian pursuit race in 6:37 after the J. J. R. dropped out in the fourth lap. G. T. Theobald in a Mercedes was the last to drop out of the race.

Dickinson's Stutz also won the 3-mile handicap from scratch after a close race with Theobald's Mercedes, which was in the lead until the last lap, when it was overtaken by the winner.

Road Race for Imperial Valley

BRAWLEY, CAL., May 23—The Imperial Valley is to have a road race. A purse of approximately $5,000 has been subscribed for a race over a course which takes in the three Imperial Valley cities, Brawley, Imperial and Calexico. The length of the course is approximately 25 miles. The event is to be run under A. A. A. sanction and a representative has been sent to Los Angeles to confer with Al. G. Waddell, representative of the A. A. A. contest board in regard to the sanction and the appointment of officials as well as securing entries from Los Angeles.

Five-Car Race for San Diego

SAN DIEGO, CAL., May 24.—Plans are under way for another race at the Exposition. The event is to be staged over the same course that Burman, Oldfield, Durant and Tetzlaff raced over in April. The A. A. A. representative has refused to allow more than five cars to start on the course and the field will be cut to the five fastest cars by elimination trials. It is planned to have the race at night, under the glare of the electric lights.

San Fernando Plans Race

SAN FERNANDO, CAL., May 24.—The Commercial Club of this city has started on the preliminary work for an automobile race to be run over the four-mile course around the city. The event is to be a sanctioned A. A. A. contest and it is quite probable that entries will be limited to cars of 231 cu. in. and under.

Sutterley Gets Pierce Contract

PHILADELPHIA, PA., May 29—G. T. Sutterley & Co., maker of a patented form of non-glaring headlight reflector, has closed a contract with the Pierce-Arrow Motor Car Co., Buffalo, for its device, which is now being used as standard equipment on cars of this make.

Multibestos Buys New Plant

Walpole Tire Building Taken Over—To Double Brake Lining Business

WALPOLE, MASS., May 30—The Standard Woven Fabric Co., maker of Multibestos brake lining, in order to provide additional factory facilities, has purchased the entire plant formerly operated by the Walpole Tire & Rubber Co., this city.

New equipment is being installed which will provide for at least double the present brake lining business and also allow for an expansion in the company's business in friction tape, tire tape and similar mechanical rubber goods.

For the present the plant at Framingham will be continued along with the work at Walpole, although in time it is planned to have all the manufacturing done at the local plant.

The offices and general headquarters have been removed and business from now on will be transacted at Walpole.

New McFarlan Six at $3,200

CONNERSVILLE, IND., May 29—The McFarlan Motor Co., this city, has brought out another new "90" for the coming year. Efforts have been confined to one chassis, equipped with a six-cylinder motor, 4½ by 6. The new model is a refinement of the Series X, which has been built for several years.

New features include a longer wheelbase of 136 in., McFarlan cradle spring suspension, improved body designs, new valve setting and combustion chamber. The motor will be of the T-head type, but the spark plugs will be placed directly over the firing chamber. The tests on this motor show a high efficiency.

Artillery wood wheels, fitted with Firestone demountable rims and cord tires, are standard equipment. A sub-frame mounted on two pressed steel cross members carries the motor and gearbox.

The front axle is an L-beam with Timken bearings in the steering knuckles. The front wheels are also mounted on Timken bearings. The Timken rear axle is of the floating type. The transmission gears are mounted on Timken bearings. Worm bevel type ring and pinion are used in the differential. The steering wheel is of the tilting type, being electrically heated.

Door locks are designed for the individual bodies. The touring car lock is especially heavy, avoiding rattles and being of the convenient type. The lever handle is concealed from the outside, but carries parallel with the top door line and is in a natural position for entrance.

Factory Miscellany

Ford Buys K. C. Land—The Ford Motor Co., Kansas City, Mo., has bought a 50-ft. lot on McGee Street south of Nineteenth Street, and a 75-ft. lot on Oak Street, across the alley from the former purchase, and may improve the property at once. On the McGee Street lot—this street being one of the chief thoroughfares and a car dealers' street—a three-story building probably will be erected, with handsome display rooms on the first floor, to be used for a retail sales department. This department is now at 1710 Grand Avenue. On the Oak Street property there probably will be erected a service station, three stories, to care for the city business. The service station and plant for assembling, at Eleventh and Winchester, would then care for the business from outside the city.

The second and third floors of the two buildings will be connected by runways.

The company opened May 15 a downtown service station at 1905 McGee Street, to serve till the new building is completed.

The total expenditures, if the present plans are perfected, will probably exceed $200,000.

Jones to Move—The Jones Motor Car Co., Wichita, Kan., is moving this month into its new home in North Wichita. The present factory on West Douglas Avenue will be retained for a salesroom. The new factory covers more ground than any other manufacturing plant in the State.

The plant has a floor space of more than 100,000 sq. ft., with six spacious buildings in addition to the office buildings. The American Warehouse Co., a broom corn establishment, is vacating the buildings now and the company is moving in as quickly as possible.

New Era to Double Capacity—The New Era Engineering Co., Joliet, Ill., engaged in the manufacture of automobiles, coming here ten months ago from Detroit, has outgrown the present quarters and will shortly double the floor space. At present the company is turning out sixty-seven cars each week, but with orders on hand for 2500 it was decided to enlarge in order to double the output. Capitalization has been increased to $200,000. The new location will be on the line of the Elgin, Joliet & Eastern Railway, a half-mile east of Joliet. The officers of the New Era company are: F. J. Alvin, president and general manager; James P. Buckley, vice-president and factory manager; Winthrop Burdick, treasurer and sales manager, and W. J. Burdick, secretary and purchasing agent. The company now has a payroll of $1,000 weekly, employing sixty mechanics.

New Haynes Paint Shop—A new three-story paint shop has recently been completed at the plant of the Haynes Automobile Co., Kokomo, Ind.

New Goodyear Plant in Canada—The Goodyear Tire & Rubber Co. New Toronto, Ont., will erect one of the largest and most up-to-date plants for the manufacture of tires in Canada at the corner of Ninth Street and Lake Shore Road. The factory will be a fireproof structure and will be constructed of brick and steel. The total cost is estimated at $200,000. When the plant is in full operation it is estimated that over 300 men will be employed. The Goodyear Tire & Rubber Co. has at present one of the largest rubber plants in Canada, at Bowmanville, Ont. It was stated, however, that it is the intention of the company to use this factory solely for the manufacture of rubber heels and soles and that the proposed plant at New Toronto will be engaged in the making of automobile tires. The reason for the securing of the new site was owing to the difficulty of securing men to live and work in a town.

Ford Assembling Plant Addition for Frisco—The Ford Motor Co. will build a five-story addition to its assembling plant at Treat Avenue and Twenty-first Street, San Francisco.

To Make Automobile Locks—Steps have been taken by Marietta (Ohio) capitalists to organize a $100,000 corporation for the purpose of manufacturing automobile locks, switches and other accessories. The plan is to occupy the plant of the Galvin Manufacturing Co., located at East Norwood, near Marietta. It is proposed to call the concern the C-D Manufacturing Co. F. A. Caskey will be president and secretary; G. F. Dupree, Jr., vice-president and sales manager, and O. D. McPherson, treasurer and auditor. F. D. Kunkle will be chief engineer.

The Automobile Calendar

ASSOCIATIONS

June 12-16—S. A. E. Summer Trip on Great Lakes.
July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

June 4—Sheepshead Bay Speedway, 30-mile Race, American Liberty Day Committee.
June 10 — Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Association.
June 20—Galesburg, Ill., Track Race, 100 miles.
June 28 — Des Moines, Iowa, Speedway Free-for-All, 300-Mile Race.
July—LaGrande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300-Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 4—Newark, N. J., Track Race, Olympic Park, Auto Racing Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portinnd, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 29—Trenton, N. J., Inter-State Fair, H. P. Murphy, Racing Sec.
Sept. 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis Ind., Race, Indianapolis Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

MISCELLANEOUS

June 8—New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphans' Automobile Day Outing Assn.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair Milwaukee Automobile Dealers.

The Week in the Industry

Trade Happenings

Northwest News—The Smith Form-a-Truck Co. has opened offices in Seattle at 316 East Pike Street. The newly-organized branch is headed by J. H. Ironsides as president, G. F. Haag, secretary and treasurer, and F. P. Kendall, sales manager.

Automobile regulations governing the admission of automobiles into the Mount Tacoma National Park state that the regulations have been revised under date of March 1, 1916, and the fees fixed at $4 for a single round trip and $6 for the season. The permissible speed has been raised from 6 m.p.h. to 8 m.p.h. Otherwise the regulations are the same as those of 1915.

The Utah-Idaho Motor Co. will hereafter handle the Maxwell output in the States of Idaho, Utah and portions of Montana and Nevada during the 1917 selling season, with headquarters in Salt Lake City. Governor William Spry of Utah, ex-Governor Gooding of Idaho and N. T. Porter of Salt Lake City are the guiding figures of the company.

The Chevrolet Motor Car Co., Seattle, Wash., has opened a new home at Tenth and Pike Streets, containing all modern garage conveniences, and will be the Chevrolet distributing center for western Washington.

The Gunn Motor Co., Tacoma, Wash., has opened at 2330 South E Street and will handle Kelly-Springfield trucks in Tacoma and southwestern Washington.

Ill. News Items—Business men of Rockford are negotiating with a Wisconsin automobile firm for the location of a $3,000,000 plant. All of the proceedings so far are under cover and no definite announcement will be made until the deal is completed. Rockford has offered the old glucose property, which has 35,000 sq. ft. of floor space and which will be added to from time to time. The president of the company which is looking for a new site has perfected an automobile engine which has some new and ingenious features which promise extensive usage. The company has two other cities in view and the one offering the strongest inducements will be selected. The representatives of the company have made two visits to Rockford and the business men here are hopeful that this city will be chosen.

H. H. Collier, Rockford, Ill., has leased the Cook Building, corner of Church and Chestnut Streets, and will shortly open a garage and sales agency. Mr. Collier will be distributor for the Studebaker line and will also operate a service station.

The Hepburn & Pope Motor Sales Co., Moline, has leased the building fronting on Fourth Avenue, near Twelfth Street, formerly operated as a garage by Hager & Rank, and will conduct a garage and sales agency. The firm is composed of George Hepburn, for 13 years with the Moline and Deere plow companies, and Henry Pope. The latter was superintendent of the Midland automobile factory in East Moline; foreman of the machine department of the Packard plant in Detroit, and later with the Hudson company. The company will be distributors for the Maxwell and Detroiter cars for Rock Island and adjacent counties.

Kansas City News—The Acton-Parke Auto Co., Kansas City, Mo., has moved its service station for Maxwells to the Velie Building, 3344 Main Street, where three floors are available. The basement will be used for machine shops, the ground floor for offices and workshop, the second floor for storage, accommodating 100 cars. Ray Worthington, formerly of the Maxwell plant, is in charge. There are facilities for handling more than 1000 cars. The Maxwell sales in April, 1916, in Kansas City, were ninety-six, and May is producing business at a rate to make about 125.

The E. S. Cowie Electric Co., Kansas City, has opened at 1238 East Douglas Avenue, Wichita, a branch house for battery and other electrical equipment service. The branch is equipped similarly to the Kansas City house. C. M. Hilt, who has been purchasing agent for the firm, is in charge. The recent rapid increase in the use of farm tractors has been an especially impelling motive for the establishment of the branch, and tractor ignition will probably be the important feature of the service. The company in Kansas City serves many automobile branch houses and dealers. It has recently installed a delivery service, to call for and return batteries and equipment.

Minneapolis Trade News—J. S. Johnson, former manager of the Winton branch, and Eddie Randall, have bought Motor Inn, a garage at 1023 Marquette Avenue, and will sell Standard cars.

The B. F. Goodrich Co. branch, and H. E. Mack & Co., representing Dodge Bros., have moved to a new building at 1221-1223 Harmon Place.

George A. Clark & Son, 227 Fifth Street N., dealers in farm implements, have added an automobile supplies department with service station for repairs and suggestions for dealers.

The Times Square Auto Co. has opened a supplies store at 1229 Hennepin Avenue.

The R. C. Smith Auto Co., 1400 Hennepin Avenue, will move to a new building at 1601 Hennepin Avenue. It handles Velie and Regal cars.

Philadelphia News Items—The Thornton-Fuller Auto Co., 2041-2043 Market Street, Philadelphia, has acquired ground between Twenty-fourth and Twenty-fifth and South and Bainbridge Streets, on which will be erected a large service building for the Dodge and Simplex automobiles.

The Gomery-Schwartz Motor Car Co., Philadelphia Hudson distributors, is accepting bids on the erection of a ten-story service building on the site of the old quarters at Broad and Cherry Streets.

Marathon Tire Changes—H. H. Replogle, formerly manager for the Marathon Tire & Rubber Co. of New York at Omaha, Neb., has been made manager of sales of the Marathon company, with headquarters at the home office at Cuyahoga Falls, Ohio.

G. R. Howell, who has been representing the Marathon Tire & Rubber Co. of New York in Iowa, has been promoted to division manager at Omaha.

C. M. Folger, Southern representative for Marathon tires, has been appointed division manager at San Francisco.

Opper Succeeds Morehead—P. T. Opper, who has been connected with the Detroit branch of the B. F. Goodrich Rubber Co. for a number of years as assistant manager, has been promoted to the position of branch manager to succeed H. J. Morehead, resigned.

Large A C Spark Plug Order—The Motor Car Equipment Co. of Boston and New York City just placed an order for 357,000 A C plugs. This is said to be the largest single order ever given for spark plugs. It tops the Beckley-Ralston order of a few weeks ago for 300,000 spark plugs.

Lyman Joins Cassidy.—H. S. Lyman has resigned as Indiana factory and jobbers' representative of the H. W. Johns-Manville Co. to represent Edward A. Cassidy, New York City.

American Body to Build—The American Body Co., Buffalo, N. Y., will build a $10,000 addition to its plant at Niagara Street.

Rutenber Adds—Work has been commenced on a new service machine shop that will employ 100 more men at the Rutenber Motor Co. factory in Marion, Ind. It will be completed in 2 or 3 weeks. The new building will be 90 by 40 ft. and will be of brick and glass. The company already employs about 700 men.

Sommers Motor to Add—The Sommers Motor Co. will build a 100 by 200-ft. machine and erecting shop addition to its lant at Bucyrus, Ohio.

Parts Co. to Build—A contract has been awarded for the construction of a one-story factory at Lakeside and Fifty-first Street, Cleveland, Ohio, for the Forest City Electric Co., Windsor Avenue, maker of electric equipment and automobile parts. The estimated cost of the plant is $25,000.

Gorton Co. to Build—The L. O. Gorton Mfg. Co., Muskegon, Mich., will erect immediately at a cost of $10,000 a plant for the manufacture of automobile parts.

New Plant for Perfex Radiator—The Perfex Radiator Co., Racine, Wis., maker of radiators for automobiles, truck and tractor engines, will erect a new plant. The main building will be 65 by 250 ft. and there will also be a warehouse and a power house.

Another Pierce-Arrow Addition—The Pierce-Arrow Motor Car Co., Buffalo, N. Y., has completed plans for another four-story addition to its plant at Elmwood and Great Arrow Avenues and the New York Central Railroad, to cost $100,000, besides the four-story addition now under construction, which will also cost $100,000.

Christopher Motor Adds—The Christopher Motor Co., Chicago, Ill., is building an addition to its plant, 50 by 100 ft., to cost $20,000.

Trippensee Body to Enlarge—The Trippensee Mfg. Co., Detroit, Mich., maker of automobile bodies, has increased its capital stock from $100,000 to $125,000, for the enlargement of its plant.

Hercules to Start Production—The Hercules Motor Mfg. Co., Canton, Ohio, will start producing around the early part of June. A new plant has been finished, costing $100,000, and the company will employ over 150 men throughout the year. The new building is two stories and 300 by 70 ft. On each floor at either side there is a continuous glass-wire window. The plant will be operated entirely by electricity.

Rives Pedal's New Distributors—The George H. Rives Mfg. Co., New York City, manufacturer of the Rives adjustable automobile pedals, has established distributors throughout the country and also in Beunos Aires, Argentina, and Montevideo and Rio Janeiro, Brazil, South America. The company's offices are in the Woolworth Building, New York City, and its factory is 171 Fulton Street, Brooklyn, N. Y.

Erickson Joins Packard Electric—J. E. Erickson has joined the sales organization of the Packard Electric Co., Warren, Ohio, and will cover the territory formerly in charge of Benjamin Smith.

Chamberlin Joins Gramm-Bernstein—C. B. Chamberlin has been appointed supervisor of purchasing by the Gramm-Bernstein Co., Lima, Ohio.

Canadian Plant News—The Canadian Regal Motor Co., Ltd., is preparing plans for a factory at Berlin, Ont., to cost $18,000.

The Acme Rubber Co., Brampton, Ont., recently incorporated, will build a factory to manufacture rubber tires, rubber goods, etc., to cost $30,000. F. D. Law, 471 Yonge Street, Toronto, is a stockholder. A by-law giving the company concessions has been passed.

The Willys-Overland, Ltd., 112 Richmond Street, West, Toronto, Ont., has been incorporated in Saskatchewan with a capital stock of $6,000,000 to manufacture automobiles, motors, etc., with headquarters at Regina.

The Begg Motor Co., 1062 Georgia Street, West, Vancouver, B. C., will build an addition to its plant to cost $15,000.

The Seymour Motor Car Co., Vancouver, B. C., has been incorporated and will take over the plant of the Begg Motor Co., at 632 Seymour Street, Vancouver. W. E. Richardson is manager.

The Perfection Tire & Motor Co., Niagara Falls, Ont., with plants at Fort Madison, Iowa, and Wabash, Ind., is carrying on negotiations with the city council. The company is contemplating the erection of a plant to manufacture automobiles, tires, etc., to cost upward of $300,000.

The Russell Motor Co., Toronto, Ont., purposes to build a new factory on 28 acres recently purchased there to house the cycle and skate business. In the past these branches of the company's activities have been handled in connection with the automobile plant at West Toronto. This has been turned over to the new Willys-Overland Co. of Canada.

Ellwood Ivins' Tube Reduces Working Hours—The Ellwood Ivins' Tube Works of Oak Lane, Philadelphia, have reduced the working hours of all employees 1 hr. each day. This applies to both day and night shifts. Its plant is running full 24 hr. This, in addition to a voluntary increase in wages of all employees a few months ago.

Ind. Plant News—The Crow Motor Car Co., Elkhart, has shipped a touring car model 30 to the French Government. If it proves satisfactory the Crow company is promised an order for 100 chassis. Recently the Crow company shipped a car to Singapore and another to Shanghai, China.

The Advance-Rumely Co., Laporte, will enter its small tractor this summer in eight tractor demonstrations in different parts of the country. One noteworthy feature of the machine is that it is reversible and can be run backward or forward with equal facility by simply turning the seat around.

The Lawndale Mfg. Co., Elkhart, has just been incorporated, with a capital stock of $75,000. Among other things the company will manufacture automobile specialties. The incorporators are A. H. Beardsley, James A. Bell and W. H. Foster. Frank R. Flynn is to be office manager.

Ind. Changes—Barney Baker, formerly general sales manager for the M. Rumely Co., has again accepted employment with the Advance-Rumely Co. and will become branch manager at Fargo, N. D.

G. H. Greiger, manager of the South Bend Cadillac agency, has been appointed general manager of the Cadillac Automobile Co. for the State of Indiana, with headquarters at Indianapolis. A building is being completed for the Cadillac company.

S. K. F. Plant Ready for Work—The new factory of the S. K. F. Ball Bearing Co. in Hartford, Conn., is practically completed and machinery set up. A large clerical force from the New York offices has come to this city. Eight Mack trucks arrived Friday evening with furniture for the offices, having been run up from New York.

Hartford Trade Items—The new sales headquarters of the United States Tire Co. in the Britton Co. Building, 121 Allyn Street, Hartford, Conn., is now ready for occupancy. Complete new office equipment has been installed.

J. H. Macdonald of the R. D. Britton Co., Velie and Allen representative, has severed his connection with that concern and joined the sales force of the A. C. Hine Co., 314 Pearl Street. For several years past he has been associated with R. D. Britton, who continues the business of the R. D. Britton Co.

Automobile row in Hartford is undergoing some material changes. Ground has just been broken by the Hartford branch of the Packard Motor Car Co. of New York for a new salesroom and service building at the corner of Park and Washington Streets. The foundation of the new three-story service building of the Fuller Storage Battery Co. on lower Church Street is completed and work will begin this week on the upper structure. The excavating for the new combined service and sales building of Russell P. Taber, Reo distributor, on lower Allyn Street, which is to have an entrance from Church Street adjacent to the Fuller property, is completed and work on the foundations will begin this week. The new three-story brick, steel and concrete service building of the

Britton company, Stearns-Knight and Federal truck representative, is almost finished. Work on the new service building for S. A. Miner, Pierce-Arrow distributor for northern Connecticut, has been resumed and possession will be taken shortly. The Pennsylvania filling station at the corner of Asylum and Hurlburt Streets has been moved a half block west, the Overland company having acquired the original site.

The business and good-will of the Hartford branch of the E. J. Todd Rubber Co. has been purchased by A. P. Gunn, formerly an officer of the company and manager of the store mentioned at 274 Trumbull Street. Business will be conducted at the same address. The firm name remains the same. A. P. Gunn has taken on the exclusive representation of Kelly-Springfield tires and is planning to install a solid tire department, together with the necessary equipment for applying these tires. Andrew P. Gunn is also conducting a store on Hartford Avenue in New Britain under the name of the Gunn Rubber Co. This establishment is being managed by his brother.

A. Kaeser has been appointed service manager of the new service station of the White Motors Co. at 22 Chapel Street.

The Palace Auto Service Co., in order to devote all time to the exploitation of Mitchell cars at 348 Trumbull Street, is disposing of a large stock of accessories. This concern was one of the first in Hartford to feature accessories.

Alterations just completed by the Ashwell Service Station, 341 Trumbull Street, provide for a larger office and a rearrangement of the oil and fuel departments. This concern has been appointed service representative of the A-K ignition devices.

Wis. Plant News—The Four Wheel Drive Automobile Co., Clintonville, Wis., manufacturing the F. W. D. truck, is preparing to build another large addition, 100 by 175 ft. Early this year ground was broken for a structure of similar size, but the capacity is still inadequate, making a second building necessary. It is reported on good authority that the company has taken over the Four Wheel Drive Tractor Co., organized at Antigo, Wis., several months ago to build quadruple drive general utility tractors, and that part of the new building is to accommodate that interest.

The Aluminum Goods Mfg. Co., Manitowac, which is building a five-story manufacturing building, 50 by 300 ft., will erect a 50 by 150-ft. shop addition as soon as possible. The demand for its goods is all out of proportion to its capacity.

A plant for the manufacture of a renewable or everlasting fuse for electric current distribution circuits will be established in Milwaukee at once by the Arrow Fuse & Mfg. Co., incorporated with $35,000 capital stock by capital identified with the Schlitz Brewing interests. The inventor is O. H. Jung, chief electrician of the Schlitz company. Heretofore fuses, when burned out, were thrown away, but Mr. Jung has found a method of easily renewing the fused wire, saving the expense of a new fuse cap and socket. The fuse will be made in all sizes and for all purposes, including motor car circuits. Production starts July 15.

The John Obenberger Forge Co., Milwaukee, organized with $100,000 capital, as noted, will specialize in motor car and engine work. A plant is being equipped at West Allis, Milwaukee County, for the production of drop forgings and forgings hammered from billets, which will be supplied to the motor car, engine and machinery trade unfinished from the dies, with the exception of crankshafts, which will be finished. John Obenberger, head of the new company, is one of the best known men in the drop forge industry of the Middle West and until recently was head of a large drop forge works in Cudahy, Milwaukee County.

Wis. Trade Happenings—The affairs of the bankrupt Milwaukee Motor Co., Milwaukee, are expected to be wound up and closed at the meeting of creditors to be held May 19. At this time the proposition of Ernst G. Miller and Elise K. John to settle claims made against them by creditors for $60,000 in cash will be discussed. The claim of the Imperial Automobile Co., Jackson, Mich., has already been settled, and it is expected that the offer to other creditors, being about 75 per cent of the claims, will be accepted.

Harry Ewing, Hartford, has leased the John Landt machine shop and is opening a public garage and repair shop, to be styled the "Square Deal Garage." Mr. Ewing was for three years a traveling service man for the Kissel Motor Car Co., Hartford, Wis.

The Grover Auto & Implement Co., Junction City, Chevrolet agent, is enlarging its repair shop and installing an oxy-acetylene welding and cutting unit.

The White Automobile Co., Milwaukee, has moved into its new salesrooms and service station at 456-458 Milwaukee Street. The representatives are Matthew C. Moore and J. W. Garbutt.

The Jonas Automobile Co., Eighth and Wells Streets, Milwaukee, representing the Cadillac, is building an addition to its big building, 40 by 70 ft., one story, to be used for extra service work.

A new garage and repair shop has been established at Monticello by Wilbert Hoesley, agent for the Maxwell, Studebaker and King. Mr. Hoesley has leased the Marty Building and is completing remodeling work.

The Milwaukee shaper, a popular machine tool in motor car and parts factories of this country, will henceforth be manufactured by the Milwaukee Shaper & Transmission Appliance Co., Milwaukee, organized with a capital stock of $75,000 by A. J. Schmitz, Robert Wild and E. J. Gross, First National Bank Building. The new company takes over the entire shaper business of the Lutter & Gies Co., 258 Lake Street, which has manufactured the tool for many years. The shaper business has grown so extensive that it was deemed advisable to organize a separate concern to handle it. The new company has leased the former plant of the Stegeman Motor Car Co. at 1148-1152 Holton Street, and is already operating. The tool will not be changed in design or name.

Arthur and Anton Zeman, Milwaukee, Wis., have established an exclusive tire repair shop at Main Street and Western Avenue, Fond du Lac. The firm will also deal in Racine tires and carry a full line of accessories.

Glen Keebler and Charles Bohls have purchased the interest of W. H. Townsend in the Townsend-Metcalf Garage Co., Reedsburg. Both have been associated with the concern for several years. A three-story addition to the garage is now under way.

The Badger Garage Co., owned by Holte & Currier, Stevens Point, has disposed of its machine shop and service station to Joseph and William Koehn, Sheboygan, who have already taken charge. Holte & Currier will retain their livery and sales agency business.

Dallas News Items—G. Newby, representing the Maxwell Automobile Co., Detroit, Mich., was in Dallas recently, negotiating for the purchase of property on which to locate a plant costing $200,000.

It is known, also, that Hart Bros., representing the Maxwell company in this section of the State, have been made the offer of a site with all the necessary advantages. The proposed site will cost $20,000, the limit specified by the Maxwell company.

Two other cities in Texas, it is said, have made overtures for this assembling plant. A definite answer is expected within a short time. The Dallas Chamber of Commerce and Manufacturers Assn. is doing all in its power to have the plant located at Dallas.

After June 15, Dallas will be made the distributing point of the Southwest for the Wilson Tire & Rubber Co., through the Dallas Chamber of Commerce and Manufacturers Assn. The Dallas branch will be the biggest the Wilson company has besides its main distributing plant at Springfield, Ill.

Robinson Joins Jones Six Co.—C. F. Robinson has connected himself with the Jones Motor Car Co., Wichita, Kan. Mr. Robinson will act in the capacity of assistant general manager.

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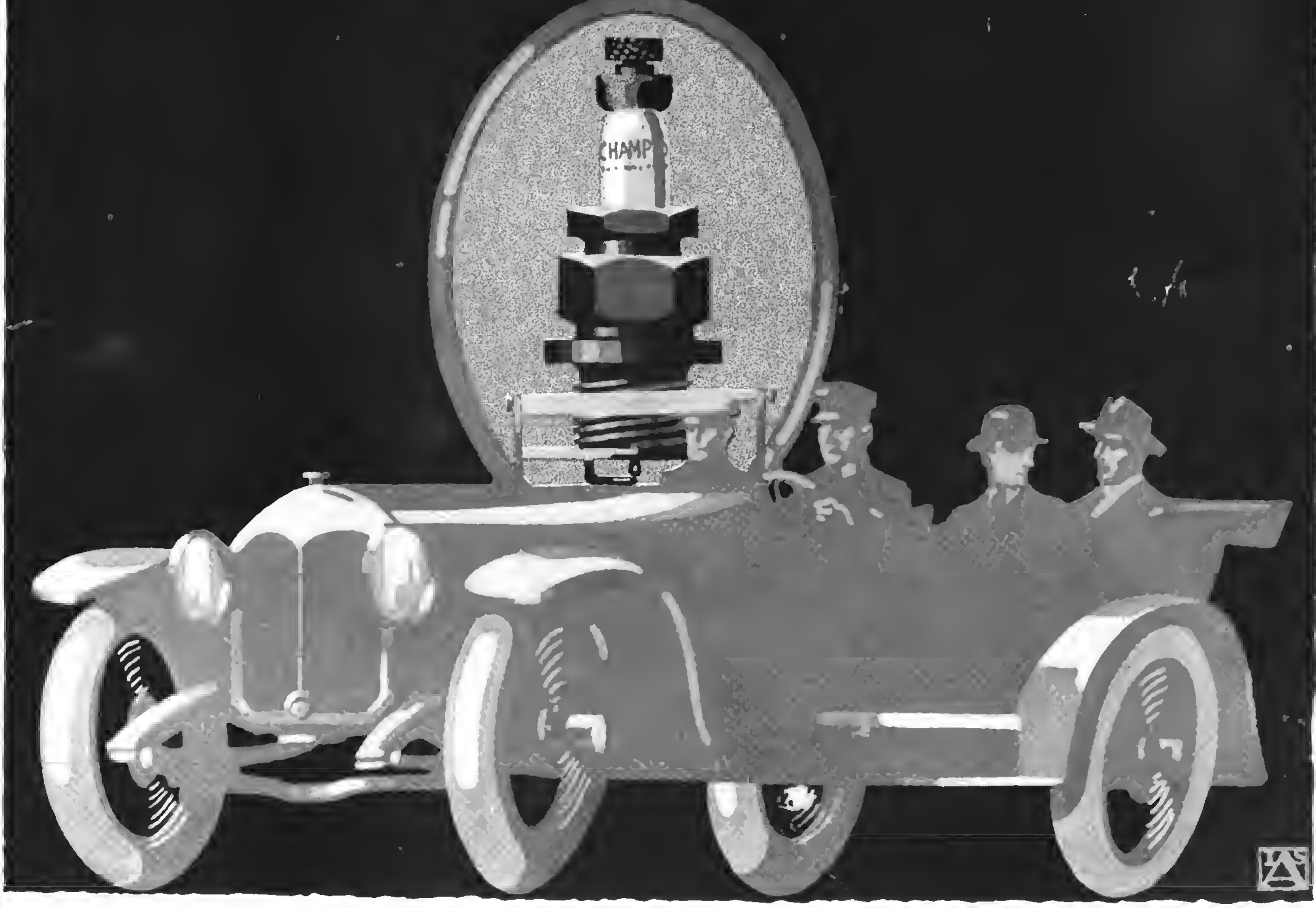

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The Automobile

Spiral Bevel Calculations

Helical Bevel Gear Bearing Loads and Tooth Pressures Obtained by Formulæ—A Study of the Radical and Thrust Loads Produced by Helical Bevel Sets, Including Those of the Spiral Type, and the Development of Charts Facilitating Solution of Problems

By A. L. Nelson

THE object of this article is to study the radial and thrust loads produced by helical bevel gear sets including those of the spiral type, and to develop charts for the easy solution of such problems.

Bevel gears are widely used in many classes of work. Perhaps the most exacting and severest service demanded of bevel gears is that of the automobile rear axle drive gears. These gears are made of alloy steels which, for the sake of lightness, are designed to work under very high stresses. This in turn means relatively small pitch diameters and correspondingly heavy bearing loads. The bearing loads are still further increased and high thrust loads added by cutting the gear teeth at an angle of from 15° to 35° with the pitch cone element. This type of gear is now used almost universally to obtain the degree of quietness imperative in acceptable automobile design.

Equations Based on Helical Bevel Type

The equations to be derived in this discussion, for the sake of simplicity, will be based primarily on the type of helical bevel gears cut on generating gear planers. However, gears of the Gleason spiral type, which have teeth that are curved lengthwise on the arc of a circle, may be treated as though the teeth were straight and the angle of the tooth with the pitch cone element taken as the tangent of the tooth at the center of the resultant tooth pressure.

This type of gear is of greatest importance, for the method of manufacture is such as to permit quantity production at a cost so low that they are now used extensively even for machine-tool machinery. For the latter class of work the gears are often run with shaft angles other than 90°; hence the formulæ will be derived for the general case of shafts at any angle.

Condition of the Problem

Fig. 1 shows the resultant tooth load diagram for a forward drive right hand (R.H.) helical gear, and Fig. 2 the mating left hand (L.H) pinion. The dimensions of the gears as required are shown in the figures.

Let $T =$ the pinion torque in pound-inches.

$P = \frac{T}{r_1} =$ the vertical component of the resultant tooth pressure in pounds.

$\phi =$ the tooth angle with the pitch cone element.

$\theta =$ the tooth pressure angle.

$A = \frac{\tan \theta}{\cos \phi}$, and

$S = \tan \phi$ which are constants for given values of θ and ϕ.

$D_1 = \frac{1}{2}$ pitch diameter of the pinion in inches.

$D_2 = \frac{1}{2}$ pitch diameter of the gear in inches.

$R_2 =$ the pitch cone radius.

$f =$ the tooth length.

$R_1 = R_2 - f$

$Kf =$ the distance from the large end of the tooth to the center of the resultant normal tooth pressure.

$\beta =$ the center angle of the gear.

$\alpha = 90^\circ - \beta$

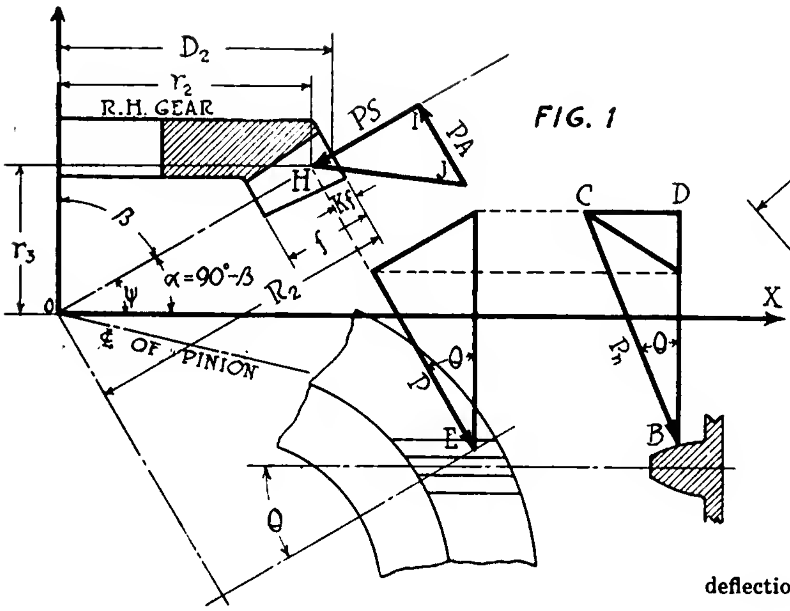


FIG. 1

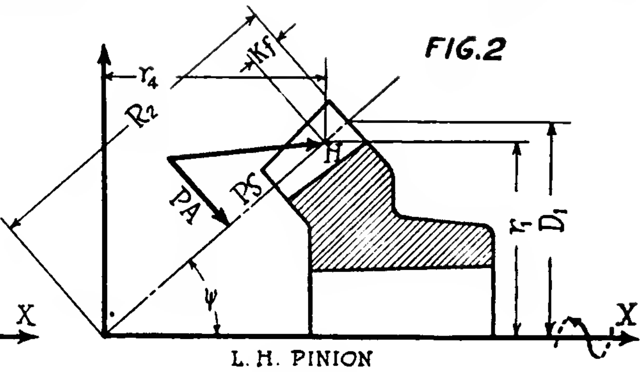


FIG. 2

Fig. 1 and Fig. 2—Diagrams explaining symbols used in calculating bevel reactions

ψ = the center angle of the pinion
(= α with shafts at 90°).

r_4 and r_1 of the pinion are x and y co-ordinates of the point of application of P, having the apex of the pitch cone as the origin, while r_2 and r_3 are the co-ordinates of P for the gear.

Application of Resultant Tooth Pressure (Kf)

For the purpose of determining Kf, Fig. 3 shows a bevel gear tooth whose apex is at O. Fig. 4 shows an end view of the tooth with the normal tooth load at the outer edge of the tooth intersecting the tooth center line at B at a distance h_2 (at large end of the tooth) above the weakest section, whose thickness is t_2 (as determined by Lewis' parabola method).

In Fig. 3 is shown an elementary slice of the tooth of dx thickness and at a distance x from O, loaded with an elementary force dp. It follows from the figure that its height $h = \frac{h_2}{R_2} x$ and its width $t = \frac{t_2}{R_2} x$. since the elementary section is a very short cantilever beam, it is necessary to take into account the deflection due to shear as well as that due to ordinary flexure in what is to follow. Each case will be treated separately, taking up the case of flexure alone first.

Let S be the flexure unit stress at the weakest section (width t and thickness dx) and Δ the deflection at the point where the line of action of dp intersects the center line of the tooth. Since all the elements of the tooth form intersect at the pitch cone apex it is assumed that this is also the case when the tooth is loaded. This assumption will obtain very closely if the gear and pinion shafts are designed properly, that is, so that the deflection of the shafts will have a tendency to keep the gear and pinion in their theoretical alignment. The latter is a point in design well worth striving for in order to obtain quiet and uniformly wearing gear pairs. From the above assumption it follows Δ is proportional to x, or

$$\Delta = C_1 x \tag{1}$$

(The letter C will be used with subscripts to indicate various constants required.)

For a cantilever beam of uniform section and of constant width t the deflection becomes—

$$\Delta^1 = \frac{\left(\frac{h_2}{R_2} x\right)^3 dp}{3EI} = \frac{\left(\frac{h_2}{R_2}\right)^3 x^3\, dp}{3E\frac{1}{12}\left(\frac{t_2}{R_2}\right)^3 x^3 dx} = C_3 \frac{dp}{dx}$$

where E = the modulus of elasticity of the material and I = the moment of inertia of the elementary section.

From the fact that all of the elementary sections of the tooth are similar, it follows that the actual tooth deflection is proportional to Δ^1, therefore

$$\Delta = C_2\Delta^1 = C_2C_3 \frac{dp}{dx} \tag{2}$$

From (1) and (2)

$$\frac{dp}{dx} = \frac{C_1}{C_2C_3} x = C_4 x \tag{3}$$

Equating the bending moment to the moment of resistance

$$\frac{h_2}{R_2} x\, dp = S \frac{1}{6}\left(\frac{t_2}{R_2}\right)^2 x^2\, dx \text{ whence}$$

$$\frac{dp}{dx} = \frac{St^2_2 x}{6R_2h_2} = C_5 S x \tag{4}$$

From (3) and (4)

$$S = \frac{C_4}{C_5} = \text{constant.}$$

Now let P be the resultant of the Σdp at a distance x_0 from O. Taking moments about O by the aid of (4) and from the

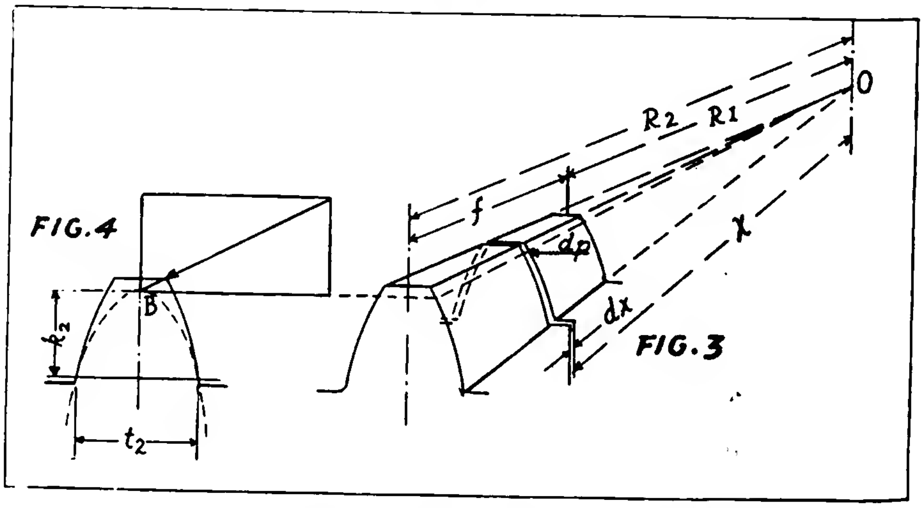


FIG.4

FIG.3

Fig. 3 and Fig. 4—Symbols representing proportions of bevel teeth

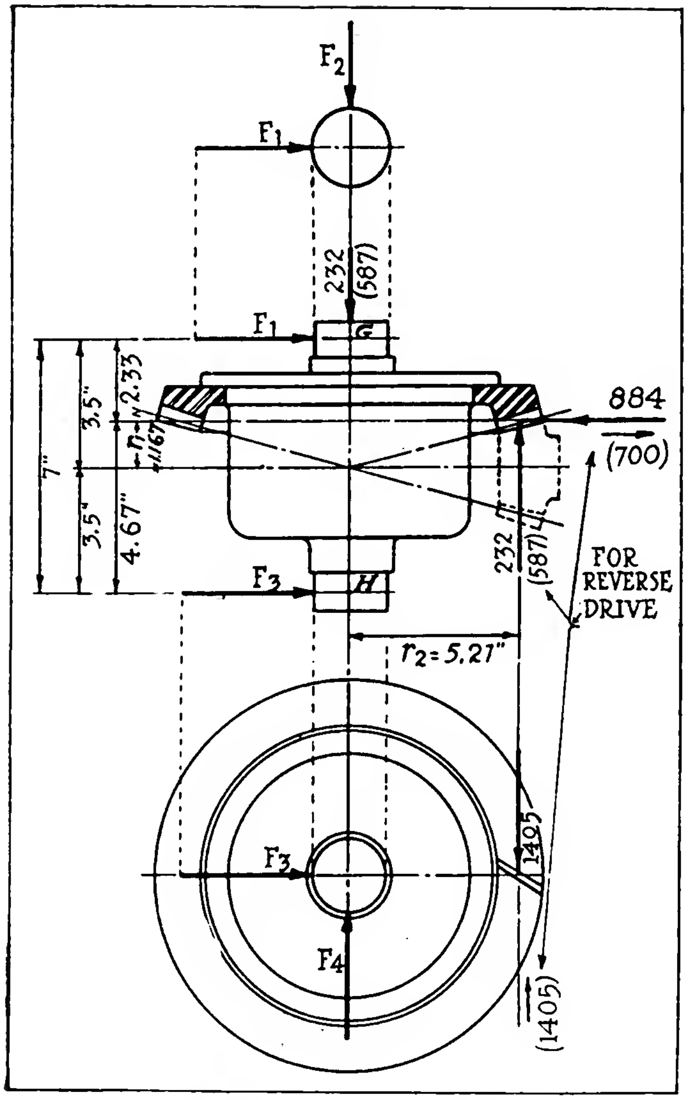


Fig. 8—Actual loads in assumed case

fact that S = constant, it may be taken outside of the integral sign, then it follows that

$$P x_0 = \int_{R_1}^{R_2} x dp = C_s S \int_{R_1}^{R_2} x^2 dx = C_s S . \frac{1}{3} \cdot (R^3_2 - R^3_1) \qquad (5)$$

Also from (4)

$$P = C_s S \int_{R_1}^{R_2} x dx = C_s S . \frac{1}{2} \cdot (R^2_2 - R^2_1) \qquad (6)$$

Substituting P of (6) in (5)

$$x_o = \frac{2}{3}\left(\frac{R^3_2 - R^3_1}{R^2_2 - R^2_1}\right) \qquad (7)$$

The next step is to determine the location of P, considering the shear deflection alone. Let G be the shearing modulus of elasticity. Then for a cantilever beam of length l, unit shearing stress S_s, and unit detrusion e

$$G = \frac{S_s}{e} = \frac{S_s dl}{d\Delta'}$$

$$\therefore \Delta' = \int_o^l \frac{S_s dl}{G} = \frac{S_s l}{G}$$

As before for an elementary tooth section

$$\Delta = C_s \Delta' = \frac{C_s S_s}{G} \frac{h_2}{R_2} x \qquad (8)$$

where S_s is the unit shearing stress at the root of the tooth.

It follows from (1) and (8)

$$S_s = \frac{C_1 G R_2}{C_s h_2} = \text{constant}$$

Equating the shear to the shearing resistance

$$dp = \frac{t_2}{R_2} x S_s dx$$

$$\therefore \frac{dp}{dx} = C_1 x \qquad (9)$$

Now since equation (9) is of the same form as (4) and since S_s = a constant it follows that x_o for shear is the same as x_o for flexure. From Fig. 1

$$x_o = R_2 - Kf$$

$$\therefore K = \frac{R_2 - x_o}{f} = \frac{R_2 - \frac{2}{3}\left(\frac{R^3_2 - R^3_1}{R^2_2 - R^2_1}\right)}{R_2 - R_1} \qquad (10)$$

To simplify the work of finding the value of K for any given case, Fig. 5 is drawn with K as ordinates and $\frac{R_2}{f}$ as abscissa. The values of K were calculated corresponding to the ratio $\frac{R_2}{f}$ by taking $f = 1$, then $R_2 - R_1 = 1$ and

$$K = R_2 - \frac{2}{3} \frac{R^3_2 - (R_2 - 1)^3}{(2R_2 - 1)} \text{ (for } f = 1\text{)} \qquad (11)$$

Now that the location of P is determined the force analysis will be considered.

Force Analysis of Resultant Tooth Pressure

For the force analysis of the resultant tooth pressure friction will be neglected, since it is small, due to the rolling nature of the tooth contact. In Fig. 1 is shown the force diagram for forward drive R.H. helical type bevel gear with the pinion driving. BC is the normal resultant tooth pressure. This pressure is resolved into three components, EG is the vertical component, HI the component acting along the element of the pitch cone, and JI the component acting perpendicular to the pitch cone element. From the figure it follows that the normal resultant tooth pressure

$$P_n = \frac{P}{\cos\theta \cos\phi} \qquad (12)$$

Also from the figure $HI = P \tan\phi = PS$, where $S = \tan\phi$ and $JI = CD = P_n \sin\theta = \frac{P\sin\theta}{\cos\theta \cos\phi} = P\frac{\tan\theta}{\cos\phi} = PA$,

where $A = \frac{\tan\theta}{\cos\phi}$

There are four cases of conditions to be considered. In each case the pinion will be considered as the driver. Clockwise rotation viewing the pinion from the positive end of the X axis will be called the forward drive. The two components of forces in the plane of the gear axes will be broken up into F_x and F_y, that is, the summation of the forces along the X and Y axes respectively.

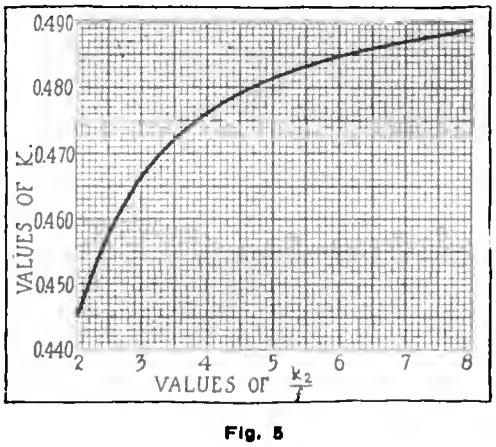


Fig. 5

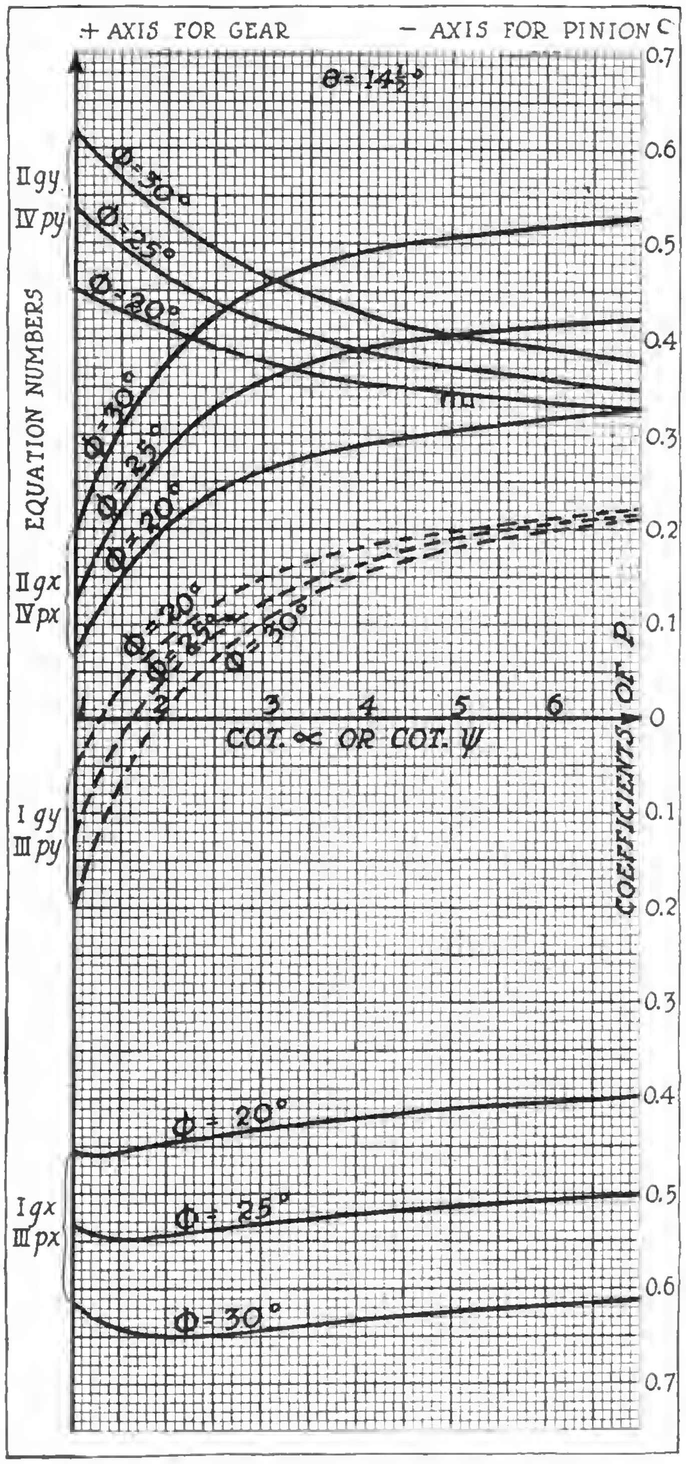


Fig. 6—Coefficients of P for gear and pinion having pressure angle of 14½

Case I. Forward drive R.H. helical gear or reverse drive L.H.

$$F_x = -P\ (A\sin\alpha + S\cos\alpha) \qquad (I_{gx})$$
$$F_y = P\ (A\cos\alpha - S\sin\alpha) \qquad (I_{gy})$$

(The subscripts of the equation numbers may be interpreted as follows: g refers to the gear and x to the X axis, while y refers to the Y axis. Later p will be used to denote the equations for the pinion.)

Reversing the helix to L.H. and also reversing the drive does not change the equations. However, if only the drive is reversed, the component along the element of the cone reverses, while that perpendicular to the element does not reverse. Hence the equations for this case are as follows:

Case II. For forward drive L.H. helical gear or reverse drive R.H.

$$F_x = P\ (-A\sin\alpha + S\cos\alpha) \qquad (II_{gx})$$
$$F_y = P\ (A\cos\alpha + S\sin\alpha) \qquad (II_{gy})$$

In like manner the equations for the pinion become as follows:

Case III. For forward drive L.H. hellical pinion or reverse drive R.H. (See Fig. 2.)

$$F_x = P\ (A\sin\psi + S\cos\psi) \qquad (III_{px})$$
$$F_y = -P\ (A\cos\psi - S\sin\psi) \qquad (III_{py})$$

Case IV. For forward drive R.H. helical pinion or reverse drive L.H.

$$F_x = -P\ (-A\sin\psi + S\cos\psi) \qquad (IV_{px})$$
$$F_y = -P\ (A\cos\psi + S\sin\psi) \qquad (IV_{py})$$

When the axes of the gear and pinion make an angle of 90°, $\psi = \alpha$ and the equations of cases III and IV become the same as for cases I and II except opposite in sign.

Graphical Solution for F_x and F_y

It will be observed from the above equations that they are all written so that the second factor is a coefficient of P. Furthermore, A and S depend only on the angles θ and ϕ, while α and ψ depend on the ratios $\frac{r_2}{r_3}$ and $\frac{r_1}{r_4}$ respectively. General graphical solutions for the equations may then be obtained by plotting two sets of curves as given in Figs. 6 and 7 with the coefficients of P as ordinates and the cot α of the gear or cot ψ of the pinion, as abscissa. Fig. 6 gives the coefficients of P for the gear and pinion having a tooth pressure angle (θ) of 14½°, while Fig. 7 gives those for 20°. Since the tooth angle with the pitch cone element (ϕ) generally varies from 15° to 35°, three sets of curves in each figure are given with the values of (ϕ) taken 20°, 25° and 30°. For intermediate values of ϕ interpolate between the curves. For gears with values of θ between 14½° and 20° interpolate between the values given by Figs. 6 and 7.

Since the equations for the pinion are opposite in sign to those of the gear, the positive ordinate is taken as negative for the pinion as indicated in Figs. 6 and 7 in the upper left-hand corner.

Verification of Calculated Results.

The following table is given as a comparison of average test and calculated coefficients of P. These pinion thrust tests were made by Gleason Works and published by *Machinery*, April, 1914.

Test Number	Gear Type	Number of Teeth in Gear and Pinion	Tooth Angle with Pitch Cone Element ϕ	Tooth Pressure Angle θ	% of Tooth Load $(P = \frac{T}{n})$			
					Thrust on Pinion Forward Drive		Thrust on Pinion Reverse Drive	
					Observed	Calculated	Observed	Calculated
1	Plain Bevel	53–15	0°	14½°	7.34	7.06	7.62	7.06
2	"Spiral Bevel"	53–15	31°21′	14½°	−49.5	−50.3	73.8	66.9
3	"Spiral Bevel"	53–14	19°45′	14½°	−28.7	−28.7	45.0	45.6
4	"Shew Bevel"	57–18	23°46′	14½°	−30.5	−33.5	50.8	50.5

The above pinions are all R.H. In each case the observed average thrust in per cent of the tooth load was taken from a large number of trials. The calculated values agree quite closely with the test values. This fact gives an added assurance to the dependability of the formulas as derived in this paper.

Determining the Magnitude of P

Having determined the coefficients of *P*, the next step is to determine the magnitude of *P*. First find r_1 and dividing the torque of the pinion by r_1 gives *P*. From Figs. 2 and 3 it follows that

$$R_2 = \frac{D_1}{\sin\psi} = \frac{D_2}{\cos\alpha} \qquad (13)$$

$$r_1 = (R_2 - Kf) \sin\psi \qquad (14)$$

$$r_4 = (R_2 - Kf) \cos\psi \qquad (15)$$

In like manner from Fig. 1

$$r_3 = (R_2 - Kf) \cos\alpha \qquad (16)$$

$$r_2 = (R_2 - Kf) \sin\alpha \qquad (17)$$

In case of shafts making 90° with each other $\alpha = \psi$ and then $r_1 = r_2$ and $r_4 = r_3$.

Shaft Bearing Loads

The bearing reactions may be found after having determined the resultant tooth pressure P, F_x and F_y. The bearing reactions will depend on how the bearings are located in reference to the gears. The method of finding the bearing reactions will be illustrated by a numerical problem for forward and reverse drive. The following data are taken from a set of Gleason spiral type automobile differential drive gears:

Pitch of teeth = 5

Number of teeth in gear = 58, in pinion = 13

$\beta = 77° 22'$

$\alpha = \psi = 12° 38'$

$\theta = 14\frac{1}{2}°$

$\phi = 30°$ Gear R.H.

$f = 1.25$ in.

$$D_1 = \frac{13}{2 \times 5} = 1.30 \text{ in.}$$

$$D_2 = \frac{58}{2 \times 5} = 5.80 \text{ in.}$$

$\cot\alpha = 4.461 =$ (speed ratio since $\alpha = \psi$)

$$R_2 = \frac{D_2}{\cos\alpha} = \frac{5.80}{0.9758} = 5.94 \text{ in.}$$

$\frac{R_2}{f} = \frac{5.94}{1.26} = 4.76$, referring this ratio to Fig. 5 it follows that $K = 0.48$ and $Kf = 0.48 \times 1.25 = 0.60$ in.

$r_1 = (R_2 - Kf) \sin\alpha = (5.94 - 0.60)\ 0.2187 = 1.167$ in.

$T = 1640$ lb.-in. max. motor torque (from test).

$$P = \frac{T}{r_1} = \frac{1640}{1.167} = 1405 \text{ lb. on direct drive.}$$

$r_3 = (R_2 - Kf) \cos\alpha = (5.94 - 0.60)\ 0.9758 = 5.21$ in.

Since the gear is R.H the forward drive comes under case I and the reverse drive under case II. Referring $\cot\alpha = 4.46$ to Fig. 6, it follows for:—

Case I,

$F_x = 1405\ (-0.629) = -884$ lb.

$F_y = 1405\ (+0.165) = +232$ lb.

Case II,

$F_x = 1405\ (+0.498) = +700$ lb.

$F_y = 1405\ (+0.418) = +587$ lb.

The gear is mounted on two Timkin roller bearings 3½ in. each side of the pitch cone apex, as shown in Fig. 8. Fig. 8 also shows the free body diagram for forward drive. P, F_x and F_y are shown acting on the gear tooth engaging the pinion. The forces for reverse drive are placed in parentheses to avoid redrawing the figure. Each normal bearing reaction is resolved into two components F_1 and F_2 for the left bearing reaction and F_3 and F_4 for the right. The next step is to find the value of these components.

Taking moments about H

$$7F_1 - 884 \times 4.67 - 232 \times 5.21 = O$$

$$\therefore F_1 = 763 \text{ lb.}$$

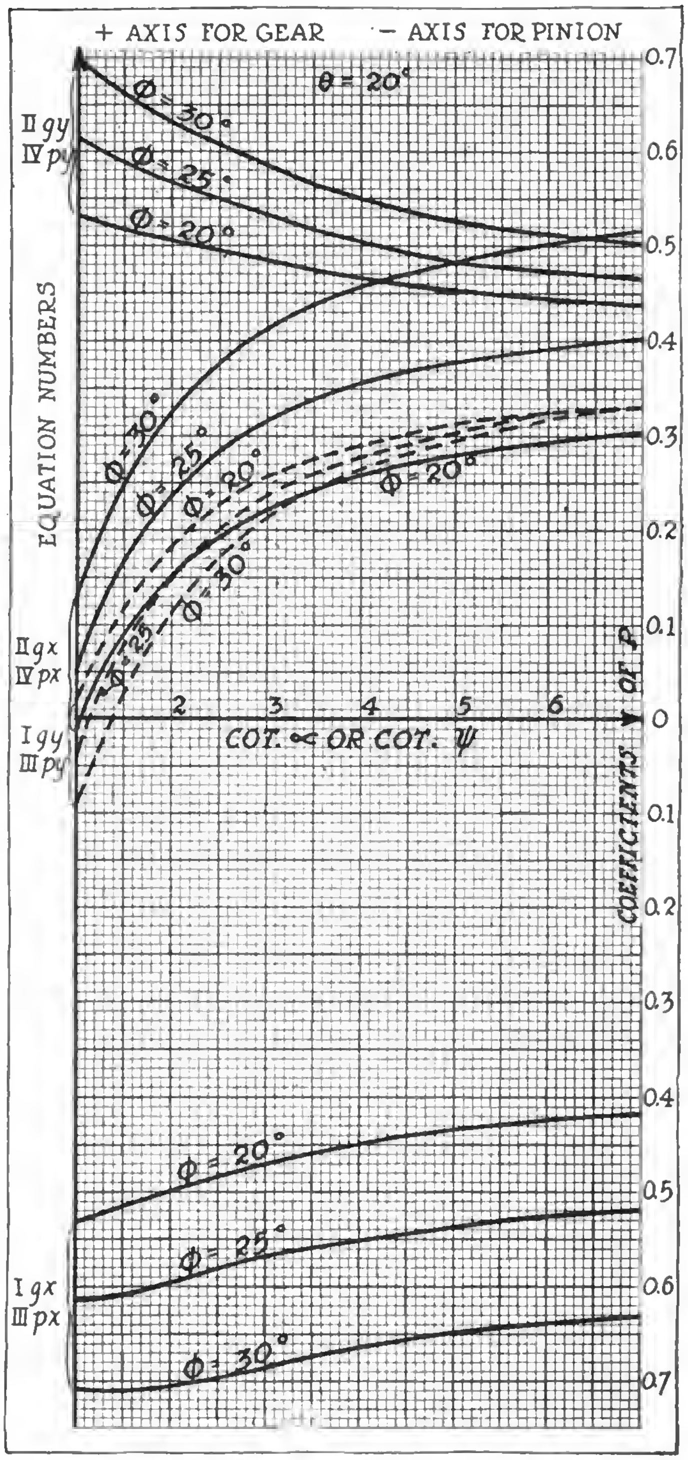


Fig. 7—Coefficients of P for gear and pinion having pressure angle of 20

$$7F_2 - 1405 \times 4.67 = O$$

$$\therefore F_2 = 937 \text{ lb.}$$

Then the total left bearing reaction is

$$R_l = \sqrt{763^2 + 937^2} = 1208 \text{ lb.}$$

The left bearing also takes the thrust of 232 lb.

In like manner taking moments about G, it follows $F_3 =$ 121.4 lb., $F_4 =$ 467.7 lb., and the total right bearing reaction $R_r =$ 483 lb.

The first speed transmission gear ratio is 2.56:1, hence the above reactions become 2.56 times as great for first speed, 3092 and 1236 lb., respectively; while the thrust becomes 594 lb.

For reverse drive, taking moments as before:

$$7F_1 - 587 \times 5.21 + 700 \times 4.67 = O$$

$\therefore F_1 = -30.3$ lb. The negative sign indicates that F_1 acts opposite to the direction shown in Fig. 8.

$$7F_2 + 4.67 \times 1405 = O$$

$$\therefore F_2 = -937 \text{ lb.}$$

In the same manner $F_3 = -670$ lb., and $F_4 = -468$ lb. Then $R_l = 938$ lb. and $R_r = 817$ lb. It should be observed that the magnitude and direction of these reactions are entirely different from those of the direct drive. In case of the pinion bearing reactions it is generally necessary to determine their direction and magnitude for both forward and reverse drive in order properly to design rigid bearing supports.

The reverse transmission gear reduction is generally so low that the rear wheels will slip before the full torque of the motor is applied. In this case the weight on the rear wheels is 2200 lb. The radius of the wheels is 17 in. Assuming the coefficient of friction is 0.6 then

$$P = \frac{17 \times 2200 \times .6}{5.21} = 4308 \text{ lb.}$$

This force corresponds to a gear reduction of $\frac{4308}{1405} = 3.066$. (The actual reduction is 3.42.) For slipping the wheels

$$R_l = 938 \times 3.066 = 2876 \text{ lb.}$$

$$R_r = 817 \times 3.066 = 2505 \text{ lb.}$$

$$\text{The thrust} = 587 \times 3.066 = 1800 \text{ lb.}$$

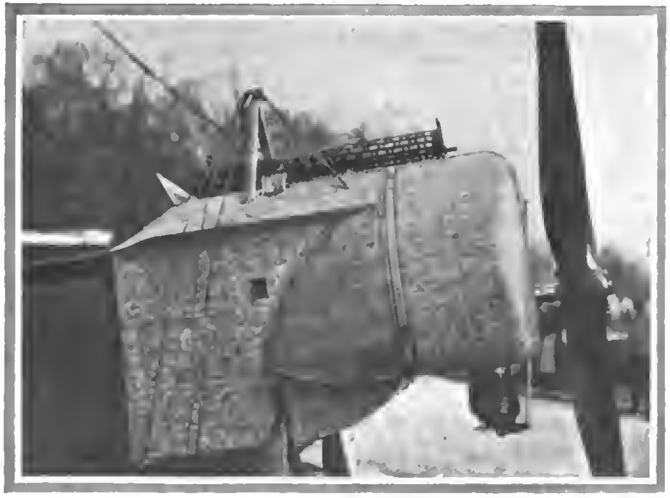
It is interesting to note that, although the torque is not great enough to slip the wheels for forward drive under the conditions as assumed for the reverse, nevertheless the maximum radial bearing pressure obtains on forward drive, namely 3092 lb. Incidentally this pressure is slightly greater than the weight of the entire car precluding the passengers. However, on reverse drive the thrust on the gear is three times as great as for forward drive.

Germans Copy Gnome Aeroplane Motor

CONTRARY to the general impression, the use of rotary air-cooled motors is by no means confined to French aviation. The German army employs the Oberursel nine-cylinder air-cooled rotary motor on practically all Fokker scout monoplanes. The Oberursel is a direct copy of the French Gnome aeroplane engine, while the Fokker aeroplane is a repetition of the Morane machine. With the exception of her Fokkers, Germany fits all her aeroplanes with vertical water-cooled motors. A few of these are six-cylinder overhead valve Benz, with vertical pushrods and rocker arms; the great majority are Mercedes engines with inclined overhead valves operated by a single overhead camshaft. Mercedes began to develop this type of engine in 1912, and in order to make more rapid progress employed the same general design for both aviation and automobile racing. These motors are produced under the direction of Heinrich Haeder, head of the aeroplane and racing departments of the Mercedes company, who has as his assistant the race driver and Engineer Seiler, who ran in the last French Grand Prix at Lyons. The latest Mercedes production is a six-cylinder motor of 5.5 by 6.29 in. bore and stroke developing 178 hp. at 1450 r.p.m. All these motors have separate steel cylinders with sheet steel jackets common to a pair of cylinders and a pair of valves inclined in the head; it is only in the racing type that four valves are employed.

Steel Cylinders Common

Steel cylinders have become very common not only in German aviation but among the Allies since the success obtained with them by Mercedes, and indications are that this type of cylinder will be largely adopted for racing and high efficiency car motors after the war. The construction is not costly, there are very few manufacturing difficulties, the combustion chamber is machined all over, water circulating space can be carefully verified, and the design is lighter than block cast cylinders. In most cases cast-iron pistons are used; but several manufacturers are designing these motors to run at 2400 r.p.m. instead of 1200, with the propeller geared down at a 2 to 1 ratio. This has necessitated lighter reciprocating parts and a considerable amount of successful experimental work has been done with aluminum pistons.



Engine housing and machine gun on captured Fokker monoplane. Engine is a rotary Oberursel like the French Gnome

In the German army much importance is attached to uniformity of design and construction. Thus, motors are invariably mounted in the front of the fusilage, with the tractive screw on the propeller shaft and, of course, running at engine speed, which never exceeds 1400 r.p.m. During the early months of the war the radiator was mounted on each side of the fusilage; this, however, was an exposed position, any stray bullet being liable to break a tube and cause the total loss of cooling water. More recently the radiators are of the honeycomb type, very similar to those used on cars, mounted in the center of the upper plane, with the head inclined considerably toward the rear. The entire cooling surface, which measures 6 meters 80, is above the top of the engine, instead of being below it as on the old type, and the maximum protection is obtained against stray bullets. All German motors, whether Mercedes or other make, are partially silenced, the exhaust gases being drawn into a collector, and the exhaust pipe carried upward and inclined to the rear to a point slightly above the top of the upper plane. With the exception of the Fokker all machines are biplanes.

No German V Engines

Germany appears to have paid no attention to V motors. This can be understood in view of her passion for uniformity. Before the war a very satisfactory type of vertical six-cylinder water-cooled motor was evolved, and the German authorities have remained faithful to this type during the war. The French, on the other hand, have refused to be bound by a mediocre uniformity, and in the midst of the war have not hesitated to give engineers a free hand and adopt the best that they could produce. Thus, the 20 months of war have seen the decline of the rotary and the rise of the six-cylinder vertical and various eight- and twelve-cylinder V motors. The rotary has not been abandoned, for recently there has been a rise in favor of the Rhone engine. This motor, originally a rival of the Gnome, was bought up by the Gnome company 2 or 3 years ago and produced by them. It has been found more satisfactory than the original Gnome and is being built in bigger quantities than the Gnome.

RUSSELL HUFF
PRESIDENT........1916

High Spots in S. A. E. History

Tracing the Growth of the Society

By Coker F. Clarkson
General Manager

WE can doubt philosophy and at times ignore friendly advice, but we must listen to wisdom and experience, particularly when the fruits of these are presented in a non-partisan manner for the common good by way of rational co-ordination of governing factors in the adequate development and orderly conduct of an industry. In any industry based upon engineering, the originating department of design, and the consequent department of production are, it is obvious, primarily determining of business success in general, although this fact is not usually given due force by controlling executives in industrial inauguration, and receives belated recognition in some degree, after an industry is well started.

In the case of the automobile industry, which in addition to being very complex and involving endless data a large part of the mass which is undergoing constant development is essentially one of quick decisions and speedy operations; the amount of broadly co-operative engineering work which has been under way for a decade is remarkable from any standpoint. The results of the work are monumental in diverse ways, fundamental among these being prompt presentation and discussion in assembly by qualified experts of design innovations appearing on the horizon, as well as consideration of comprehensive collated data of engineering elements already developed to a material degree (representing the more or less classic idea of professional societies and associations), and the majority, followed by the general, adoption of thoroughly considered formulations of recommended practices and standards of those features of specification, design (in part) and production which represent epochal development and which it is irrational to have differing in an immaterial way.

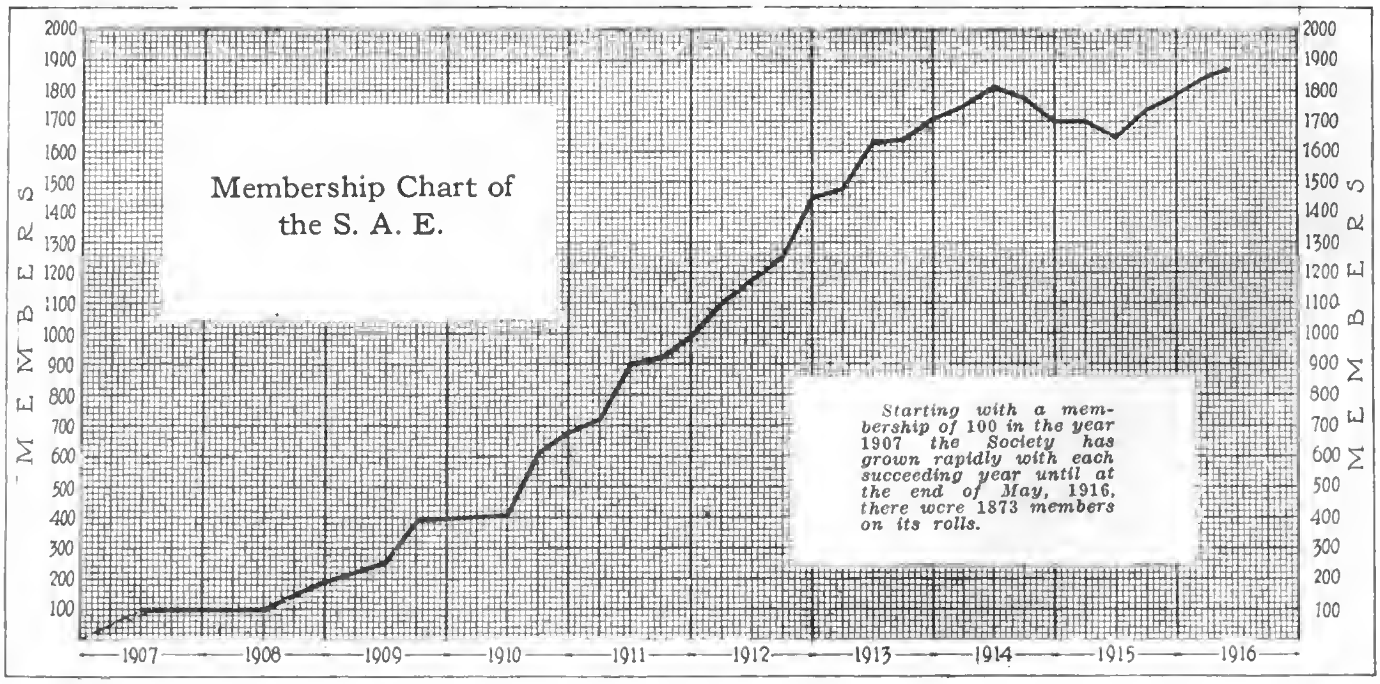
The dominant agency in the planning and conduct of the accomplishment of the progress which has been outlined briefly is, and has been for many years, the Society of Automobile Engineers.

It is the expression of mechanical genius of the American automobile industry. Its work relates to to-morrow and the day after to-morrow, not the past. Constant investigation and research are necessary to even keep pace with the advance in the automobile building art.

Coker F. Clarkson, General Manager, S. A. E.

Founded over 10 years ago, this band of congenial spirits has expanded constantly from a few to upward of 2000 men, associated with nearly 1000 different companies engaged prominently in the automobile and allied lines of production. The early records of the Society are more or less indefinite, but it is clear that the same feeling of fellowship and eagerness for progress, which are so familiar to-day, prevailed during the days when the problems of the members were not so great in degree although not really different in kind.

The impetus of the later and present advance of the Society had its inception shortly subsequent to the discon-



Membership Chart of the S. A. E.

Starting with a membership of 100 in the year 1907 the Society has grown rapidly with each succeeding year until at the end of May, 1916, there were 1873 members on its rolls.


1915

W. H. VanDervoort


1914

H. W. Leland


1913

Howard Marmon

tinuance of the Mechanical Branch of the Association of Licensed Automobile Manufacturers, in which many of the pioneer and leading American automobile designers and superintendents had taken an active part for several years. In 1910 a staff was put to work in the office of the Society, and at that time the aggregate membership was about 400.

An Enthusiastic Session

A large, enthusiastic meeting was held during the summer, a relatively large number of papers being presented on such subjects as pyrometry, testing of metals, engineering basis of vehicle taxation, variation in practice of anti-friction metals, patents, gear grinding, test data on frame sections, smoky engine exhaust, non-poppet valve engines, motor trucks and automobile nomenclature.

The Standards Committee

The paper on non-poppet valve engines represents a type which has been very well received, and valuable in the proceedings. A report on specifications for materials, steels, iron, bearing metals and aluminum alloys was submitted, this being a revision of the specifications which had been issued annually theretofore by the Association of Licensed Automobile Manufacturers. From these, the standards of the Society for the metals in question have been evolved, through several years of work of the Iron and Steel Division of the Standards Committee.

The most significant feature of the first summer meeting, so far as the recent work of the Society is concerned, was the vote of the Society that a Standards Committee should be appointed to take up in a thorough way this most important feature of the Society's work.

A Rapid Growth

In 1911 the publications of the Society became about twice as extensive as they had been before. The 1911 annual meeting of the Society, held at the Automobile Club of America, was attended by about 250 members and 150 guests. The election of over 300 additional members during the latter-part of the previous year was reported. Discussion was held as to the advisability of the Society meeting during the time of the annual automobile show, a dilemma that is always present. The attendance of the professional sessions is undoubtedly affected adversely by the alluring show attractions, so far as members in town at the time is concerned, but on the other hand, the best opinion probably is that the show is the time for the annual gathering as the members cannot get time to make two trips from home within a short period and want to attend the automobile show. The present theory of the Meetings Committee in this matter is to shorten the length of the annual meeting, making it so attractive as to counteract the show "competition."

In 1911 The Iron and Steel Division made its first report on specifications, these being accompanied by notes and instructions on the use of steels and their heat treatment, descriptions of forms of testing and metallurgical definitions. The work of standardizing a stock list of ball bearing sizes was inaugurated at this time, many years of struggle having followed before it was possible to get foreign and domestic bearing manufacturers to agree upon a satisfactory basis, relating particularly to permissible variation from nominal dimensions.

The Sheet Metals Division and the Broaches Division, which have since submitted valuable data for general reference and which before long resulted in accepted practice, began activities at this period. The table of sizes of seamless steel tubing, which had been established by the Mechanical Branch, was reduced about two-thirds in size and a thorough investigation was made on the question of whether the tolerance practice which had been established could be changed to give a condition of greater accuracy; with a negative result. A test was made at the A. C. A. for the benefit of the members on the effect of multipoint ignition on the performance of automobile engines.

Many Papers on Springs

At most of the meetings held in recent years, papers on spring suspension have been presented, as they doubtless will be at meetings for some time to come, this field of engineering being apparently one of the most complicated with which the members have to deal.

The very promising session on automobile fuels, to be held next week on board the Noronic, is, in a way, a culmination of discussion which has been conducted by the members for years. "What is commercial gasoline?" was the question asked at a meeting of the Society 5 years ago, it being pointed out that there was no standard to refer to. We are now at the stage of actually determining what can be done in the way of utilizing kerosene as fuel in engines modified to the extent that shall be necessary. The possibility of benzol as a fuel was brought up for discussion in a meeting several years ago.

One of the most informing phases of the proceedings of the Society is the number of papers which have been submitted on the commercial testing of engines, full pertinent details being given. The matter of putting into effect forms to be used in the testing of engines for the purpose of secur-


1912

H. F. Donaldson


1912

H. W. Alden

Henry Souther

Howard E. Coffin

ing practical results of performance of different products is still under advisement of a committee of the Society, and will develop into even greater benefit to the members than has already been received by them as to the making and checking of tests.

The Handbook of Data Sheets

The S. A. E., so far as I know, is the only organization of the kind which has undertaken and carried into effect a loose leaf form of engineer's pocketbook known as the "Handbook" of data sheets of the Society. The sheets, the preparation of which involved a great deal of detail, are furnished to the members without cost in addition to the conventional dues, supplemental and revised sheets being distributed twice a year, together with up-to-date indices when required. The last list of sheets giving the substance of matters referring essentially to the Society work shows that there are 110 items to be credited to standardization achievement, many of these items consisting of groups of various subitems. The policy of the Society with regard to the dissemination of its standards publications has been very liberal from the first. Reprints of data sheets are furnished free of cost to any legitimate inquirer, and additional sheets at a nominal sum. These sheets are used widely in different fields of engineering besides that of the automobile industry.

It can be said that the growth and value of the Sections of the Society, the first of which was established in 1911, have exceeded the fondest hopes of the members. The local organizations with headquarters at Detroit, Cleveland, Indianapolis, Chicago, New York and Philadelphia, have a high average of enthusiasm, friendly intercourse and performance in furnishing helpful engineering knowledge to the membership of the Society as a whole, and to the public. About one-half of the annual volume of Transactions of the Society is constituted of papers and discussion presented at meetings of its Sections.

The S. A. E. *Bulletin*, which was started in a desultory way in 1911, became a regular monthly publication with second-class mail permit 3 years ago. The current issue of the *Bulletin* contains 256 pages.

There is a form of membership of the Society called the Affiliate grade to which firms and corporations engaged in the manufacture of automobiles or trucks or the manufacture of parts and accessories used in connection therewith, are eligible. Affiliate members have the right, subject to the approval of the Council of the Society, to designate personal representatives up to a total of six. The interest of many firms is served by the Society, who have the opportunity, through their representatives, to bring to the attention of the latter many things that can be discussed with mutual advantage. Affiliate membership was established in answer to a distinct demand. Frequently firms want their employees to have the benefit of the publications of the Society. Many of these employees are more or less fleeting, they are at one time with one firm, then with another. Through the Affiliate membership firms can secure the advantages of knowledge their employees get through contact with S. A. E. members, attendance at meetings, reading of papers and reports and participating in discussion. It is felt that the Society owes a duty to many firms and companies who should have a channel through which they can present much valuable material in the way of experience, all of which redounds to great progress in automobile engineering, and many allied lines of the automobile industry.

A Visit to Europe

In 1911 the Society made its first official visit to Europe, going to England and France. The reception accorded was most cordial and elaborate. The members were admitted to renowned factories that had never before been opened to outsiders. Among the tangible results of the trip were the acquisition of a great fund of technical information by members of the party at first hand; the making of valuable acquaintances, both as between members of the Society and between them and foreign members of the industry, important commercial and technical relations resulting in many cases; the opening of avenues of information and interchange of ideas between American and European engineers; and the accruing of benefits to the industry at home and abroad.

The I. A. E. as Guests

Returning this visit, a party of British engineers came to America in 1913 to attend the semi-annual meeting of the Society and to go on an inspection tour of automobile manufacturing establishments throughout the country, under the auspices of the S. A. E.

It can be said unqualifiedly that as a result of the Society's careful and thorough work, the barriers which existed between American automobile engineering and that of our English cousins have been broken down.

As showing the breadth and nature of the Society's activities the following paragraph of its Constitution is interesting:

"The Society shall claim no exclusive copyright to any papers read at its meetings, or any reports or discus-

(*Continued on page* 1043)

Henry Hess

Thomas J. Fay

A. L. Riker

The Standards Com Automobile

A. Ludlow Clayden, Chairman Standards Committee Society of Automobile Engineers. (Engineering editor The Automobile)

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W. R. Strickland, Peerless Motor Car Co.
E. E. Sweet, Cadillac Motor Car Co.
C. H. Loutrel, National Lock Washer Co.

Nomenclature Division

K. W. Zimmerschied, Chairman, General Motors Co.
H. E. Coffin, Hudson Motor Car Co.
A. Ludlow Clayden, Class Journal Co.

Research Division

David L. Gallup, Chairman, Worcester Polytechnic Inst.
R. M. Anderson, Master Carbureter Corp.
H. L. Connell, Central Continuation School.

R. J. Broege

Wm. P. Kennedy

Herbert L. Connell

Cornelius T. Myers

F. M. Germane

H. C. Snow

H. G. Osburn

H. W. Waite

Bruce Ford

Chester E. Clemens

B. D. Gray

A. L. Riker

Alden McMurtry J. R. Cautley Berne Nadall F. A. Whitten E. P. Chalfant E. Sweet

W. T. Fishleigh, Engineering School.

Ferdinand Jehle, Automobile Club of America.

Daniel Roesch, Armour Institute of Technology.

C. B. Veal, Purdue University.

F. R. Hutton, Automobile Club of America.

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W. M. Newkirk, William & Harvey Rowland, Inc.

C. F. W. Rys, Carnegie Steel Co.

Ralph L. Morgan.

Truck Standards Division

H. D. Church, Chairman, Packard Motor Car Co.

B. B. Bachman, The Autocar Co.

L. P. Kalb, Kelly-Springfield Motor Truck Co.

W. T. Norton, Jr., Selden Motor Vehicle Co.

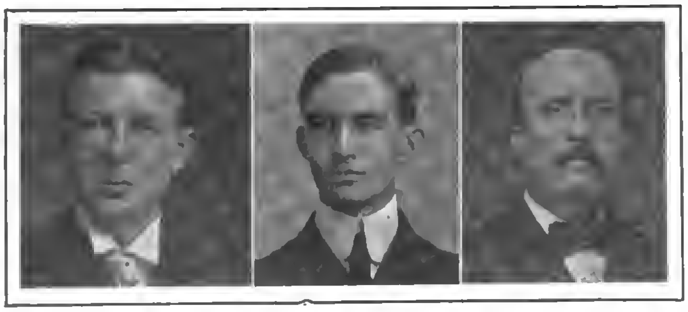
A. L. Riker, Locomobile Co. of America.

C. C. Carlton Paul Sutcliffe

David Fergusson F. Jehle

R. S. Fend E. G. Gunn

Robt. M. Anderson C. W. Findeisen



A. F. Milbrath W. A. Frederick Russell Hoopes

Daniel Roesch W. E. McKechnie C. H. Loutrel

C. P. Grimes Frank Conrad H. D. Church G. M. Bunnell B. B. Bachman C. B. Veal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Geo. W. Smith, The White Co.
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Aviation Engines

What Has Been Learned by Automobile Engineers Through Study of Aircraft Abroad—Development Points to Many Cylinders

By J. G. Vincent
Vice-President of Engineering, Packard Motor Car Co.

AT the beginning of the war there was no settled opinion in Europe with respect to the proper number of cylinders and the best cylinder arrangement, or indeed many other details in aircraft engine design. The only concerted plan possessed by any foreign government was that of Germany, who was contented to leave the task entirely in the hands of the automobile engineers. The latter naturally made use of their automobile knowledge, making the aircraft motors just as they would have built engines for a racing car. This produced a high speed motor with a high volumetric efficiency but not astonishingly light to the proportion of the power developed.

The Mercedes is the best known German aviation engine, and readers of THE AUTOMOBILE are all familiar with its construction and its reliability. It is nothing more than a good vertical six-cylinder in which lightness is obtained by making every possible use of very strong materials. In France development was around an entirely different line and before the aeroplane had demonstrated its military value there were many French aircraft engineers who, being rather ignorant of automobile engineering, developed peculiar engines aiming principally for intrinsic lightness.

Owing no doubt to the great success of the Gnome rotating cylinder engine there was a strong tendency in this direction and rotary engines were developed to a point where their volumetric efficiency was high and they produced a remarkable power per pound of weight. Repeated trials, however, showed that the typical French engines seemed unable to make very long flights while it was common knowledge that the need for frequent tearing down, cleaning, etc., was a distinct trouble. Long before the war it was pointed out that in figuring the weight of an aircraft engine its consumption of fuel and oil should be taken into consideration, because if this were not done the true weight efficiency of the engine would not appear.

Long Flights the Problem

Under war conditions scouts are required to make long flights and the enormous bulk of fuel and oil needed by most of the French motors made them undesirable for anything except very short trips. For long flights the water-cooled engine of much higher fuel efficiency was actually lighter as well as being more reliable. Realizing that something had to be done, and done quickly, the French automobile industry was appealed to, thus receiving official backing which had produced the Mercedes motor in Germany.

Some of the French engineers followed the Mercedes lead, building water-cooled six-cylinder engines. Others already had air-cooled eight-cylinder or twelve-cylinder V-type engines and these, together with newcomers, commenced to make water-cooled six- eight- and twelve-cylinder engines in addition. In England development had been somewhere between the German and the French system so that the British machines were usually better fitted than French.

Despite the apparent strong tendency toward the elimination of the old idea of an aeroplane engine and the substitution of something much more like an automobile motor, it is to be doubted whether there will ever be one ultimate type. Some of the rotary cylinder air-cooled motors have done excellent work in very light scout machines possessed of extreme speed and with ability to rise very rapidly, and it may be this type of engine will continue to find its scope in this field. As soon as it is necessary to carry much weight, such as passengers and ammunition, etc., so far as can be ascertained it is the fixed cylinder type of engine which is used almost invariably.

Leaving the rotary motors on one side and confining consideration solely to the fixed cylinder pattern, there are a number of varieties from which to choose. The four-cylinder is not admissible, partly owing to its inherent vibration and partly because its dimensions would need to be very large if adequate power were to be obtained. The typical German pattern of six-cylinder can be made to give excellent service, but even with six-cylinders we soon come to the practical limit of power.

Width Is a Limit

Using gasoline, we obtain a certain temperature of explosion and this intensity of heat limits the piston size quite definitely. It is noticeable that everyone who has studied the fighting aircraft in use to-day comes back impressed with the immense speed capability of the machines and their enormous power. At first the six-cylinder was able to take care of conditions, then, as more power was asked for, the eight V-motor came into favor, but this was only able to carry the power range a little farther than the six so it was followed rapidly by the twelve-cylinder and it is doubtful if even the latter can be made to give sufficient power for the planes about to be built. One suggestion which is perfectly practical is that of an eighteen-cylinder engine with three sets of six-cylinders arranged fanwise on a single crankcase with a single crankshaft. It is believed that some of these motors are being constructed in England and, theoretically, the only disadvantage appears to be the fact that such a construction will be rather wide. The desire to keep down the width has been largely experimental in developing the twelve-cylinder aviation engine as opposed to the eight. It is stated as a rule that the fusilage of a high speed plane should not be over 26 in. in width and it is none too easy to get even a 60-degree twelve-cylinder engine within that dimension.

Packard Co. Plans

It was with this information before us, and with a feeling that someone in this country should put in some real time developing aircraft motors (partly because we believe there may be some commercial future in it, but largely because we think this country may need some type of that motor) that the Packard Co. set out to develop a twelve-cylinder or rather, a couple of twelve-cylinder aviation motors. Of course, having settled the type of motor, it became important to consider the thousand and one details.

The first important detail that came up for discussion was the matter of propeller ratio. That is, whether the propeller should be mounted direct on the crankshaft, or geared down. Of course, if it is mounted direct on the crankshaft, the motor speed is limited to not over 1200 to 1400 r.p.m. In other words a load-carrying machine will run approximately 1200 r.p.m. at the propeller and, in the very heavy load-carrying machines, it is sometimes desirable to run the propeller as low as 900 r.p.m. So it seemed very desirable to gear down the propeller, but we knew that there were a lot of problems to be met in the geared down construction. While it has been experimented with to a considerable extent, there has been much trouble experienced. So far as that is concerned, the direct driven machine, with the propeller mounted on the crankshaft, is not free from trouble, by any means. Out of balance of the propeller is bound to exist, in spite of fine workmanship. This, coupled with the inequalities of the air through which the machine may be flying, puts some very heavy stresses on the propeller and its mounting. A test that one of the foreign governments is putting on propellers now amounts to something like mounting a seven-pound weight 30 in. from the center of the propeller, and running the engine at its rated speed for some considerable length of time. That may not sound like much, but it will come pretty near walking off with the dynamometer base at 1400 r.p.m.

Propellers Break Crankshafts

The out of balance that exists in propellers is, I believe, responsible for crankshaft breakage on the direct-driven outfits. Many engineers have been working on aeroplane motors who know much more about that subject than I do, but they all agree that the crankshaft is one of the very weak links in aeroplane motor construction. I do not know whether they would agree with me that crankshaft breakage is very largely due to inequalities of balance of the propeller, or not, but nevertheless, I believe that has a very important bearing on it, judging by the way the crankshafts break.

It would seem, in going to the geared type, that we get away from some of the strains on the crankshaft due to the propeller, but of course we must put them somewhere else. A short lay shaft, which must be very rigidly mounted, on very heavy bearings (and those bearings must, of course, provide for radial load, and also for end thrust), seems the best practice using very large self-aligning ball bearings at both ends of the short shaft, and mounting a very heavy double thrust bearing in between. This, of course, causes the use of very substantial gears, to gear down with, and provides ample means for cooling them with oil. I believe that with a properly designed outfit, an efficiency between 98 and 99 per cent can be obtained. This mounting must be very rigid, and I believe it is desirable to cast the crankcase and the case to carry the propeller mounting out of an alloy a little stronger than the ordinary aluminum.

Valve Location a Study

One of the next things that might be considered is the location of the valve. We, of course, know that we want the most power we can get, coupled with the best possible economy and reliability. Noise is not so much a factor, so that we naturally come to the valve-in-the-head. Of course, it is not absolutely necessary to use two overhead camshafts, but it seems desirable, as it does not necessarily add greatly to the weight of the motor, and it very greatly lightens the reciprocating valve parts. This is particularly desirable with the geared down type of motor, because it will probably be desirable to run the motor in the neighborhood of 1800 to 2200 r.p.m., and it must be remembered that, in an aeroplane, the motor is always running, when it is running, at its rated load. It is not like an automobile motor, that is working about one-tenth of its speed the greater part of the time; and some surprising things happen when you put a motor in an aeroplane.

The overhead camshaft is, of course, of very clean-cut construction, and allows a good clearance for the mounting of the carbureter and exhaust pipes. There are, of course, two general schemes in use for mounting carbureter and exhaust pipes. One is to put the two carbureters, one each on the outside, and mount the exhaust pipes in the center. The other is, of course, to mount the carbureters in the center, and the exhaust pipes on the outside. I think that individual mounting in the plane will determine the location of these accessories. It is a little cleaner-cut proposition to mount the carbureter in the center, as low as possible, with the manifold, and put the exhaust pipes on the outside. I believe this is particularly desirable, as the spark plugs should, in my estimation, be on the inside, where the oil will drip off from them, and it would be undesirable to have the exhaust on the inside and the spark plugs also, as more pre-ignition might result.

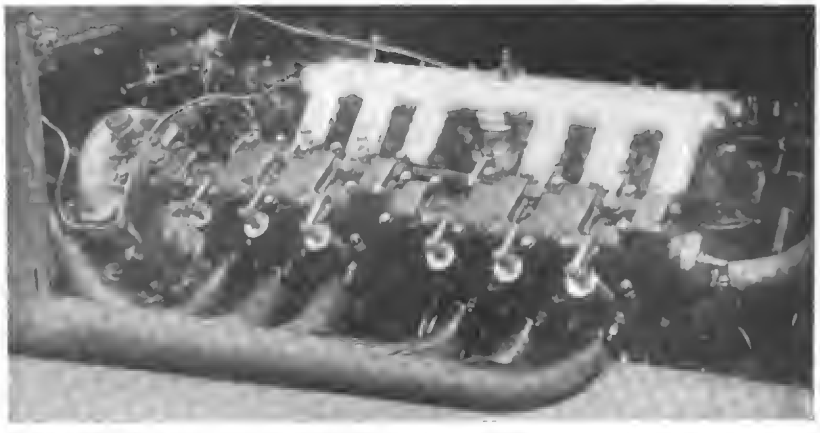
Points in Cylinder Construction

The next point that might come up would be the cylinder design. There are a number of constructions that are fairly satisfactory. The straight cast iron cylinder can be made rather light, especially when you take into consideration that you can nowadays weld jackets onto the cast iron and make quite a light construction. We know that it is good and reliable, and it is probably as cheap as any construction which has been developed up to this time.

Of course, another construction is to use aluminum with steel liners, either casting the cylinder separately, and leaving the head integral with the cylinders, so that you have to take the cylinder off to take a valve out, or casting the main barrels of the cylinder integral with the crankcase, and pressing the liner in, and bolting the head on.

Then there is still the Mercedes construction, of steel cylinders made out of forgings, all properly machined up and welded together. In my opinion, the steel cylinder is the best possible answer, although it is the most expensive, and the hardest to make, and may require considerable experimental work before we find out how to do the job in this country as well as they do it in Germany.

Of the other two constructions, I believe that the aluminum


Small size Packard aviation engine with overhead camshafts and two valves to each of the twelve cylinders

cylinder is more apt to survive than the cast iron, on account of the weight.

Location of Accessories

One of the problems that comes up next is the location of the accessories, and what accessories we want to carry. We of course got in touch with many foreign engineers, as well as our American engineers, and consider carefully the various problems regarding equipment. Practically without exception, they all said that they wanted electric lighting and starting, if it could be put on so that it would operate successfully. They had had experience, however, with badly designed electric lighting and starting, and were more or less skeptical about the design, of course. However, the need for electric lighting and starting seems to be just as great as it was in the automobile, and even more so; because, if your motor stops up in the air, and if you are in a dangerous place, it would be very desirable to start it if you could. So that we are planning to try to get the best possible work out of the electric generator lighting and starting motors for turning the big motor over. You will understand, in coming to these big units, it is pretty hard to turn the motor over anyway, considering that there are twelve cylinders, 4 by 6.

Overcoming with Difficulty

It has already been announced in THE AUTOMOBILE that the Packard company is building a 900 cu. in. twelve-cylinder aviation engine and it may be interesting to show how the width of this large motor has been kept down. As stated earlier in this article, it is far from easy to get a large motor with the cylinders set at 60 deg. sufficiently narrow to be installed in a fusilage 26 in. wide. In order to overcome this trouble the big Packard engine will have the cylinders at 40 deg. The object of putting them at 60 deg. is, of course, to divide the impulses evenly. Both sides of the twelve-cylinder motor are in perfect natural balance, so a change in the angularity of the cylinder blocks will not affect the balance, although it will affect the impulse frequency.

Careful experimental work, however, reveals the fact that the very slight variation in impulse frequency due to setting the cylinders at 40 deg. cannot be detected above speeds of 400 to 500 r. p. m. Seeing that the aeroplane engine runs at a practically constant and much higher speed, this low speed variation is not important.

It has been found that building the large twelve-cylinder Packard engine with a 40-deg. angle saves approximately 7 in. on the width. It also saves a little weight and adds a little to the strength.

Expects Battery Ignition

As to ignition, the foreigners nearly all wanted magnetos, because they are not familiar with the present state of the generator ignition art in this country. I believe it is desirable to design an aeroplane motor so that either magnetos or the generator type of ignition can be used. It is my belief that as electric lighting and starting becomes popular, as I am sure it will, the generator type of ignition will go with it.

It is, of course, necessary to provide an accurate tachometer, which is driven off the camshaft, and also an air pump for providing either pressure or vacuum. There seems to be a growing tendency to use vacuum for the gasoline feed, on account of holes being shot in the tanks, and releasing the pressure.

I will just very briefly run through two other points here: Lubrication is course pressure feed, and there are two general systems in use. One is to carry the oil in the sump, and the other is to pump it all out of the sump, and pump it through a radiator. I have not had enough experience to be able to make any prediction as to which is the better. A great many foreigners want two spark plugs in each cylinder, more for reliability than because it is necessary for power. The radiator location is a very important question. It makes the nicest looking job to locate it in front, but it does add somewhat to the head resistance, although if properly designed, and not over 26 in. wide, it makes a very good work out in a large motor. Of course, the other arrangement is to locate the radiators one on each side of the fusilage.

Weight Second to Reliability

My investigation showed that weight is secondary to reliability and economy. Just one word as to workmanship on aircraft motors. This sort of motor will, of course, have to carry with it workmanship that we could not possibly afford to put in an automobile, and it would not do any particular good if it were put in an automobile. In other words, it is absolutely impossible to put a gasket in an aeroplane motor in any place. You might possibly use it between the intake and the carbureter, but no place else. The constant weaving of the motor in the air seems to just naturally work the gaskets loose, and they blow out. In other words, every joint must be a lapped joint, so that they can be taken down any number of times without leaking, under any conditions.

Seats Staggered in New Three-Passenger Mitchell

The Mitchell-Lewis Motor Co., Racine, Wis., has brought out a three - passenger roadster as an addition to its line for 1917. Some features of the new car are the staggered seating arrangement, slanting windshield and the close-up position of the driver without any segregation of passengers. The Mitchell six chassis with its long wheelbase, cantilever springs and the two-unit, three-point suspension, which, like the other features of construction, are the ideas of the company's designer, J. W. Bate, is particularly adaptable to the roadster type of body. The illustration brings out its smart appearance.

Industry's Debt to the S. A. E.

Part of Engineers in Development of Automobile Business Should Be Appreciated—Great Results from Small Beginnings

By Russell Huff
President S. A. E.

THE rapid development of the automobile industry has aroused the curiosity and admiration of the world. Never in the history of mankind has an industry grown like the automobile business in the United States. It is now classed among the half-dozen largest enterprises in the country.

A New Dynamic Force

When one reflects that this wonderful evolution has been brought about in practically fifteen years' time, one naturally inquires the reasons for such an unusual growth. Of course, capital has played its part in the development of this business, but without a new dynamic force, frank co-operation and able standardization, the industry must have gone forward at a much slower pace.

Spirit of Co-operation

What once looked like a plaything in the business field has now become a real octopus in size and economic importance. Much has been said about the captains of industry who have risked their money and labored day and night for the success of the business, but little is said about the part the silent engineer has played in laying the foundation for the present state of this vast industry. Ten years ago the chief engineers of the leading companies were meeting regularly every month, exchanging ideas and devising standards for the general good of all. These early engineering conferences established a spirit of co-operation between the representatives from the various companies then engaged in the automobile business, which has been maintained through a period of ten years.

Value to Industry

These engineers early recognized the value to the industry, which was even at that time growing by leaps and bounds, of perfecting and adopting many standards for use in automobile construction. The wisdom of undertaking this work in the early history of the business cannot be overestimated, as no one can now figure in dollars and cents the value of the existing S. A. E. standards to the motor car industry. A recent investigation among manufacturers has shown that a large majority are making extensive use of the standards established by the Society.

The S. A. E. screw and bolt standards, which have been specially developed to meet the needs of the industry, are used by 94 per cent of the manufacturers. S. A. E. lockwasher standards now include thirty-five sizes instead of three or four hundred sizes formerly used and are standard practice with 90 per cent of the makers. The S. A. E. spark plug thread size is used by 93 per cent of the producers. These figures merely show a few of the S. A. E. standards which have practically become universal in their use by the industry and are cited to show the far-reaching effect of the early work done by the pioneer engineers in their original monthly conventions.

Energy in Standardization

Dozens of equally valuable standards have been adopted and recommended by the Society and are rapidly being taken up by the different manufacturers. This standardization work has been a great benefit to the manufacturers by permitting a steady reduction in the cost of cars and actual improvement in quality. Finally, the purchaser benefits through the steady reduction in the original price of cars and cost of maintenance. The work of standardization is never finished. The automobile industry is developing so rapidly that constant investigation and research are required. This work is being carried on with greater energy at the present time than ever before. The brightest minds among the automobile engineers of today are at work on numerous problems.

Results of Foresight

It is doubtful if the present methods of rapid manufacture, the low cost of production and the high quality of automobiles could all have been realized in such a short space of time without the untiring work of the engineers, whose foresight and interest in the future of the business spurred them on to sacrifice their valuable time to meet and work out the solutions to the many different problems always encountered in any standardization efforts.

The industry surely owes a debt to the S. A. E., the value of which can never be estimated, and that debt will grow larger as the industry expands, for the S. A. E. will grow in unison. There is no branch of engineering that does not lean upon the work of its societies.

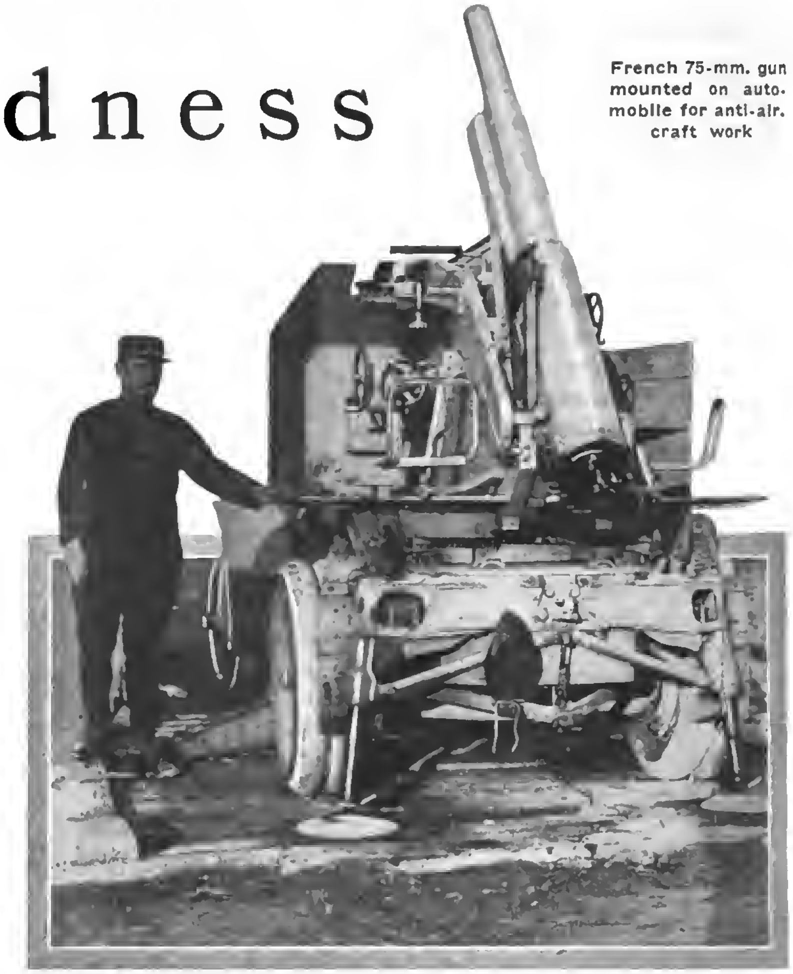
Preparedness

and Motor Trucks

A Review of the Lessons Learned at Heavy Cost in Men and Money by the European Belligerents

Part I

By Donald McLeod Lay



French 75-mm. gun mounted on automobile for anti-aircraft work

WITHIN the past few months the necessity for utilizing motor trucks and automobiles in the expedition into Mexico after Villa has brought home very strongly to the car and truck engineers and manufacturers as well as to the United States army officials the fact that ordinary commercial vehicles are not best suited to military requirements. All these men have been interested in the work of motor vehicles in the European struggle and have watched closely for any salient features in design and manufacture resulting from the experiences brought by war conditions. Still there are numerous points that have not been brought out very strongly but which a review of the development of the motor arm of the service in the European armies throws into relief.

At the outbreak of hostilities it was estimated that there were 100,000 motor vehicles in use with the French army, 18,000 of these being trucks, including 1100 buses, 200 four-wheel-drive tractors, fifty motor searchlights and 100 special vehicles. When the British expeditionary force first established itself in France it was estimated that its motor vehicle equipment comprised 2500 to 3000 machines, the great bulk of which were requisitioned among motor truck users and manufacturers' stocks, the British army's subsidy system at that time having progressed very little beyond the paper stage.

No Uniformity in Vehicles

In comparing the equipment of these two armies the French vehicles were then far superior to the English for military purposes, the latter being of such diversified types that they were not suitable for working together in convoy formation, some of them in operation in convoys having speed abilities varying from 7 to 17 m.p.h. Not only were they of different makes but the bodies were of all kinds for the trucks had been taken direct from private service without even removing the advertising matter with which they were usually almost covered. These convoys worked fairly well on level ground but as soon as hills had to be negotiated the slower vehicles and the defective ones dropped back, thus delaying the entire convoy. Hilly country also necessitated passing and repassing, which of course was dangerous, many radiators being smashed owing to cars running backward down the hills due to the lack of provision of sprags. With a closely spaced procession a rear movement of a few feet would be sufficient to cause an accident. These defects were known to the officers in charge of the motor vehicle service but of course there was no time to remedy them when war had been declared. The French authorities, however, had been working on this problem long enough—8 years—to have created what may be termed a model type of truck in all the factories. These vehicles, although differing considerably in design, were uniform in power, size, speed, load capacity, body, clearance, tire sizes and in such details as sprags, towing hooks, radiator guard, magneto and carbureter.

The English subsidy specification was based on the Leyland chassis and practically ordered manufacturers to abandon their own designs, no matter how good these might be, and accept that provided by the war office. As a proof of the indifference which this scheme met from the manufacturers, the last British army trials before the war comprised only three vehicles as compared with 110 trucks participating in the last French trials at that time.

Under the French scheme, as originally adopted, practically every manufacturer was able to enter with his standard types, there being no preference for bevel-drive over worm or chain, for a particular type or position of motor or for a certain class of gearbox. The field was even left open to steam, gasoline and gasoline-electric machines, the only requirement being that the trucks should be capable of doing good work on the road individually and collectively. Year by year, the regulations and tests became more stringent without, however, interfering with the general design. Thus a type of vehicle of uniform size, power, weight, speed, body, clearance, etc., was developed throughout the country so that when the war broke out practically all the best trucks in France were subsidized types. When called into actual service some of the features on which the army insisted, although of little importance to the private user, were justified. They are the use of sprags, sufficient clearance, radiator guard, uniform bodies, towing hooks front and rear, three-fuel carbureters and tanks allowing a big range of action.

An Early Peace Expected in 1914

It is interesting that in October, 1914, the end of the war was confidently expected in France to be very near, 1915 being looked upon as a dead year or go-between year in the automobile business. At this time it was estimated that the French Government owned 70 per cent of all motor vehicles both cars and trucks, of 12 hp. and over in that country.

The Germans had large numbers of armored cars in readiness at the outbreak of the war and used them with great effect, being able to keep up a steady fire until the enemy was almost upon them and then to get away in safety with cars and guns.

The ability of the German army to shift masses of men from one front to another in extremely quick time has been one of the features of the war and is credited to the systematic use of automobiles and motor trucks in transporting men, supplies and ammunition. Many of the German armored cars in use early in the war were nothing more than commandeered touring cars fitted with plates of steel to protect the vital parts and sometimes the occupants.

Automobile artillery batteries were found of inestimable value almost from the beginning of the struggle. In many cases ordinary 2½-ton chassis were used, the guns being fitted by the arsenal. Better results were obtained however with specially designed chassis having provision against the recoil of the gun and a certain amount of armor plating.

In December, 1914, it was stated that every type of motor vehicle seemed to have been thought suitable for receiving a gun and some armor plating, on the one hand being the traveling German fortresses standing 9 or 10 ft. high and probably weighing 8 or 9 tons and on the other hand ordinary touring cars with a quick-firing gun back of the rear seat and entirely devoid of plating. Two types of armored cars seemed really desirable at this time, the first was a powerful touring car or 2-ton truck chassis well armored without being too heavy, somewhat like the Belgian cars already described. The total height of such a car should not exceed 60 in., the driver being close to the center of the single compartment and the steering wheel raked to make his seat low. Motor and radiator should be completely protected, but wheels need not be inclosed, detachable types being an absolute necessity. Differential locks should be fitted, the second type of serviceable armored car was held to be a very light car of the Ford class with a minimum amount of plating, the object of these cars being to extend the scope of machine guns attached to cavalry and infantry regiments.

Most high grade automobiles with four-cylinder motors of 4 by 6-in. bore and stroke have proved satisfactory for armored car work. With an adequate front radiator and good capacity trunk, overheating troubles are not experienced despite the plating. On many cars a reduction of the gear ratio has been the only mechanical change, double steering is a refinement though not always adopted. A machine gun and sometimes a 1-in. gun in addition comprise the armament of these cars, usually mounted in a turret which protects the gunners. Best results have been obtained when these cars worked together in squadrons.

Some Practical Armored Cars

The Belgian armored cars which won great renown in the campaign of Northern France were built up from powerful touring car chassis fitted with machine guns and armor plating consisting of steel not less than 5 mm. thick, the gun being pivoted in the center of the single compartment. In some places a revolving turret was fitted while others merely had a shield in front of the gun and revolving with it. The driver occupied the most central position in the machine and was practically immune from attack. He had a view straight ahead through a hinged shutter and in addition had a small port on the right, level with his head.

The Renault company built a number of armored cars for the French Government at the end of 1914. The chassis was the Renault 18-hp. model having a four-cylinder motor, 3.7 by 6.3-in. bore and stroke and detachable wood wheels with pneumatic tires, twin wheels being used at the rear. Armor plating protected the entire car with the exception of the tires and wheels. The method of construction was to place steel ribs at wide intervals from frame member to frame member above the motor and as far back as the steering wheel. Steel plates were attached to this framework by means of bolts and wing nuts, so that any plate could be quickly dismounted to get at the mechanism, both motor and radiator being completely covered. A steel plate was carried at the extreme front between the

Above—Motor buses transporting troops drawn up behind the French lines

Right—Rolls-Royce armored car which hauls a naval gun on a special twin-tired chassis

One of the automobile repair shops which help to keep the cars and trucks with the French and British armies in condition

frame members to protect the underpan which with this system of cooling must be completely air-tight to prevent the draft passing otherwise than through the radiator tubes. At the rear there was a similar plate protecting the axle and differential housing. The body was a box-like structure with a quick-firing gun pivoted in the center and having a rectangular shield. The steering column was raked to give the driver a low position.

Overloading a Frequent Fault

A common fault in the construction of armored cars was the loading down of a touring car or light truck chassis with armor and guns too heavy for its capacity. This was especially the case where naval engineers were responsible for the construction, an example of this being a Pierce-Arrow 5-ton chassis on which was placed a big bed plate mounted on heavy I-beams, 1 ft. apart and carrying a 6-lb. gun which brought the weight of the gun and mounting assembly up to 5 tons, the armor plating weighing between 3½ and 4 tons. In addition, ammunitions, stores, supplies, and accessories had to be carried. This truck without full equipment weighed 4 tons. There were a fleet of trucks built in this way and each one developed trouble of some kind. All the springs flattened; one car had a 1¼-in. twist in every universal back of the gearbox and the main shaft was sprung ⅛ in. so that it was impossible to move first or reverse gears without a heavy hammer. Before the car could go into service it was necessary to cut away sufficient unnecessary metal to reduce the weight to a reasonable quantity.

Four-wheel-drive early in the war proved its value for armored car purposes, since such a machine driven and steered at both ends would be capable of traveling over any country and of high speed on good roads. It would also be able to get out of difficulties at a rapid pace from which it would otherwise be inextricable. Four speeds forward and two reverse were mentioned at this time as being desirable for these vehicles.

Four-wheel-drive tractors also found favor with the artillery service early in the war, these vehicles being found much more efficient and serviceable than horses for hauling guns and for bringing up ammunition.

The French artillery was greatly strengthened by heavy guns mounted on special chassis fitted with four solid struts capable of lifting the wheels from the ground and thus providing a solid platform. Many of the 155 mm. guns were drawn by four-wheel-drive tractors instead of horses. After the guns were in position the tractors were run into shelter the same as horses, being more easily concealed, however, and also having the advantage of being able to haul the guns out of a difficult position without actually exposing themselves. The French made a light four-wheel-drive tractor in large numbers which was designed to pull a useful load of 6 tons. These vehicles were found very useful.

Mounting the 75 Mm. Gun

The lighter Peugeot high speed chassis fitted with double steering gears, so that the driver could face either front or rear, a couple of reverse gears and two quick firing guns and adequate armor protection was later adapted by the French army to its artillery work.

Later, the 75 mm. gun was extensively mounted on 30 hp. chassis, a pivot carried on the steel platform and bolted to the frame members carrying the gun, at the left side of which the gunner's seat was attached. When brought into action the chassis was raised from the ground sufficiently to remove all weight from the springs but not to lift the road wheels, this raising being done by four hydraulic jacks, one at each corner of the chassis and simultaneously operated.

There appear to be no four-wheel-drive tractors in Italy, but heavy gasoline tractors for hauling heavy artillery are produced in considerable numbers, these vehicles being designed primarily to operate away from made roads. The Fiat chain-driven 70-hp. tractor is an excellent example and is fitted with a caterpillar band attached to the driving wheels which can be used for traveling across rough country.

A number of special army trucks such as searchlight and wireless telegraphy cars are now being produced while armored cars with 5 mm. plating and generally fitted with two machine guns are manufactured in moderately large quantities.

A French ambulance fording a stream while carrying wounded to the field hospital. Note the dual rear tires and the flat fenders

Standards for Aircraft

Work Done by S. A. E. and Success Thereof Brings Existing Standards Into Aviation Field—Need for Special Air Standards

By Henry Souther

Past President of the Society; First Chairman S. A. E. Standards Committee

AFTER getting away from active participation in the work and looking at it from the standpoint of an observer on the side lines, and as an executive in a manufacturing firm using S. A. E. standards, I am glad that some work of the kind was done by our S. A. E. standards committee. Much use is being made of the standards and much confusion and waste of money have been avoided; of this I am certain from personal observation. The gap existing between these two limits is very wide, when measured in dollars and cents.

Eliminating Waste

As an executive it was a great comfort to feel that a lot of time and money was not being wasted in the drafting room by some ambitious young draftsman in the design of a new screw thread, a new spark plug thread, or a new lock washer. A general order to the engineering department to adhere closely to S. A. E. standards was easily obeyed by the engineering force. Departure from S. A. E. standards was very rarely necessary.

I am sure S. A. E. data books are a success in this matter. The information is quickly available, thanks to the untiring efforts of the manager and his force at S. A. E. headquarters. It is a great pleasure to hear in many quarters the commonplace nomenclature adopted by the S. A. E. standards committee in the naming of the many qualities of special steels used. Producer and consumer now talk the same language when steels are mentioned. The consumer knows how to ask for them and the producer knows how to furnish the desired quality without argument or unnecessary correspondence.

Saves Drafting Time

It is much easier for the designer to lay down a tube section, an angle or channel section, or other standard shape, with an exact detail drawing to follow, than to work up something original. It is vastly easier for the producer to furnish a standard stock size than to make something special.

This all seems platitudinous; but there are a few who have not learned it yet. Such consumers must be lacking in common sense.

The old bugaboo of throttling originality has evaporated. Progress in the art has been rapid, in spite of the money saved by the use of S. A. E. standards. It is fair to assume that some of the money saved has been spent to advance the art even more rapidly.

Just now my attention is focussed on the development of the aeroplane. The observations of a few days show that S. A. E. standards are playing an important part. They creep naturally into the detail of design. They are natural standards. The engineering detail has stood the criticism of many minds. The producer has approved, and so has the consumer. Nearly every objection was eliminated at the outset. The result is as good as may be, and the airship designer is quick to see this. It is plain that similar work in making standards is to be done in airships. A preliminary glance shows that certain parts of all air machines should be the same. Propeller hubs, spark plugs, screw threads for turnbuckles and end connections for wire cables are a few examples.

It is plain, also, that this new industry is to be a real one in this country. The progress made is far beyond that realized by the public; even the engineering public, who should be best informed.

Schools Give Fundamentals

Our technical schools have courses of instruction that are teaching the fundamentals in a very practical manner. The students are not all youngsters, but are the business men, engineers and flyers who are pioneering the industry. The result is many good air-planes and many good engines. The term good is used in reference to the age of the art. The art is young and the product no more 100 per cent good than was the product in the automobile art 10 years ago.

It is fair to assume the same rapid progress in the new art. Airships are practically new; they will come into use more and more rapidly, just as the motor car did.

Will Help New Work

I hope to play some part in developing the new standards. It is natural to assume that, inasmuch as the United States will be a large consumer of airships, army and navy engineers will be active in establishing standards for the new fighting arm. Such co-operation with all concerned will make progress very rapid.

Consumer and producer have learned to get together in one art; surely it will not be hard for them to do so again.

Library Extension by Volunteer Service for Aid in Research

A Proposition Dedicated to the S. A. E. and Addressed to the Library Authorities Throughout the United States

By **Marius C. Krarup**

SOME librarians have a surprising amount of information in different branches of knowledge, as well as a "nose" for quality in books, enabling them to make excellent selections from the book market and from collections which come under the hammer. Requests for certain books from patrons of the library probably help or hinder in each case, according to the liberality of the budget for purchases and the average information of the patrons. But, on the whole, librarians cannot be specialists in any branch, and the public value of the library must depend mostly upon its *completeness* in the branches it aims to cover. On this basis there are few, if any, libraries in the United States which are well enough stocked for the research work of specialists. The information wanted is too often in books which are not on hand. Only the modern resumption of the good old habit of citing all sources of information in scientific books helps out somewhat. But it does not produce the cited book, which may be wanted.

In addition to the scarcity of good libraries, their local character curtails their usefulness. To get the full benefit of them, one must be on the spot. Chicago's libraries are mainly for Chicagoans, Boston's for Bostonians, that of the Case School for Clevelanders, and the New York Public Library as well the library of the United Engineering Societies mainly for New Yorkers and visitors to New York.

The idea that such a policy may be deliberately maintained for the purpose of drawing visitors to the city where the library is located, can probably be dismissed without comment. The spirit of library boards is broader.

Now, apart from the bulk of work done by visitors, quite a bit of research work is done in these libraries, or in some of them, through the employees, but the requests come principally from persons living in the same city, who shrink from doing the work themselves, because they are unfamiliar with it or cannot spare the time. This is excellent, so far as it goes, but the library can usually not hire more assistants than needed for routine work, and these cannot as a rule be competent beyond a mere word knowledge in any specialty. Knowledge of foreign languages is merely literary, and seldom that. Both quantity and quality of the requested work must suffer. The greatest curtailment of library utility comes, however, in the work which is neither done nor requested, because the facilities for having it done well or at all are not on hand, and because the public within as well as outside of the library city are not aware that anything of the kind might be arranged. Occasionally a physician or engineer living in a provincial town commissions a friend living in a library city to look up a subject for him, but, on the whole, *no conception of the large libraries as national stores of information which may be drawn upon from any part of the United States, under a regular routine system involving moderate fees for competent work, has been cultivated or exists.* This although the general system of library arrangement and extension work within the home community is more advanced in other respects in the United States than in most other countries.

The writer remembers from the period 1873 to 1882, during which he occasionally frequented the Royal and the University libraries in Copenhagen, Denmark, that the chief librarian at one or the other of these large institutions sometimes received requests for research work to be done for pay and that he commissioned competent outsiders who were willing to do this class of work to come and do it at the library; in most cases on a time basis for the compensation, I believe. Whether he had a list of such men or merely picked them from his circle of personal acquaintances in each instance, I do not know. This vague recollection prompts the suggestion that the same thing may be done here on a much larger scale, as a perfectly regular feature in library activities and one entitled to frequent and free mention in the newspapers.

Though not highly competent in this matter, I must for the sake of completeness outline the kind of service contemplated.

A good-sized room in the library set aside for the Volunteer Extension Service, in the charge of the second or third assistant librarian.

A corps of workers, graduates from universities or equivalent institutions, each worker having some broad specialty and being indorsed with regard to character as well as competence; those from foreign countries and institutions being provided especially with consular attestations; all of unobjectionable personal habits. The list secured by advertising; its members to qualify to the library board.

The services of these volunteers or examiners for research work to be obtainable on call by mail or telephone, with preference for those, among equally qualified, who can respond most promptly. Evening work permitted, even at late hours, in order to have a good selection of men. Women only on perfectly equal terms of qualification. Compensation on a time schedule, with registry of time for coming and going at library upon the service card for each job. In cities with more than one library, co-operation in service cards and registry.

A number of typewriter machines at disposal in the room set aside for this work. A list of operators obtainable on call. One or two of them constantly on hand, the list taking turns at full day and full evening service. Their compensation on a time schedule, for each job, even on days when whole time is required, the assumption being that the time on these days will be fully engaged, while the necessity is the avoidance of any incalculable special expense for the libraries.

The uniform charge may be composed of $1.00 per hour to the examiner, 40 cents per hour to the typist who transcribes his dictation, notes or selected passages from books and 10 cents to the library for each hour of examiner's time. For rush work or when translations render such disposal expedient, more than one examiner and more than one typist may be employed for a job. Each request for research must be accompanied by cheque or postal order for $25, the unused balance of which is returned to the sender by library cheque. If work cannot be completed within this sum, sender is notified, and he must send another cheque for $25.

When request is received, blank is mailed the sender, specifying the rate of charges and the methods used, and this must be mailed back to library with the subject for the desired research clearly stated and limited. The need for translation must be stated in order to have it done. In default thereof, foreign language is merely transcribed.

When the research work is finished and transcribed, it is mailed to the client with filled-in blank stating number of examiner, his qualifications, number of hours used by each worker, attestation that examiner has verified the work of the typist, and giving a complete list of the works (with edition and year of publication) which have been examined, including not only those mentioned in the research record but also those from which no results have been obtained.

For photographs (by photostatic or similar process) done from books or plates upon request of examiner, a special charge of 25 cents for each is made, including the white-on-black negative. An apparatus for this work shall be at disposal, but may be shared with library at large.

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Such or similar might be the plan by which thousands of professional men, newspaper men and business firms could become affiliated with the libraries of the large cities in the matter of acquiring knowledge which they may need and which they now usually acquire less promptly, in less reliable form, more expensively or not at all.

So far as members of the S. A. E. are concerned, it is by no means the idea to suggest that any considerable amount of research among books and periodicals usually comes within their province or would be profitable. On the contrary, their interest can be enlisted for the plan mostly because, in their case, it could occasionally save their own individual time, while giving them nearly the same security to the effect that nothing has been overlooked—in patent records or earlier developments akin to the subject in which they are interested—as they could obtain by laborious personal research.

Paragraphs on Current Topics

By **Marius C. Krarup**

Motto: Radical Thought, Conservative Action

Weather and time-tables, swashing waves and shady stoops begin to assert their silly rights of temporary precedence over gears and uncomfortable calculus. Cooling by splash and lubrication by syphon begin to look rational. Single-cylinder headgears are in dead storage. The season of frivoling is on. It is to be formally opened next week, when fortunate members of the S. A. E. are to try once more to reach the shores of Georgian Bay by skilful navigation and such jettison of accumulated loads of learning as may be found necessary and practicable.

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This joyous event throws its shadow beforehand over these topics. War echoes, gasoline prices, the dust of the road, the overhauling of the old motor boat, Preparedness in all its five senses (each more important than the other), the results of the races, our new hopes in aeronautics—all these subjects receive a new coloring through the stupendous amount of pessimistic philosophy which the S. A. E. excursion stirs up in the breasts of members who can't go. What would become of the automobile industry, for example, if Lake Huron were infested with the tin sharks of the North Sea; nay, if a single U-boat had been dropped into the lake (through diplomatic channels of course) and were to direct its devilish aim at the precious ship carrying most of our hopes of progress? This dread thought alone may account for many cautious absentees.

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This raises the question: Why do automobile engineers go junketing by sea or lake, instead of sticking to their own professional element, which we believe is an equable mechanical mixture of gasoline vapor, road dust, curves and equations? An authoritative answer is fortunately at hand. It comes in several sections. They could not get to Georgian Bay by car in a straight line, and any other is abhorrent to engineers. They could not get back in time. They might be commandeered in Canada. They would have to go one engineer in each car, as nobody would want to advertise or indorse the more or less erratic product of his less clear-sighted colleague. Furthermore, they are, each and all, 90 per cent human and only 5 per cent engineer, the remaining 5 per cent being made up of variable impurities which defy chemical analysis, but in which all sorts of special abilities are said to reside.

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Additional reasons can be mentioned: With regard to gasoline, Standard Oil continues to offer substantial prizes for operative economy with this commodity, and the engineers are not out for economy on this trip. They are out to forget gasoline and dust, to give the 90 per cent human a needed airing and to work all the rest into a stable emulsion of fraternal sentiment in which no conflicting interests can be distinguished; for they have discovered that Fraternity is now the only one of the revolutionary trio whose gilt remains untarnished, while Liberty and Equality look much the worse for wear and tear.

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No doubt, from the clear atmosphere on board the ship a few thoughts will revert to the dust which has been left behind. Unlike Dr. Guglielmini and Pierre Giffard we always carefully dodge this subject. It is unflattering to our resourcefulness. Dust—to be cussed! That is about all you can do with it at less than five to sixteen dollars per square yard of road surface. But, of course this is only because the S. A. E. has nothing to do with road engineering. May the thought come to them to take it up; to form an S. A. E. division of civil engineers or a road division within the S. A. E. Since the road is recognized as the other half of the automobile, the subject should lie at least as close to interest and duty as Industrial Preparedness. And Pp is getting as common as π with automobile engineers. No, it does not stand for preposterous propensities, but for prosperity and preparedness.

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In another direction the influence of the automobile engineer seems to have been too strong. Because racing motors were taken out of the automobile and put in the motor boat, the four-cycle type of motor has predominated in boats ever since. Is this again because there is no influence among motor boat constructors comparable to the discriminating and yet unifying effect of S. A. E. work? The opportunity for developing the two-cycle motor to equal perfection with the four-cycle motor under the most favorable conditions is identified with boats, and if this natural bent had been followed, we might now have had twin-cycle twin-twelves, which in turn might have become useful for automobiles and aeroplanes. How about a motor boat division of the S. A. E.?

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If cars were faster than their drivers at Indianapolis, as on ordinary roads, while the drivers were faster than the cars on the smooth Sheepshead speedway, a superlative spring suspension seems to be the next logical demand for racing cars.

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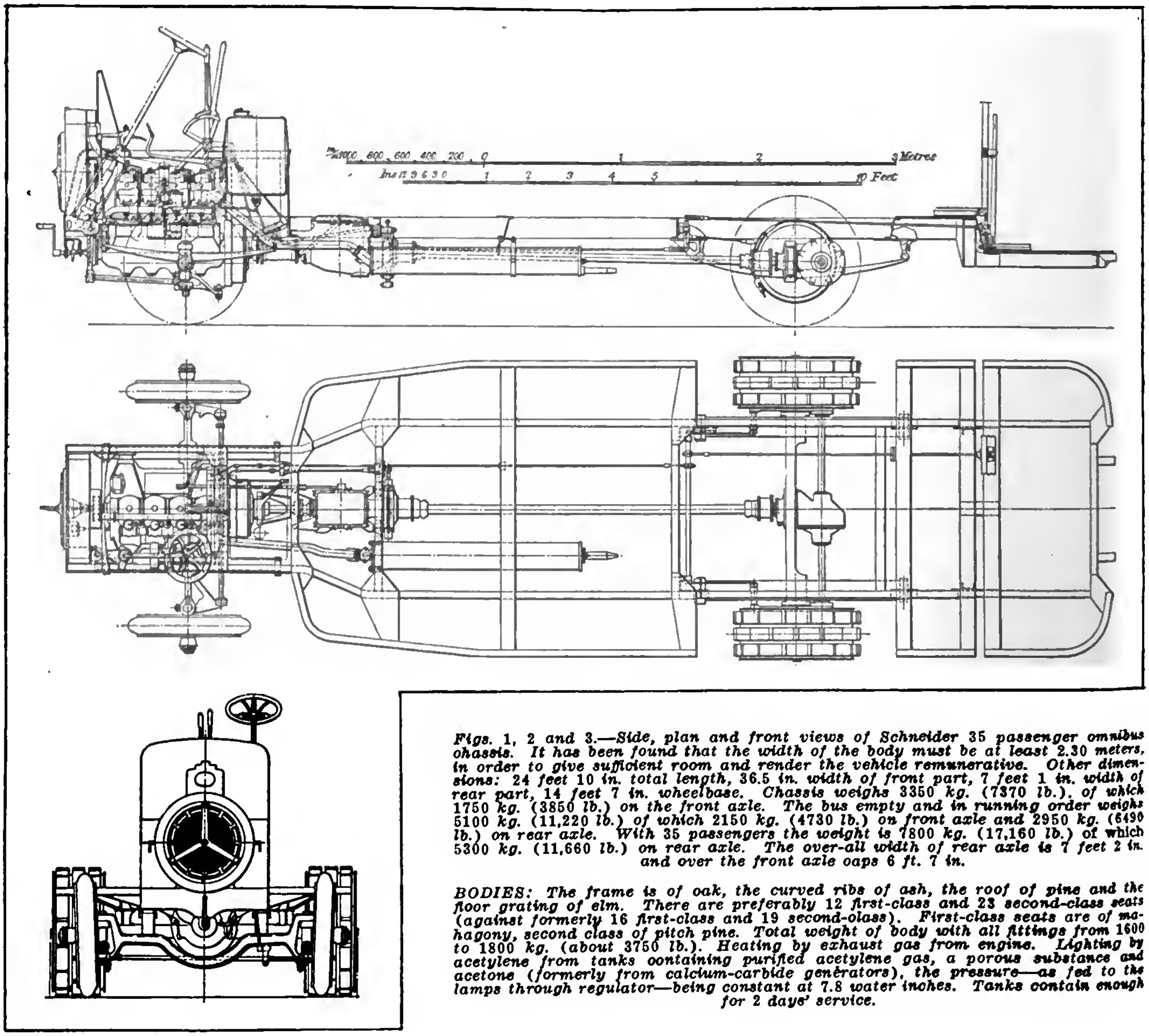
That aeroplanes are mostly shot down these bellicose days, makes us forget perhaps—the president of the Aero Club says they are now safe—that they can still come down for less complimentary reasons, and do. Scarcely too safe for sport, as yet, they should be meat for S. A. E.

Omnibus Construction Graduated from Both Peace and War Service

WHEN a few months ago the Paris General Omnibus Company decided to resume on a small scale the service which had been interrupted at the outbreak of the European war, it was held that the best thing to do in the matter of design and construction was to duplicate the type of vehicle which had been finally adopted in the middle of 1914, just before the company's entire equipment was commandeered for use in the military operations. Many new vehicles were built on this plan, but they did not go into commission in the streets, as the army continues to take them as fast as they are turned out. The indorsement which this type has received through its success as a money-maker in the public transportation system of Paris and subsequently through the satisfaction derived from the use of the chassis for very rough war service, lends special interest to a study of their construction and, actuated from this point of view, *Engineering* (of London) presents a number of scale drawings representing the main features in the Schneider chassis and body and also the principal varying features in the De Dion chassis, which is used to a more limited extent. These drawings are reproduced in the following, with brief explanatory captions, but the reader is likely to find, according to his own needs and experience, special points of interest in each drawing which are left unmentioned.

These omnibuses are the result of a practical evolution which had reached the stage at the beginning of hostilities that breakdowns had ceased to occur, expenditure was on the decrease and receipts were rising. The population favored the buses more and more in competition with the underground service, and neither the comparatively heavy gradients of Paris streets, nor the short routes rarely exceedingly 4.3 miles in length and necessitating considerable waste of time at the termini, prevented satisfactory financial returns to the operating company.



Figs. 1, 2 and 3.—Side, plan and front views of Schneider 35 passenger omnibus chassis. It has been found that the width of the body must be at least 2.30 meters, in order to give sufficient room and render the vehicle remunerative. Other dimensions: 24 feet 10 in. total length, 36.5 in. width of front part, 7 feet 1 in. width of rear part, 14 feet 7 in. wheelbase. Chassis weighs 3350 kg. (7370 lb.), of which 1750 kg. (3850 lb.) on the front axle. The bus empty and in running order weighs 5100 kg. (11,220 lb.) of which 2150 kg. (4730 lb.) on front axle and 2950 kg. (6490 lb.) on rear axle. With 35 passengers the weight is 7800 kg. (17,160 lb.) of which 5300 kg. (11,660 lb.) on rear axle. The over-all width of rear axle is 7 feet 2 in. and over the front axle caps 6 ft. 7 in.

BODIES: The frame is of oak, the curved ribs of ash, the roof of pine and the floor grating of elm. There are preferably 12 first-class and 23 second-class seats (against formerly 16 first-class and 19 second-class). First-class seats are of mahogany, second class of pitch pine. Total weight of body with all fittings from 1600 to 1800 kg. (about 3750 lb.). Heating by exhaust gas from engine. Lighting by acetylene from tanks containing purified acetylene gas, a porous substance and acetone (formerly from calcium-carbide generators), the pressure—as fed to the lamps through regulator—being constant at 7.8 water inches. Tanks contain enough for 2 days' service.

Many of the buses taken over by the war department were, after the first rush, returned to Paris from the war zone, and their bodies were converted with the object of further facilitating the transport of men and foodstuffs. For the commissary service, the whole of the seating accommodation was removed, the glass panes were replaced by wire netting and strong hooks were secured in the roofs. Some of the new-built vehicles were equipped in the same manner.

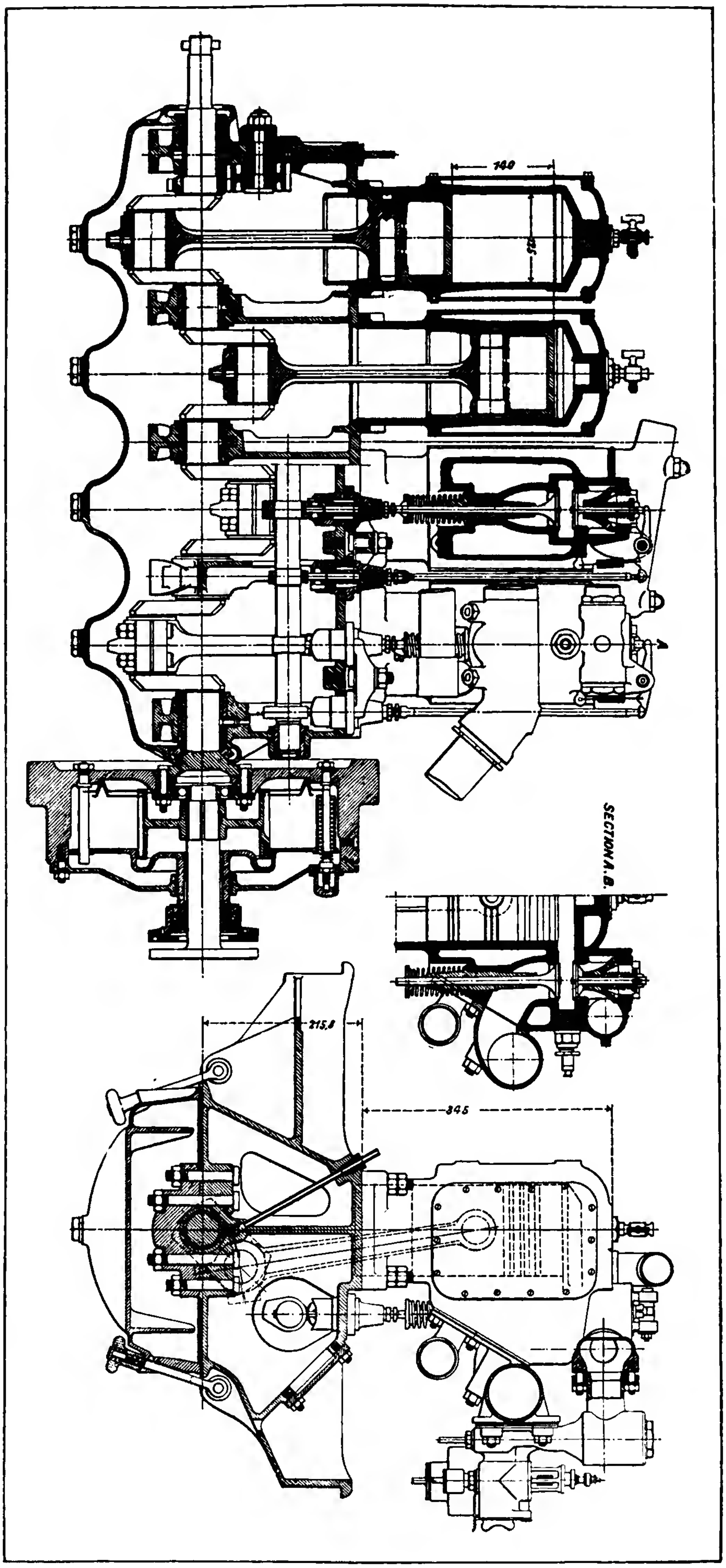
Earlier Developments

Prior to 1906 a number of double-decked buses were in use, but they have been gradually discarded, mostly owing to the delays caused by passengers taking their time when entering or leaving. An otherwise satisfactory bus of this class carried thirty-two passengers and was mounted on a Schneider chassis. The four-cylinder Schneider motor, with bores of 4.9 and stroke 5.5 in., developed 30 hp. at 900 r.p.m. The chassis weighed 3190 kg. (7018 lb.), of which 1690 kg. (3718 lb.) was on the front axle. The empty omnibus weighed 5060 kg. (11,132 lb.) with 2030 kg. (4576 lb.) on the front axle. With all seats occupied the weight came to 7270 kg. (15,994 lb.) and the maximum speed on the level was 13.7 m.p.h. Second speed was 8.1, and low was 4.05 m.p.h. The same type was built to thirty-four passengers, while engine and vehicle speeds were slightly increased, becoming the same that are now used; namely, 1000 r.p.m. and 14, 7.9 and 4.05 m.p.h. On the whole this became the prototype for the present model, by removal of roof seats and lengthening of the chassis, a platform built of angle bars being added. Many of these remodeled vehicles are among those still in service.

Other types which were tried and discarded were: One seating twenty-three passengers longitudinally; one with twenty-one seats and wheels shod with pneumatic tires those on the rear wheels being treble; one seating twenty-eight with side entrance close to rear end; one seating thirty with rear platform on a lower level and reached by a step on center line of vehicle.

Heating

The buses are heated with the exhaust from the engine, for which purpose these gases are piped



Figs. 4, 5 and 6—Sectional views of engine for 35-passenger Schneider omnibuses. The four-cylinder engine is carried by two cross-members. The cylinders are of the L-type and lubricated by splash. Bore 4.9 in., stroke 5.5 in., as in earlier type before referred to. Camshaft has keyed-on cams and is gear-driven. Inlet valves operated by long tappets and exhaust valves by overhead rockers. Ignition by high-tension magneto. Cooling by thermo-syphon, with radiator and fan on front of chassis. Aluminum three-armed spider protects copper tubes of radiator. Power transmitted by Hele-Shaw clutch in flywheel.

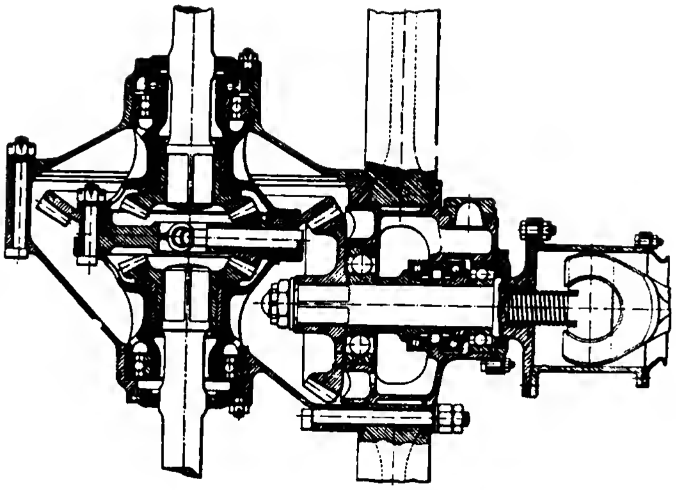
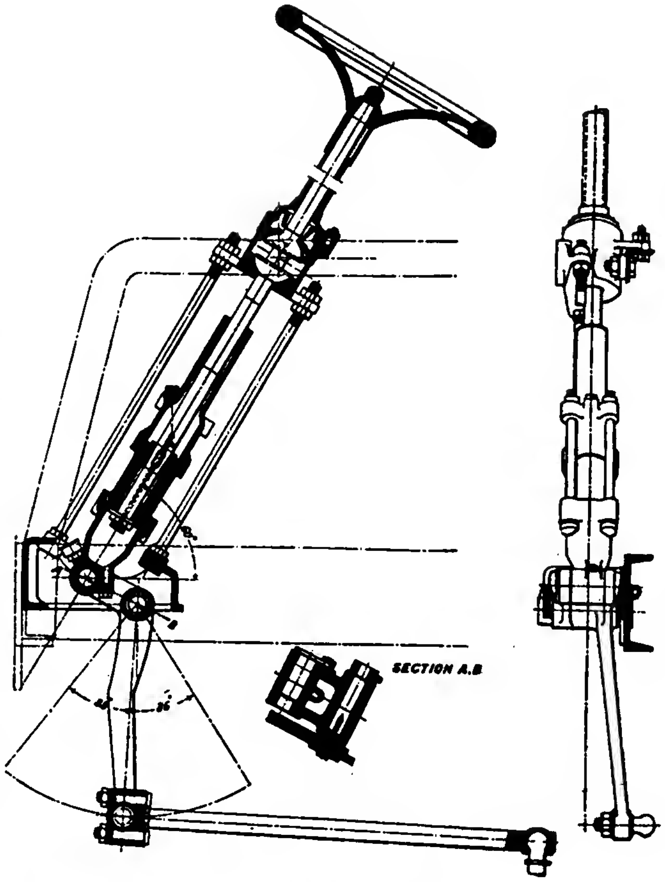


Fig. 7—Shaft drive with universal, bevel gear and differential gear in Schneider omnibuses, showing also relations to the load-carrying axle and wheel shafts to final gear reduction by annular spur gear drive in the rear wheels, the latter parts being shown in Fig. 13. The vehicle has two brakes; a transmission brake actuated by a pedal which also disengages the clutch, and a rear wheel lever brake.



Figs. 8, 9 and 10—The Schneider steering-gear. It is of the screw and nut type and on the left side of the vehicle on the outer side of the frame members. (Figs. 1, 2 and 3 show it on the inside of the frame and also in other respects seem to represent the chassis of a remodeled double-decked omnibus rather than the final type, showing, for example, treble-tired rear wheels though final type has only twin tires.) The front wheels, which have single rubber tires, are 35.4 in. in diameter.

through aluminum foot-warmers, and baffle plates in the pipes in conjunction with a butterfly valve in the muffler serve to regulate the temperature in each heating unit. But these foot-warmers have not always been found perfectly gas-tight.

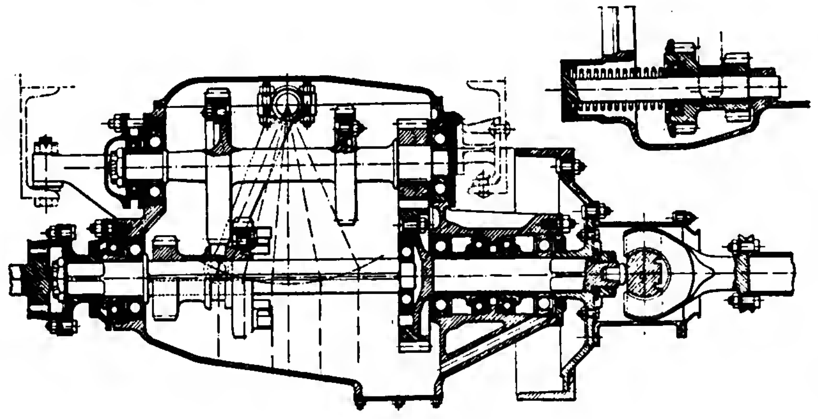
The 31-Passenger De Dion-Bouton Omnibus

In the development referred to above it was found most profitable to use vehicles of slightly smaller size for the shortest routes; and these were built on De Dion-Bouton chassis at Puteaux, near Paris. The frame is 22 ft. 8 in. long, 37.2 in. wide in front and 7 ft. 1 in. at the rear, while the total width over front axle caps is 7 ft. and over rear axle caps 7 ft. 4½ in. The body width in front is 6 ft. 3 in. and at the rear 7 ft. 4 in. The wheelbase is 11 ft. 8 in. The wheels have the same diameter as those of the Schneider chassis. The weight is 3470 kg. (7634 lb.) of which 1770 kg. (3894 lb.) is carried on the front axle. The whole vehicle empty and ready for service weighs 5070 kg. (11,154 lb.) with 3100 kg. on the rear axle. With thirty-one passengers the weight comes to 7160 kg. (15,752 lb.) and the front axle load to 2085 kg. (4587 lb.). The speeds on the level, with the motor at 1000 r.p.m., are 12.4, 6.85 and 3.75 m.p.h.

The accompanying illustrations, Figs. 14, 15, 16 and 17, show the most important details in which these omnibuses differ from the 35-passenger Schneider omnibuses.

Maintenance of Paris Omnibuses

When the omnibuses were in city service, they were inspected by a mechanic at each terminus of routes and every



Figs. 11 and 12—The speed gear box of Schneider chassis, mounted between two transverse frame members and connected by universals at front and rear ends of lower shaft. Three forward speeds and reverse (Fig. 12). Transmission brake of large diameter, internal expansion type. All universal housings metallic; leather discarded.

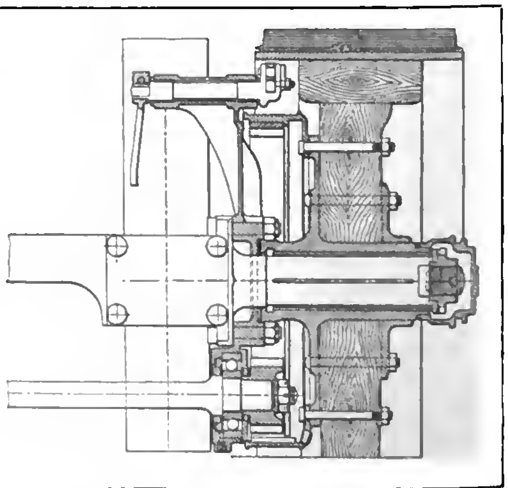
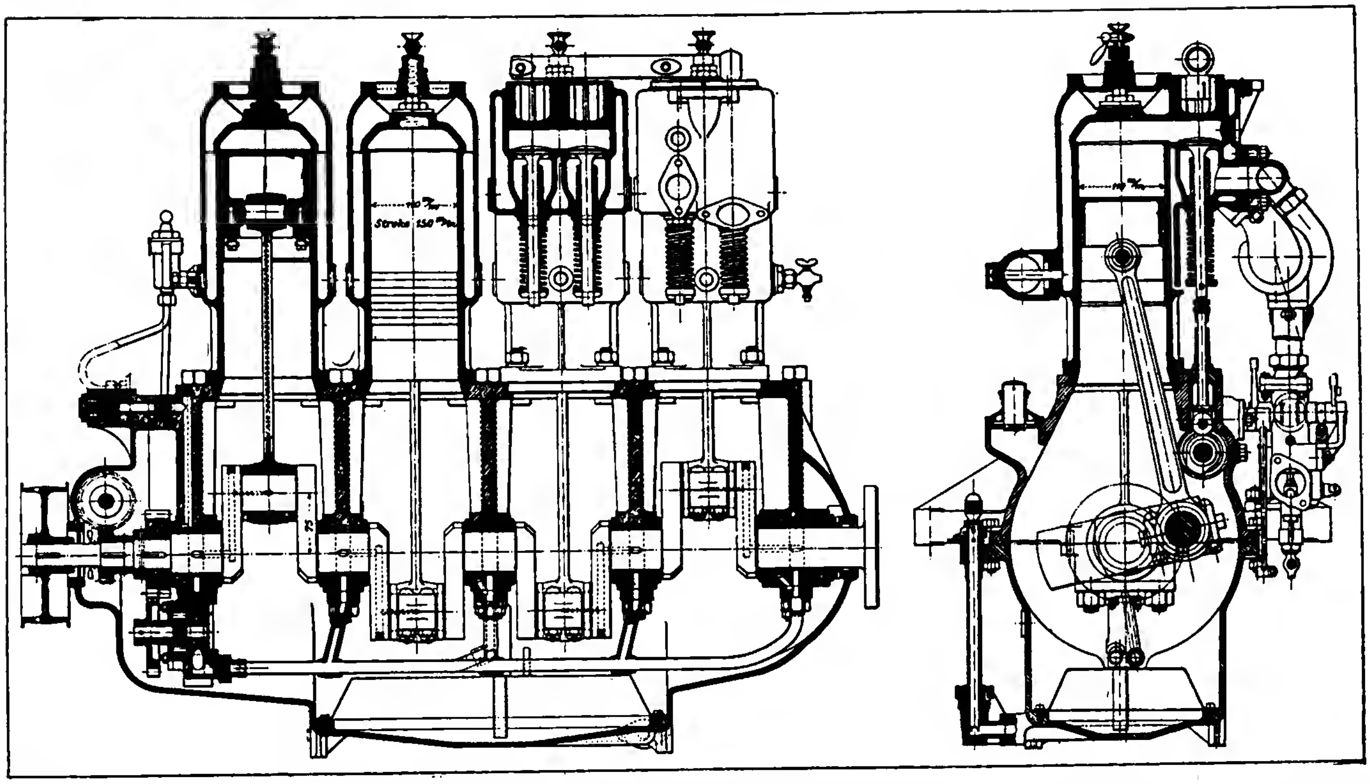


Fig. 13—Rear wheel of Schneider chassis, with spur-gear drive, brake drum and one-piece twin tire. Diameter 37.4 in. The shoes of the brake are wood-lined. The wheels are of wood and manufactured at the omnibus company's works; the spokes of acacia; the rim of elm; the naves of steel with phosphor-bronze bushes.



Figs. 14 and 15—Four-cylinder, 30-hp. engine in De Dion-Bouton 31-seat omnibuses. It is placed beneath the driver's seat. Bore and stroke are 4.3 and 5.9 in., respectively. Normal speed 1000 r.p.m. Ignition by high-tension magneto, without adjustment for timing the spark. Carbureter is of double-jet type. Control by accelerator pedal. Engine speed limited by governor. Cylinders are fired 1, 3, 4, 2. Cooling by thermo-syphon. Lubrication forced. Radiator similar to that in 35-seat vehicle. The plate clutch is of the De Dion type. The engine is mounted in a cradle resting at 3 points in cross members of the frame. Three forward speeds, direct on third, and reverse. Steering by worm and segment, irreversible. Transmission brake and rear wheel brakes similar to those on Schneider chassis. The front axle is a one-piece drop forging.

night at the garage. After working 25,000 miles each vehicle was taken to the shops and overhauled, the body being first removed; all loose rivets were replaced. The whole working mechanism was taken apart, re-adjusted and tested.

Cost items under this plan were found distributed as follows: .13 franc per kilometer for chassis and motor; .03 franc for the body; .12 franc for tires; .0265 franc for washing, lighting and heating; .2125 franc for fuel.

The fuel was at first an equal mixture of benzol and alcohol; later; benzol alone. The consumption was, average, .176 gal. per mile of 90 per cent benzol, density .880; .180 gal. per mile of gasoline, density about .745; .2 gal. per mile for the alcohol-benzol mixture. Lubricant, grease and cotton waste totaled .02 franc per kilometer; driver's wages .10 franc; depot charges .06 franc.

These figures are here given for mutual comparison only, as the radically different cost of labor and materials in France renders all other comparison illusory. The same applies to administration expense. The Paris company collected 426 million fares and 58 million francs in 1913.

Fig. 16—Bevel gear drive and differential on De Dion-Bouton omnibus. The wheel shafts by flexible joints operate spur pinions which engage the internal gear teeth of two rings which are bolted to the wheels, as shown in Fig. 17.

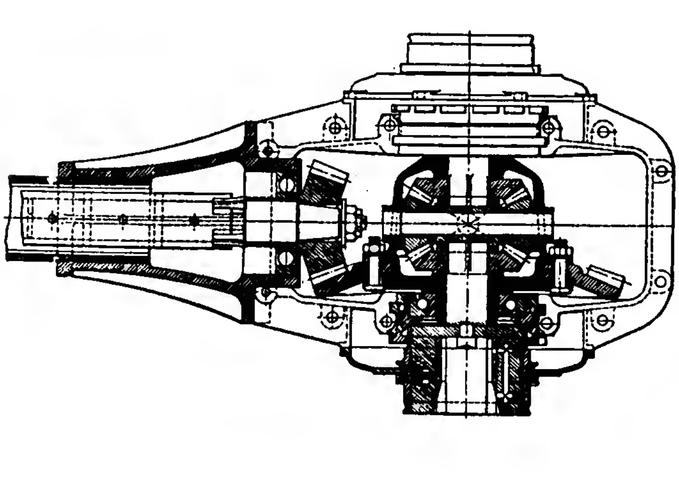
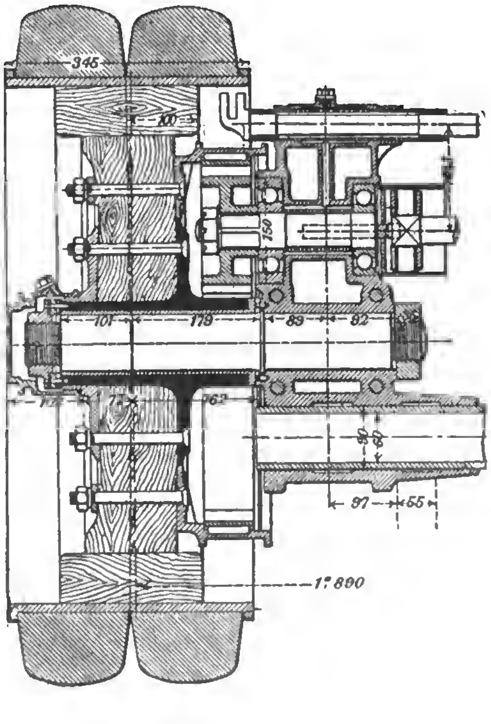


Fig. 17—Rear wheel and axle head of De Dion-Bouton omnibus. The rear axle consists of a tube fitted in two cast-steel axle heads, and the latter are connected to the rear springs.



What Can We Learn from Racing?

Engineering Lessons Derived from Speed Contests Too Valuable To Be Neglected—Manufacturers Must Not Overlook Value of These Tremendous Tests

By J. Edward Schipper

RACING means no more to the automobile industry than baseball, golf or any other form of sport and entertainment if the valuable lessons to be derived from it are not taken to heart. There are just two ways of looking at automobile racing from the standpoint of the industry. First, is racing merely a means of attracting attention to the automobile, a sort of advertisement for its possibilities, as it were, or is it a means of imposing the greatest possible test of strength, endurance and speed in order that from the lessons we learn we can make stock cars that better endure the stresses of every-day usage?

Not a Sales Proposition

The automobile industry is not in a stage where it needs racing or any other form of hippodroming to act as an incentive for car sales. Perhaps this is the underlying reason why factories are not engaged upon the manufacture of speed creations which will be able to win contests on the country's speedways. Rather than build high-priced racing cars, the costs of which must be added to the costs of regular production, they are bending every effort toward the more productive business of reducing output costs.

As a Teacher

With this phase of the situation out of consideration, the other standpoint comes to the fore. The automobile race as an object lesson for the designer, the metal worker and the machinist, is a different proposition. Valuable lessons can be learned on the track which would never be brought to light by the testing dynamometer or by the road test. The stock car will never be a speed creation, but if the parts which fail in speed creations are strengthened in the stock jobs, it is quite certain that the factor of safety and of life of the touring car will be increased.

Watching for Weak Points

The average cost of building a racing car will range between $5,000 and $20,000. This is actual cost of building and there is no profit or overhead figured in with it. It is not uncommon for a car that is racing all around the circuit to carry with it in spare parts alone a supply that is valued at $10,000. Almost enough parts to build an entire new engine and practically a new chassis are necessary in order to make the replacements that become necessary. This great burning up of metal should be watched very carefully by the engineer of the factory, for by watching the parts that fail through weakness and through faulty design he can guard against the same failures in his own standardized product and also may incorporate little features of design which cost no more but which make his car better.

Multi-Valves an Example

Perhaps the most striking lesson from racing is coming in the way of multi-valves. There are at least five manufacturers in this country who have been playing around with four-cylinder motors of four valves to a cylinder. More than one announcement of models of this type can be expected within a few months. Where did the idea develop? In racing. High speeds are necessary on the racing car. It is also extremely necessary to have the power high at these faster rates of travel in order to overcome the enormous wind resistance and also to carry and maintain the speed itself and still have a little in reserve for a spurt. This condition of high speed and high power means that the gas has got to be brought into the cylinder and burned. It must not remain in the intake pipe or allowed to wire draw. Big valves and plenty of them is the answer.

The same condition is beginning to hold true in the passenger car. Speed capabilities are demanded more than ever. The engines are running at higher rotative speeds. At these fast rates of travel, the engine must be efficient and it must be developing high power. The same conditions as in racing obtain all the way through. Hence, wide-awake designers are going very deeply into the merits of the sixteen-valve four for stock work.

Importance of Details

It is not all in basic design that the lessons of the racing car are to be learned. Pick up the little details that are being tried from time to time on the speed creations. The lesson of the pistons is still being watched. Many are on the fence regarding aluminum. In racing the slap at low speeds is not to be contended with, and that renders the situation different. On the other hand the hour-glass shaped design used in some of the racing cars with the piston supports at top and bottom are worthy of consideration. May it not be that the system of piston rings all near the top as used with the iron piston is wrong with aluminum? Rings near the top and bottom are being tried out in many cars and may result in securing the advantages of aluminum without its one disadvantage.

Placing the Plugs

There is much food for thought in the placing of spark plugs. Even in some of the racing cars this has not been given the care that it should have been given. This was shown on one or two cars at Indianapolis this year. It was not the fault of the plugs that they sooted or failed. Placing spark plugs in close proximity to the exhaust where they are away from the cooling influence of the intake and also placing them where they are subjected to the spray of oil that is apt under conditions of high vacuum to shoot past the pistons is a mistake that brings its own penalty. The same conditions may hold true with a touring car, only not anywhere near to such a degree. In a word, a 300-mile race will show plug troubles that are covered in the space of a year on the touring car.

Larger Waterjackets

In no one thing have racing cars improved so much in the last few years as they have in waterjacket spacing. This same lesson can be taken to heart in the stock motor. It is true that an engine which is too cool is inefficient. Every heat unit thrown away through the radiator is lost as far as power is concerned. On the other hand, every part of the motor should be as near the same temperature as possible.

When waterjacket spaces are cut down and skimped, especially around the valves and plugs, the engine is sure to be troublesome. Larger waterjacket spaces gain more for the engine as far as life and all-around satisfaction are concerned than they lose in the way of heat. This trend toward larger jackets is very noticeable in racing cars, where particular care is being used to keep the water around the head of the cylinder, especially where the overhead actions are employed.

Lubrication Problems

Oiling problems are so pronounced in racing cars that it is very doubtful whether the questions of oiling the ordinary passenger car and the racing car are at all parallel. On the other hand, where the touring motor is operated at high speeds the question of proper oil feed is quite important. Of late there has been quite a reverse in racing motors as well as in some of the touring cars as regards cylinder lubrication. The question up to a short time ago was how to get enough oil to the cylinder. It has now become how not to get too much.

With Aluminum Cylinders

With aluminum pistons the problem of how to keep the oil supply to the cylinder walls properly regulated is even more complex. The difficulty lies in the number of conditions under which the car is handled, and the problem of securing proper oil at all speeds and under different load conditions becomes very much like that of carburetion. A variation in feed is really required to handle the work properly even on a touring car. On a racing car the difficulty is so pronounced that a car oiled correctly at Sheepshead Bay will suffer from too much oil at Indianapolis.

A Question of Speed Variation

The reason for this is that on the Sheepshead Bay track the speed is nearly uniform. Here the pressure feed system works beautifully and where splash is used also the amount fed is very close to constant. At Indianapolis when the car reaches the turns the engine is shut down, with the result that the oil has an opportunity to build up, and when the throttle is opened again the combustion chamber is filled with lubricant and consequent carbon. As the car is accelerated, the smoke shoots from the exhaust.

The Touring Car's Problem

The same problem holds true in the touring car, but not nearly to the same extent. If the oil feed could be regulated to each driver, the proposition would be different. As it is, it must be so arranged that under conditions of city driving at low speeds the proper amount of oil must feed as well as at speeds of 50 or more miles an hour. On the track, the low-speed condition does not have to be met to any extent; on the touring car it is becoming very common to drill the pistons with oil holes to relieve the excess of low speeds, and at high speeds the oil is fed freely without having an opportunity to escape to any great degree by the way of the drilled ports.

Closing the Valves

One of the difficulties of high speeds is to obtain positive closing of the valves. In the racing cars the springs have to be so stiff that the power consumed in operating the valves amounts to a considerable factor. With the higher speed motors in the touring car, it is quite certain that this point of valve closure will have to be watched. In one racing car which has had considerable success on the track this year, it takes a pressure of 150 lb. to operate the valve the distance of its lift, which is ⅜ in. In other words, it takes about 56 inch-pounds, or practically 5 foot-pounds, to open one valve.

Preventing Valves from Riding

It is becoming necessary to give a similar amount of thought to the valves in the ordinary stock motor. These are being run at speeds which make it quite possible that the valve will have a tendency to ride. This can only be cured in one of two ways. The springs have got to be made so heavy that they are quick-acting enough to positively close the valve, or the same principle as Delage uses on the new racing cars will have to be employed and the cam so shaped that it not only opens the valves but closes them.

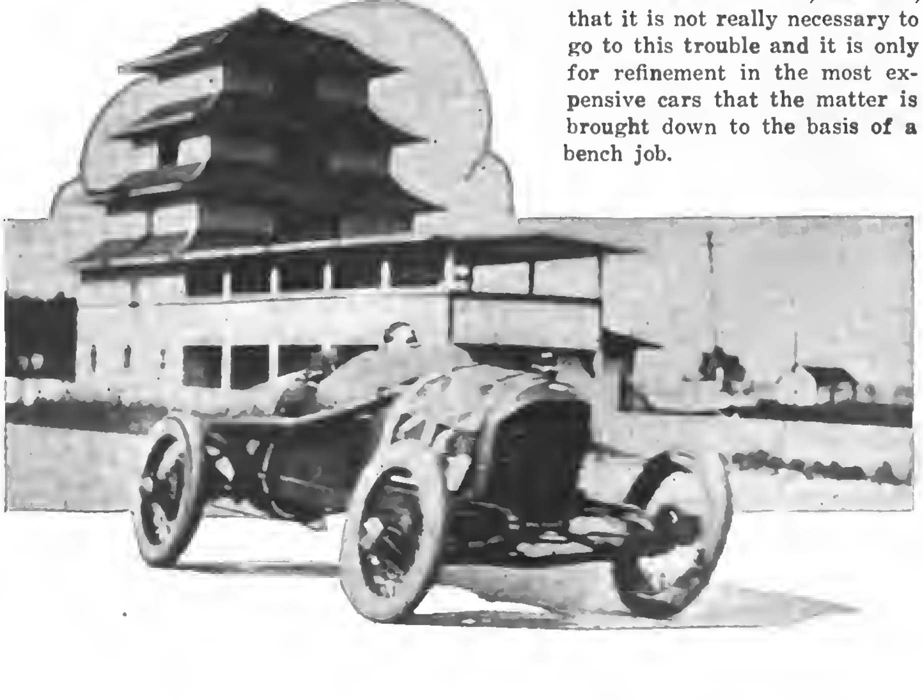
The constant engagement cam is a difficult thing to handle on account of the expansion factor. It has been handled nicely on this Delage type, however, and may act as a hint to some high speed motor manufacturer in this country.

Connecting-Rods Are Important

Connecting-rods are a detail that form an interesting study. At first sight the stresses on a connecting-rod seem to be very simple. When the speed of the motor increases, however, to such a degree that the inertia forces begin to become very high, the stresses on the rod are more complex. It would seem, however, that after all the rod experience the industry has had an almost ideal rod would be worked out by now. Still rod troubles have haunted the Peugeot racing cars and others. Even now one of the engine manufacturers in this country is turning away from the I-beam and adopting the rod of elliptical section. It is difficult to see the reason for this, as the disposition of the metal on the I-beams seems to give the proper section modulus.

Light Parts Are Factors

Rods must be watched on racing cars and touring car manufacturers have to follow their example closer now than ever before, in view of the light reciprocating parts tendency. It is difficult to machine around the bosses at the upper and lower ends of the rods. It means hand work on the racing car, and on at least one expensive stock car hand filing is resorted to on every rod. This is impossible in quantity production and the handling of a good rod when turned out by production methods is a difficult problem. Rod failures in stock cars are so few, however, that it is not really necessary to go to this trouble and it is only for refinement in the most expensive cars that the matter is brought down to the basis of a bench job.



Finding a Figure of Merit

Search for an Ability Formula Is Worldwide—Comparison of Different Efforts Shows Close Correspondence in Results

By John Younger
Chief Engineer Truck Division Pierce-Arrow Motor Car Co.

THERE are many ability formulæ expressing the fundamental functions of a car. They may, however, be divided roughly into two groups, the one showing the physical conditions the car is able to overcome, the other showing its economy in so doing.

The first group contain such formulæ as

Thomas' $$\frac{63000\ Pre}{p \times \frac{D}{2} \times W \left[\frac{20g+R}{2000}\right]} = 1. \qquad (1)$$

Roebuck's $$K = 14{,}550 \frac{d^2\,s\,n\,r}{D\,W} \left[\begin{array}{l}\text{Converted from cm. to}\\ \text{in. and long tons to lb.}\end{array}\right] \qquad (2)$$

Roebuck (*The Autocar*, England, June 22, 1912) states:
K should range from
120 to 130 for "de luxe" cars,
100 to 110 for ordinary touring cars,
80 to 90 for trucks.

Thomas' $$Q = 3000 \frac{d^2\,s\,n\,r}{D\,W} \qquad (3)$$

Myer's $$T.\,F. = \frac{7.055\ d^2\,s\,n\,r}{D.\ W.} \qquad (4)$$

(S. A. E., June, 1913)

The fifth formula, which is the only one that takes into account values obtained in practical road work, is Thomas' Sigma. (*Automobile Engineer*, England, April 2, 1913.)

$$\Sigma = \frac{.0047\ d^2\,s\,n\,r\,M}{D} \qquad (5)$$

In these formulæ

d is diam. of cylinders in inches
s is stroke of cylinders in inches
n is number of cylinders (4-cycle principle)
r is total gear reduction
D is diameter of wheel in inches
W is gross weight of vehicle in pounds
e is mechanical efficiency of transmission
P is Brake Horse Power of engine at p revs. per min.
p is revs. per min. at which P, hp., is developed
g is percentage gradient
R is Road Resistance in pounds per 2000 lb.
M is average gasoline consumption in miles per gallon.

Let us first consider formulæ 2, 3 and 4. Obviously, they are exactly the same in composition, except that the arbitrary constant K, Q or TF has been chosen differently. K was formulated on a basis of metric measurements, Q on a basis of inches, whilst TF was formulated for use with trucks. These three formulæ represent actual piston displacement per pound moved 1 ft., and on the reasonable assumption that every cubic inch of piston displacement represents so many foot pounds of energy, these formulæ give a measure of a car's ability. The greater the displacement per pound moved 1 ft., the greater should be the car's ability to speed, to climb and to accelerate on the particular gear reduction considered. Incidentally, the greater should be its gasoline consumption, but this we will come to later.

Inasmuch as K, Q and TF are arbitrary constants, there would seem to be no reason why the straightforward $\frac{d^2\,s\,n\,r}{D\,W}$ should not, itself, be used, or perhaps better still the Q value, $\frac{3000\ d^2\,s\,n\,r,}{D\,W}$ which represents the actual number of cubic inches piston displacement per pound moved through one foot.

Take now formula (1). This represents what might be called the static condition—the condition of balance, in which the inherent power of the vehicle exactly balances the combined resistances of incline and road surface. This falls into the "ability class," because it represents the practical physical conditions the car will overcome. Suppose we write $\frac{P}{p}$ as "$k\,d^2\,s\,n$" in this formula, we arrive at

$$\frac{63000\ e\ \text{“}k\text{”}\ d^2\,s\,n\,r}{\frac{1}{2}\left[\frac{20\,g+R}{2000}\right] D\,W} = 1.$$

This shows exactly the similarity of (1), (2), (3) and (4), inasmuch as for given conditions of "g" and "R" there is no difference between any of them.

Take now the Σ value (5), which is $.0047\ \frac{d^2\,s\,n\,r\,M}{D}$. It is obvious that if we take the displacement per pound per foot moved and multiply it by the weight of the car, we get the gross displacement per foot traveled. Multiply this by the theoretically perfect quantity of gasoline that is required to explode in this displacement and you have the perfect value of gasoline used per this displacement.

If, however, you multiply it instead by the average observed, gasoline consumption in miles per gallon, you at once obtain a figure of the car's economy. This is *Sigma*.

We have seen that a car is able to perform better the greater its K, Q or F values, but at the expense of greater gasoline consumed. If, however, we multiply the K, Q or F values by the miles obtained per gallon of gasoline, either in average practice or as obtained by the proposed S. A. E. method, we at once obtain a formula which imposes a penalty at once on either the big Q value, or the small Q value, and tends to strike an amount which will represent standard good practice.

I would, therefore, strongly recommend that the *Sigma* formula be considered fully, as a necessary rating formula in all cases where gasoline consumptions are measured.

Mr. Thomas, in his original article on *Sigma*, states that probably the best recorded gasoline consumption for straightway road work was that obtained on the R. A. C. officially observed Rolls-Royce car in 1911. The *Sigma* value works out at 4.70, giving a suggestion that an ideal *Sigma* would be about 5. Values are given here for other cars, based on long road work. None of them is for freakish gasoline tests. They are all values such as would be obtained by the ordinary driver over give and take roads.

Rolls-Royce, 50 hp., 1911, R. A. C. trial	4.70
Napier, 60 hp., 1912, R. A. C. trial	4.27
Rolls-Royce, 50 hp., on average roads round Buffalo, 1912	2.60
Mandslay 3-ton truck, 1907, R. A. C. trials	2.70
Pierce-Arrow 5-ton truck in Buffalo service	2.60
Pierce-Arrow 38 in 1912	2.25
Pierce-Arrow 48 in 1912	2.24
Pierce-Arrow 66 in 1912	2.16
Pierce-Arrow 38 on several hundred miles, hilly country, 1912	2.00
Sunbeam 30 on same route at same time	1.69
Pierce-Arrow 66, average of a long tour in California	2.62
Sunbeam, 30 hp., 200-mile run, Buffalo-Toronto and back, 1913	2.20
Pierce-Arrow 2-ton truck in two weeks' N. Y. service	2.57
Pierce-Arrow 5-ton truck on 100-mile good road run	2.91
Ford, 1913 model	3.84
Thomas-Leyland-Delahaye electric transmission truck, R. A. C., observed in 1911	3.56

Digests of S.A.E. Papers To Be Read on S.S. Noronic

Official Abstracts Show the Wide Range of Subjects Covered by the 1916 Program—Many of These Papers Will Be Read Simultaneously—See Program on Page 1048

THE following abstracts of the papers to be given at the S. A. E. summer meeting include all but H. E. Coffin's address, which was not available at the time of going to press. It is understood that this will follow in a general way the talk which he gave recently before the Indiana gathering, which was reported in the last issue of THE AUTOMOBILE.

Possibilities of the Constant Pressure Cycle

By Arthur B. Browne and Herbert Chase

THE authors, having shown that Otto cycle engines possess certain limitations, notably low thermal efficiency and characteristics which render the use of any but highly volatile fuel exceedingly difficult, state their belief that engines of this type must sooner or later give place to others operating on a different cycle.

The advantages and disadvantages of various other cycles are then discussed and it is shown that only constant pressure cycle engines seem to be well suited to the requirements of motor vehicles. The many advantages of constant pressure engines are then set forth as follows:

(1) High M.E.P. with low maximum pressure.
(2) Variable cut-off with constant compression pressure.
(3) Adapability to use of low grade fuels.
(4) Superior scavenging qualities.
(5) Absence of volumetric losses from which Otto cycle engines suffer.
(6) Adaptability to two-stroke cycle.
(7) Lower maximum temperatures.
(8) Absence of complication because no fuel or starting pumps are necessary.

The reason for slow development of constant pressure engines are then given and a new form of constant pressure cycle engine is proposed and its operation fully described as is also a special burner giving "flameless combustion," the latter being an essential feature of the engine. This engine compresses into a receiver, heats it with exhaust gas and expands it *at constant pressure* by adding heat (due to combustion of fuel in the burner) as the air enters the working cylinder. Both compression and work take place in the same cylinder. The operation (and resultant card) is practically the same as that of a steam engine, but is accomplished without a boiler, condenser or other accessories used with a steam engine. The proposed engine is said to possess all the advantages of the steam engine without any of the latter's complications or disadvantages.

As applied to motor cars the proposed engine is said to possess the following among other advantages:

(1) It renders readily available for use cheap fuel such as kerosene and fuel oil.
(2) It is thermally efficient at all loads because of constant compression pressure, utilization of exhaust heat, etc.
(3) It has lower maximum pressures, higher M.E.P. and more constant torque than Otto cycle engines. It will therefore be freer from vibration and will be lighter itself than Otto cycle engines. For this and other reasons cited its use will result in lower car weight.
(4) It has a large overload capacity and therefore requires no changed speedgear.
(5) It may operate on a two-stroke cycle with all the advantages and none of the disadvantages of two-stroke Otto cycle engines.
(6) It requires no starter and is expected to be free from carburetion and carbonization difficulties.
(7) Its use will result in simpler car control since no change speed gear on spark advance mechanism will be required.
(8) It will be readily reversible.

Car Performance

By D. L. Gallup

THE author points out the diversity of opinion on what constitutes desirable car performance in the minds of engineers and of the public generally. He believes this is largely due to the great diversity of claims which have been made in advertising literature and decries the sort of tests which have been made the basis of this publicity, pointing out that a majority of them are conducted under such conditions as make it practically impossible for the car owner ever to duplicate or confirm them.

The kind of an expression or test which will inform the buying public most is one which will tell what the car will do in the hands of the average owner, and define the conditions under which a demonstration of this ability can be made, such conditions to be relatively simple and easy of fulfillment.

Only very broad tentative suggestions are made but it is hoped that concrete suggestions will be formulated as a result of the discussion.

High-Speed Engines

By A. P. Brush

THE author outlines in a general way the relation of car performance to modern engine development. He considers particularly weight reduction and torque performance of high-speed engines, giving the undesirable characteristics attending the increased torque range gained by higher speed.

He next discusses the relation of torque to total car weight, to acceleration and to hill-climbing ability and suggests a method of determining the value of a car in terms of its performance ability.

The author holds incorrect those systems in which the amount of lubrication is in proportion to speed only; and in which oil for crankshaft and crankpin bearings must cool as well as lubricate them. He shows a system designed to solve these oiling problems.

Static, running and distortion balance of a rotating mass are defined by the author, who shows how they apply to a large number of types of crankshafts. The paper not only deals with the counterbalancing problem as regards the crankshaft itself, but also with the centrifugal effects of the connecting rod and piston parts. In conclusion a discussion is given of what are correct counterbalancing masses for service conditions.

Some Factors of Safety in Automobile Design

By President Russell Huff

THE author has selected fourteen automobiles on which to make a study of the factors of safety used in their design. He considers specifically the front axles, front-wheel spindles, propeller shafts, clutch shafts, transmission drive shafts and rear-axle drive shafts. The method of calculating the stresses is outlined; compositions of the steels used are given; and complete data are presented showing the factors of safety of the various parts, together with the intermediate figures used in obtaining the factors.

Mechanical Transport Mobilization

By Arthur J. Slade

The paper opens with a number of quotations from publications issued by the Army War College and showing the bearing of motor transport on a proper military policy for the United States. The author then describes two experimental trips recently made by motor-truck owners near New York in an effort to determine proper motor-transport operating conditions. A statistical summary is given for these two experimental trips.

Differential Substitutes

By D. D. Ormsby

MR. ORMSBY considers the conventional type of differential in a somewhat different light than it is usually regarded. According to his view, the conventional differential, rather than being inefficient is, on the other hand, too efficient in that it differentiates for all differences, whereas the automobile engineer only wants it to take care of the unequal velocity of the rear wheels.

Substitutes for the conventional type of differential are considered under four classifications; namely, the free-wheel type, the crank and eccentric types, the spiral gear type, and the solid axle. Examples of each of these classifications are described and the advantages and disadvantages of some of the more practical ones discussed.

In connection with the free-wheel types, the author explains that while these eliminate the inherent defect of the standard differential by differentiating when the wheels have unequal traction, yet with unequal size of tires the free-wheel type will drive more on a large tire because the wheel with smaller tire will have to rotate faster to make up for the distance traveled by the wheel having the larger tire. It is explained further that in making a turn all the power is applied to the inner wheel.

Mr. Ormsby believes that the spiral gear type will be the ultimate solution of the present differential problem.

Considerable space is devoted to a discussion of the elimination of any form of differential whatever. Although such construction has advantages of eliminating the spinning of the wheels and assuring positive travel under all conditions, Mr. Ormsby believes the disadvantages too great to be overcome. There must always occur, when the car is making a turn, a slippage of either the inner or outer wheel, or both, and from experiments conducted with a standard type of touring car and a well-known runabout, the author of the paper has come to the conclusion that the difference in travel of inner and outer wheels in making a turn at a given angle depends on the gage and not upon the radius of the turn. Therefore, no matter how great the radius, the amount of slippage through a given angle is always the same; consequently, no matter how slight the diversion from a straight line, an extra load is always thrown upon the rear wheels, tires and axles where the solid axle construction is used. Another objectionable feature of the solid construction is the extra amount of power consumed in making short turns, on account of the necessity of slipping one or both wheels. Another condition which the solid axle does not take care of is unequal size of tires. In a motor truck one tire is usually worn more than the other. To make up for the greater distance traveled by the larger wheel, the smaller wheel must slide the difference, or the larger must slip part of the time to compensate for the less distance traveled by the smaller one. This would occasion excessive wear on the new tire until both were brought to a uniform size.

Mr. Ormsby mentions some interesting experiments conducted by street railway engineers in connection with using differentials for street cars, to eliminate the corrugation of rails and wheels, as well as to economize in power consumption. It was indicated that with a street car equipped with a differentiating mechanism about one-half the power consumed by a car equipped with solid axles would be saved.

The author believes that the ultimate differential will be one which compensates freely for the difference in speeds of the rear wheels when the car diverges from a straight course, and is so constructed that it will be impossible for either wheel to spin when the other has lost traction.

"The year 1915 stands out more than any other as the one in which considerable effort was made to correct the inherent faults of the conventional type of differential. These efforts have extended into the present year and have been attended with much interest on the part of automobile engineers as well as gear accessory manufacturers. The outcome of present experiments will be of interest to all.

"Before discussing the substitutes that have been designed to rectify the faults of the spur and bevel type differential, let us consider whether the standard types fail through inefficiency or because of too great efficiency. I believe the latter to be the fact. With these conventional gears we find that in making a turn the outer wheel, which travels the greater distance, accelerates and the inner wheel retards, this being the desired action. There is another difference which the standard differential takes care of; that is, a difference in load which is caused by unequal traction of the wheels, by allowing the wheel having the lesser load to revolve faster than the one having the greater load.

"From the above, one can see that the conventional differential rather than being inefficient is on the other hand too efficient in that it differentiates for all differences, whereas the automobile engineer wants it to take care only of the unequal velocities of the rear wheels. It becomes inefficient as a means of transmitting the power to the rear wheels if the wheels have unequal traction. It is to correct this defect of differentiating for unequal traction of the wheels that a great many intended substitutes for the present types of differential have been invented. I will describe a few of them briefly."

The Farm Tractor

By C. M. Eason

THE author shows the need this country has for farm tractors, due to the fact that, so far, less than one-half of the possible farm resources have been developed.

Reviewing the necessity for developing our tillable lands to take care of ourselves in time of war, it is pointed out that farm production is largely a matter of power. Aside from windmills used for pumping water, the available farm power equipment of the United States consists of about 25,000,000 horses and mules, 60,000 gas tractors, 100,000 steam tractors and 1,000,000 stationary gasoline engines. Large as this total is, however, it only allows 1 hp. for each thirty acres of farm land, which is not enough by perhaps one-half or one-third. Inasmuch as horses cannot meet the demand for increased farm power, the tractor must come right away. So far the supply of tractors has been entirely inadequate to meet the demand.

The writer specifies some of the problems which confront designers of farm tractors. To make the tractor immediately available for farm work, it must be adaptable to practically all of the existing types of horse-drawn implements, besides furnishing belt power for a wide variety of present power-driven farm machinery. In designing tractors it must be remembered that the horse is a very flexible unit, capable of a wide variation in power output. The tractor must compete with this. Designing a tractor to furnish power for the majority of farm conditions requires an intimate knowledge of crops, soils and farm management. These must be analyzed carefully so as to make the machine have as wide a range of usefulness as possible. Mr. Eason dwells on the power required for operations in connection with various crops, including what conditions must be met in the plowing and cultivation. There is a wide variation in this respect as between corn, wheat, oats and other crops. The power required for pulling plows varies from 250 to 1500 lb. per bottom, depending upon the condition and kind of soil, depth and type of plow. One objection to the tractor is that it must be made to follow the furrows by careful attention from the driver, whereas a horse follows the furrow instinctively.

The author reviews what the tractor must show in the way of economical operation, pointing out that for permanent success it must show higher returns on the investment than horses.

Valuable information is given in regard to the mechanical efficiency, engine efficiency, friction losses, rolling resistance and general design requirements. Other factors peculiar to farm tractor work, which must be taken into account, are treated. The tendency in tractor design is toward better material, greater refinement and higher efficiency.

Bronze Alloys for Automobile Construction

By W. M. Corse and G. F. Comstock

THE authors point out the need for more concrete data concerning the physical properties of bronze alloys and present an extensive chart covering the results of actual tests on a large range of cast bronze alloys. The influence of the method of making a test-specimen is discussed and it is hinted that new evidence concerning the proper interpreting of the true proportional limit is available.

A very extensive set of photo-micrographs illustrates the variety of structures existing in the ordinary and in some unusual bronze alloys.

Large Single Versus Dual Solid Tires for Rear Truck Wheels

By W. H. Allen

THIS paper is mainly an argument in favor of the use of large, single rear wheel truck tires instead of smaller dual tires. Although the practice of using large singles is comparatively new, the author gives the results of experience and research to show the advantages of the newer method of rear tire equipment.

In developing his arguments in favor of single tires, the author goes into the history of dual tire application to show why it was necessary to use two tires in the earlier days of truck operation. As the necessity for increased carrying-capacity grew, tire manufacturers found the then existing single tire equipment inadequate, and they set about to develop suitable equipment to meet the new condition, the result being dual practice. According to Mr. Allen, dual tires were supposed to have a carrying-capacity two and a half to three times that of a single tire of the size of which the combination was composed. The method of attaching the earlier dual tires is shown to have been poor, inasmuch as the cross bars tended to draw the rubber together in such a way that it was impossible to secure the same degree of friction over the entire base, owing to the outward spring which took place in the center of the cross bar, thus relieving compression under these bars. This reduced the stability of attachment, which resulted in circumferential creeping of the whole tire to a much greater extent as the width of the dual equipment increased. Inability to correct this weakness resulted in conclusion to the effect that tires of such method of attachment were not suitable when widths in excess of 4 or 5 in. were employed. The metal base type of tire was developed to overcome the difficulty.

Mr. Allen holds that dual tires are overrated, and believes that the practice of saying that dual equipment is capable of carrying loads double that of the single of which it is composed, is open for discussion.

Some reasons for advocating large singles in place of small dual equipment are:

1. The contact area of single tires exceeds that of the duals which they are proposed to replace. 2. The load per square inch distributed over the contact area is in every case reduced correspondingly with the increase in contact area. 3. Small dual equipment does not give satisfactory performance for the reason that neither single tire is sturdy enough to resist momentary imposition of the total wheel load, such as occurs, for example, when traveling over rough road surfaces, excessively crowned or furrowed roads. It is pointed out that in such cases one of the small tires carries during a large part of the time the entire wheel load, which is shifted back and forth from one small tire to the other; with large, single units the load is concentrated on a tire sufficiently sturdy to absorb reasonable load inequalities. 4. Saving in tire cost, ranging from 8 to 15 per cent. 5. Saving in wheel cost, because of narrower felloe and wheel rim. 6. Saving in cost of handling and applying one tire in place of two. 7. Saving in wheel, tire and rim weight. 8. Fitting of non-skid chains easier. 9. Better trackage with front wheels. 10. Greater height of rubber tread, providing better cushioning properties and increasing tire lift. 11. Less strain on axle and wheel bearings.

The large single tire has, however, its limitations and, pending the results of further investigation, it seems advisable to consider 7-in. tires as the limit of practical single equipment.

The Pneumatic Tire and Rim Situation

By J. E. Hale

MR. HALE follows up the development of the pneumatic tire since its invention by Dunlop in 1888, and shows why there are now several different types of tire construction in use. The main thought expressed is that the straight-side tire is the logical solution of the variety of requirements, in this country, South America and Europe.

Why should the car manufacturers continue to complicate their production processes by making some of their cars with millimeter clincher equipment and others with straight-side, when by proper co-operation between the tire and car makers, the straight-side tire can be introduced quietly into the foreign market, fully standardized? Mr. Hale discusses in detail the merits of the three types of tires; namely, the clincher, straight-side and quick detachable, confining his discussion to energy consumption, traction, total mileage, cost-per-tire-mile, cushioning effect, reliability, ease of applying and service. The results brought out show principally the advantages of the straight-side tire.

Statistics are offered to show the trend of the rim situation, and it is pointed out that it is just a question of time until the quick detachable clincher will cease to survive. It had a legitimate place during the development stage, but with the developed straight-side tires giving entire satisfaction, Mr. Hale holds that there is no excuse for continuing the quick detachable clincher type.

The American standard inch clincher rim contours, the British standard millimeter clincher rim contours, and the American wide standard inch straight-side rim contours will undoubtedly survive all others. However, outside of the rim contours, the rim situation is still in the process of evolution. In the struggle to minimize weight, expense, and tire troubles, the existing demountables may lose ground, particularly as the light-weight one-piece clincher and the two-piece straight-side rims, on either permanent or detachable wheels, apparently offer the next step in progress of this department of the automobile industry.

On the Dynamics of Vehicle Suspensions

By Dr. Benjamin Liebowitz

THE author believes the riding qualities of present motor vehicles are unsatisfactory and that this is due largely to a lack of appreciation on the part of automobile engineers of the fundamental dynamics of the problem. He undertakes to strip the problem down to the consideration of a simple system consisting of a wheel with its sprung weight carried on a simple type of spring and then to analyze the action which takes place when simple irregularities are encountered by the wheel.

Analysis of this problem results in several expressions, the interpreting of which reveals the influence which the varying of specific factors has upon the action of the spring and its suspended load. These expressions take into account the effect of the ratio between sprung and unsprung weight, of speed, of size and kind of irregularity encountered by the wheel, tire inflation, flexibility of the spring, and wheel diameter. Other factors which are considered as a result of interpreting the very interesting curves are the effect of friction in the suspension, and of synchronism. Statements of the betterment which can be looked for in riding and steering qualities as a result of varying different factors are made. The effect of shock absorbers is discussed.

Kerosene Versus Gasoline in Standard Automobile Engines

By Charles E. Lucke

THE author outlines the factors leading up to the present high cost of automobile fuel, states that the introduction of new distillation processes will not solve the problem, but that the development of kerosene-utilizing appliances will produce results satisfactory to everybody.

The paper proceeds to show why kerosene cannot be used on the present gasoline cars. The adaptation of the gasoline automobile engine to the use of heavier fuels than will vaporize without the use of heat is entirely a problem of heating and heaters.

The author reviews at length the principles embodied and the construction of the heated vaporizers or vaporizing heaters now used in stationary and traction kerosene engines and in alcohol engines, giving illustrations of a number of such devices.

After thus developing what in his opinion are desirable and good principles, the author describes a form of vaporizer embodying such principles, which he states has had successful trials (both block and road) in automobile service. A semi-automatic starting burner to accompany the vaporizer is also described, both as regards its construction and operation. In conclusion the hope is expressed that the principles outlined will result in the production and use of kerosene automobiles on a scale sufficiently large to affect the price of fuel within the next year.

Coarse Crystallization in Cold-Pressed and Cold-Drawn Steel Parts

By Ralph H. Sherry

FOR reasons of economy in production and in construction cold-worked low-carbon steel in such forms as cold-rolled or cold-drawn bar stock and cold pressings has assumed an important position in motor car construction. Expensive and heavy castings have been replaced by cheaper and lighter pressings and the use of cold-drawn or cold-rolled bar stock has permitted the use of greater speed in machining with a resulting increase in production. There has been, however, one factor which has made the use of such material seem of doubtful value from the standpoint of reliability. From time to time certain parts made from cold-worked low-carbon steel have been found to be exceedingly brittle, a condition usually accompanied by a coarsely crystalline fracture which in some cases resembled fractures found in steel known to be "burnt." Mysterious epidemics of brittleness appeared intermittently in material supposed to be in the best possible condition. The annealing usual in such cases not only did not cure the trouble but often seemed to aggravate it. Parts were often placed in service with a feeling of doubt as to their reliability. The cause of the trouble being unknown, breakage of such parts was ascribed to "crystallization in service."

The causes of this condition have gradually become known and methods of control have been clearly defined. In this article the author gives the results of an investigation of this phenomenon which was carried out with commercial materials such as cold-drawn wire, hot and cold-rolled sheet, strip steel, cold-drawn tube, and cold-pressings. The results of other investigations are briefly outlined.

Coarse crystallization, or grain growth, it is stated, is due to the action of a limited amount of strain, exceeding the elastic limit, followed by annealing within certain temperature ranges. The experimental work which led to this conclusion is stated in detail in the article. The effect of forging, cold-drawing, cold-rolling and cold-pressing was determined with commercial materials. Some study was made of the effect of carbon on grain growth and of the effect of coarse crystallization on the physical properties. No grain growth was noted in steels that were uniformly above 0.15 per cent in carbon content. The effect of coarse crystallization on the physical properties was marked. Not only was the resistance to shock seriously lowered, but there was also a marked drop in the elastic limit, maximum strength and elongation.

In the discussion of commercial materials special reference is made to those used in motor car construction. Methods are given by which coarsely crystalline material may be detected. Methods of control which are necessary for the elimination of coarse crystallization are given in detail for each commercial material investigated, together with a general summary of the essential factors. When it is considered that the ranges of temperature within which coarse crystallization is produced are those within which annealing usually takes place, the necessity for exact knowledge of the details becomes apparent. The materials which receive individual consideration here are sheet, strip steel, cold-drawn tube, cold-pressings and cold-drawn rivet stock. The occurrence of coarse crystallization in cold pressings, of particular interest to the automobile engineer, has received special attention.

The author's conclusions outline briefly the general conditions under which grain growth occurs as determined in his investigation. Accompanying the article are tables giving in detail the results of cold-rolling and cold-drawing, together with other experimental data. A considerable number of photo-micrographs are given which illustrate a number of the factors determined in the investigation.

Automobile Experiences in the Great War

By W. F. Bradley

THE author outlines the constructions that have shown up well under war conditions of operation, mentioning especially that four-cylinder engines carried under a hood were the most satisfactory. The internal combustion engine had found favor as compared with the gasoline-electric and steam-driven vehicles. The defects revealed by war service are given in considerable detail, the author finding that all of the trucks used had developed some weak point. Radiators and springs were given as a general source of trouble. The author believes more attention should be paid to the draining off of water from radiator, pump and jackets. The lubricating system for the engines should be of the pressure or circulating type so designed that the dirt will deposit away from the pumps. He outlines a number of operating troubles developed under the existing conditions of operation and gives examples of the way these have been remedied.

Considerable attention is paid to the methods of operating trucks away from made roads. The methods of fitting chains to the wheels and the use of carterpillar attachments are described. All-metal wheels are being used in place of the wood wheels. Considerable tire trouble has developed; one reason being the tendency for the cambered roads to force one of the dual tires to carry the greater portion of the load. Dimensions are given for bodies and a number of suggestions made as to their proper construction.

Although practically all the general transportation is done by rear-driven trucks the four-wheel-driven vehicle is used to a limited extent mainly for operation off the main roads or on no roads at all. A description is given of tractors developed for this service. These are used mainly to draw batteries and heavy artillery. The importance of the armored car has been exaggerated mainly because of the adoption of underground warfare. The author describes briefly the most suitable type of such a machine. One effect of the war has been to bring about the extensive use of trailers, the author stating that they are now being used behind all kinds of automobiles, both for the transportation of men working in the rear of the lines and for general haulage work around the depots.

In conclusion the paper considers the arguments found in the war zone in favor of standardization. The author holds that such a tendency should be opposed as regards the general features of automobile design. Certain features that can be adopted without handicapping the design should, however, he insisted upon. He gives specifically the size and style of bodies, sizes of wheels and tires, magneto bases and couplings, carbureter flanges, towing hooks, turning radius, clearances, driving chains, and threads for all bolts and nuts as subjects for standardization. He also mentions the necessity for uniform nomenclature inasmuch as a great deal of confusion has been created by the difference in the names of American trucks, not to mention the trouble caused by the variation in English and French terms.

Recent Aeroplane Engine Developments

By Neil MacCoull

THE author gives a brief review of developments during the past year in the construction of aeroplanes, particularly as affected by the European war. He takes as an example the Renault twelve-cylinder engine, citing the respects in which the present differs from previous models. Such factors as the changes in cooling systems, method of drive, valve construction and starting devices are considered.

The requirements of aeroplane engines, such as constant service, high speeds (of aeroplanes) and stream-line form of engines and radiators, are outlined. Propellor requirements are dealt with at length, curves being given by which the efficiency and diameter of the propeller can be obtained. In conclusion a number of different engine installations are illustrated and compared.

Refinement and Generalities in Truck Design

By H. D. Church

THE author describes a number of detailed developments that took place during the working out of a line of worm-driven trucks.

The details of front axle and steering parts are dealt with at length, the reasons for the final constructions being clearly explained and the constructions themselves well illustrated.

Details concerning difficulty with the Hotchkiss type of drive on heavy trucks, troubles with drive shafts and lubrication of the worm wheel are all covered thoroughly; spring shackle construction and lubrication, radiator and hood mounting come in for detailed attention, and the question of governors is interestingly covered.

Brief reference is made to the influence of unsprung weight, the differences between truck and pleasure car practice in this respect being pointed out.

Moreland Sprinklers Show Economy Over Horses

OVER a year ago the officials of Los Angeles, Cal., began investigations to determine the cheapest and most effective method of cleaning the streets. A motorized equipment was finally decided upon, and the city engineering department prepared plans for modern sprinklers and flushers, embodying numerous improvements over other systems and in keeping with the other motor equipment already installed in other departments. Later the contract for the sprinklers and flushers was let to the Moreland Motor Truck Co., Los Angeles.

The official tests show a large saving in the cost of operation over the cost of operating horse-drawn vehicles. One outfit of horse-drawn apparatus will sprinkle 5 miles of street in an 8-hr. day at a cost of $4.50; while one truck will sprinkle 38 miles in 8 hr. at a total cost of $14.71. These figures show that each truck will save the city approximately $20 every 8 hr. Furthermore, the trucks are so constructed as to eliminate all overlapping of the streams, with a consequent saving of 25 per cent of the water used in the old sprinklers.

In the night hours the trucks are used for flushing and here they show to even greater advantage when compared with horse-drawn equipment. One driver, team and harness cost the city $5 a night. The flushers are owned by the city, and the interest on the investment, depreciation and upkeep is figured at $1 a night. Taking into consideration the greater amount of territory covered by the motor flushers and the lower cost of operation, each truck will save the city $21 a night. When to this amount is added the $20 saved by each truck during the sprinkling hours, it appears that each truck so used will save the city $40 every day in the year.

British Standardize Automobile Steels

Following Example of American Industry—Ten Steels Agreed Upon by Automobile Engineers, Steel Makers and National Engineering Standards Committee

As was mentioned last week in THE AUTOMOBILE, the American lead in matters of standardization is being followed by Great Britain. In *The Automotor Journal* (British) for May 12, there is a good review of these standard steels from the engineer's viewpoint. The author is A. E. Berriman, chief engineer of the Daimler Motor Co., a man holding a high position in the British industry. His report follows:

The publication of the British Engineering Standards Committee's specifications for automobile steels inaugurates a new phase in the progress of this industry, and renders important assistance to its allied branch of aircraft manufacture.

Ten classes of steel have been labeled by these official specifications, and they cover the whole range of the more important kinds in common use.

There are four case-hardening steels and six steels that may be called, for distinction, stamping steels.

The E. S. C. specifications are wide, that is to say, they define classes rather than "brands."

This is as it should be. There is nothing to prevent users with particularly definite requirements from obtaining special casts of steel to guaranteed fine limits of chemical composition.

Steels of Average Requirements

The specifications themselves were drawn up by a committee of the Institution of Automobile Engineers, comprising steel makers, stampers and automobile manufacturers. The steels specified, therefore, may be taken as representative of average requirements.

The formation of the committee in question was the direct outcome of a paper read by L. H. Pomeroy, technical director of Vauxhall Motors, Ltd., before the I. A. E. during the early part of the war.

It must be remembered that all the steel used in motor cars is "special" from the standpoint of ordinary engineering construction. These specifications are, therefore, a first attempt to define the more commonplace materials of a particular group.

So far from handicapping development, this standardization of what is merely ordinary should promote intelligent interest in what is really new. Undoubtedly, much confusion of mind hitherto has prevailed among steel users about matters well known by steel makers to be insignificant.

To Test Physical Properties

The standardization of these steels has prepared the way for an important line of research that has been undertaken by the joint research committee of the Society of Motor Manufacturers and the Institution of Automobile Engineers. The funds for this research have been contributed partly by the Government, partly by the S. M. M. T., and partly by individual firms in the automobile industry. The object of the research is to test the physical properties of the standard steels over the range of chemical composition tolerated by the specifications and over the range of heat treatments appropriate to the class of material.

When this information is published, the full value of the specifications themselves will be realized, and the automobile industry will have acquired a collection of data that has long been wanting as the basis of scientific design.

Under the ordinary conditions of commercial production, it is essential that the engineering department's specification should give sufficient latitude for the proper exercise of the functions of the purchasing department. This co-ordination is much facilitated by the E. S. C. standards, for it is now possible for the engineering department to place a thoroughly definite specification on the drawing without limiting the source of supply.

E.S.C. STANDARD STEELS (*Tons are long tons = 2240 lb.*)

	Case Hardening Steels									
	"10" Carbon	"15" Carbon	2 Per Cent Nickel	5 Per Cent Nickel	"20" Carbon	"35" Carbon	3 Per Cent Nickel	1½ Per Cent Nickel Chrome	3 Per Cent Nickel Chrome	NC Air Hard
Carbon	.08/.14	.12/.20	.10/.15	†.15	.15/.25	.30/.40	.25/.35	.25/.35	.20/.30	.28/.36
Silicon	†.20	†.20	†.30	†.20	†.25	†.30	†.30	†.30	†.30	†.30
Manganese	†.60	.65/.10	.25/.50	†.40	.40/.85	.50/.85	.35/.75	.85/.60	.35/.60	.35/.60
Sulphur	†.04	†.07	†.05	†.07	†.06	†.06	†.04	†.04	†.04	†.04
Phosphorus	†.04	†.07	†.05	†.05	†.06	†.06	†.04	†.04	†.04	†.04
Nickel	....	....	2.0/2.50	4.75/5.75	....	....	2.75/3.50	1.25/1.75	2.75/3.50	3.50/4.50
Chromium	....	....	....	....	....	....	....	0.75/1.25	.45/.75	1.25/1.75

Check Tests

Solely to provide a uniform basis for checking consignments irrespective of the state in which the steel is to be used.
The test bar must he heat-treated when 1⅛-in. in diameter.
Treatment:—N = Normalized; OH = Oil hardened; AH = Air hardened; T = Tempered deg. C.

	N	N	N	N	N	N	N	OH/850	OH/820	AH
Treatment deg. C.	900/920	890/920	850/900	820/860	890/920	850/880	840/880	T600	T600	820
Max. stress, tons/in²	23/28	25/33	25/35	25/40	26/34	30/40	85/45	•45	•45	•100
Elastic ratio, per cent	•50%	•50%	•55%	•60%	•53%	•50%	•55%	•70%	•70%	•75%
Elongation	•30%	•28%	•30%	•30%	•28%	•25%	•24%	•15%	•15%	•5%
Reduction	•50%	•50%	•55%	•55%	•50%	•45%	•50%	•50%	•50%	•13%
Brinell (approx.)	92/112	103/143	103/153	103/179	105/149	121/179	140/202	179	179	418

• = Not less than. † = Not more than.

Colors in Which Steels Should be Painted Before Delivery

Case Hardening Steels									
"10" Carbon	"15" Carbon	2% Nickel	5% Nickel	"20" Carbon	"35" Carbon	3% Nickel	1½% Nickel Chrome	3% Nickel Chrome	NC Air Hard
Yellow	Yellow and Dark Brown	Yellow and Red	Yellow and Violet	Light Brown	Dark Brown	Red	Light Blue	Violet	Green

Such a specification might read, for example, 3 per cent nickel chrome steel to fulfill R. A. F. test No. 32a. This insures the supply of an appropriate class of material for the work, and its use in a suitable heat-treated condition; at the same time, it enables the entire steel industry to compete for the business on even terms.

Building Up Reputations

It is, however, necessary to remember that much of what constitutes "quality" in steel appertains to detail of manufacture that cannot be recorded in the chemical composition, and is not necessarily apparent in the physical tests. Reputation, both for good material and for good service, is, therefore, likely to be much more securely founded in the full light of the standard specifications than ever it was before under the vague glamour of a "brand."

In the long run, it will be worth more to the steel maker to supply the best steel of a universally used class, than a very good steel of an isolated kind.

The specification of high quality was not really faced by the committee responsible for drawing up the E. S. C. standard steels, and there is no doubt that useful work remains to be done in this direction by any representative group of steel makers willing to concentrate upon the subject. The absence of a quality clause in the E. S. C. specifications is no detriment to their fundamental purpose, for it must be remembered that quality is a question of degree and therefore of price. It is undesirable in engineering to employ steel that is unnecessarily costly for its purpose, and it would be a mistake for the standard steels arbitrarily to define only the highest quality, and, therefore, the most expensive class of material. It is, however, important that engineers should be able effectively to specify the highest quality when they require it. On this aspect of the subject authoritative information is at present lacking. To say, for example, that a steel must be crucible cast, is perhaps to take a very arbitrary action in respect to the capabilities of the electric furnace, which may be able to produce the highest quality steel more economically. Similarly, there are points in connection with the casting of the ingot and its subsequent preparation into the billets and bars of commerce on which the steel making industry might well prepare some authoritative information that would serve as a most useful supplement to the existing E. S. C. standard specifications.

The accompanying table summarizes the E. S. C. standard steels, and gives additional information relating to the testing of steel.

Check Tests for Stock

Check tests for steel that is bought for stock purposes are included in the E. S. C. specifications. Most of them are specified for annealed test bars in order to facilitate uniformity of the conditions under which the steel is checked.

Steel that is bought for a particular purpose as defined by a special test must necessarily be the subject of special arrangements as between the purchaser and the supplier.

In principle, the responsibility for producing the results should coincide with the source of the specification; and the appropriate source for the specification is the firm undertaking the heat treatment.

Maker Is Responsible

In short, if the steel maker supplies heat-treated steel, he should be wholly responsible. If the stamper heat treats the steel, he should be responsible for the specification and for the results, the steel maker being merely responsible for the standard check test. If the engineer manufacturer heat treats his own steel, he should specify it and be responsible for getting the results, and also for getting good stampings that do not spoil the steel.

In any event, if the purchaser discloses the results he requires, a responsibility naturally rests with the steel maker to demur if he considers the steel specified to be unsuitable for the purpose.

When the research on the physical properties of these steels is published, the appropriateness of any particular physical test will rest on a firmer foundation than it does at present.

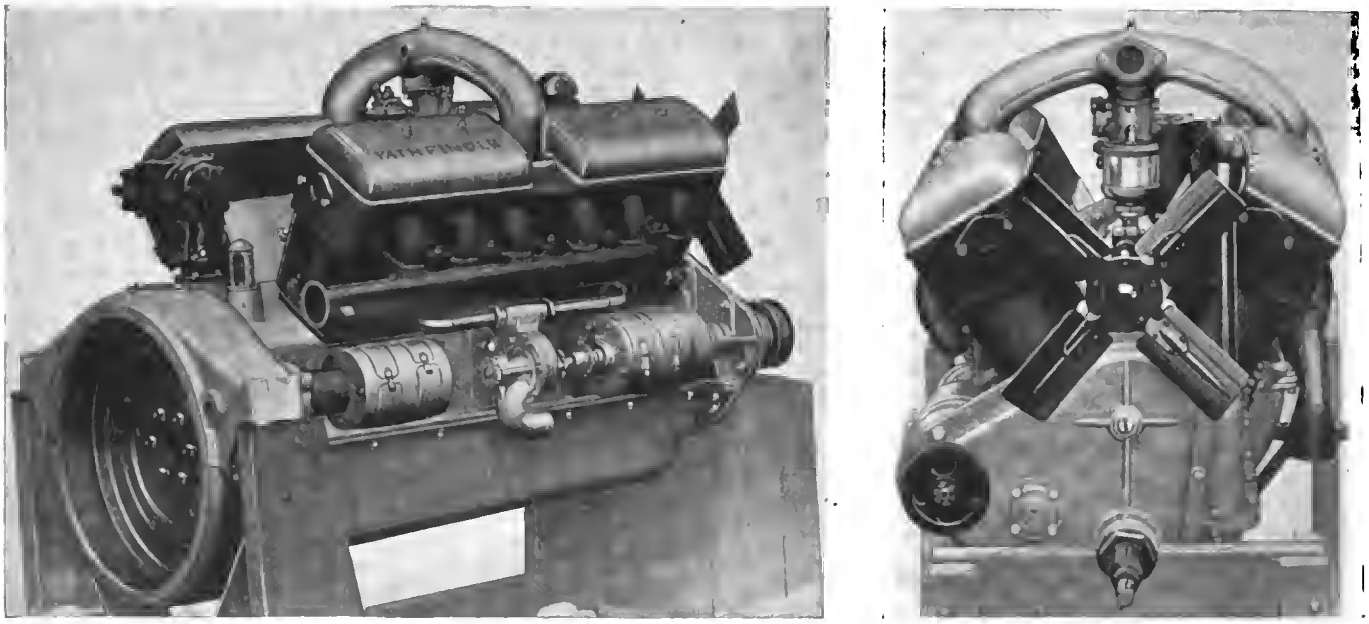
In the meantime, it is only possible in a general way to use a hypothetical series of tests based on the characteristic variations of the physical qualities of steels.

A Scheme of Coloring

The E. S. C. standards specify a scheme of coloring to facilitate the visual identity of steel. It is to be hoped that uniformity in this direction will come into vogue. Most firms have some system of coloring, and as none can be perfect, all might as well conform to the E. S. C. standards, so that the steel could be painted at the source.

Trucks Expedite Delivery of S. K. F. Bearings

THE accompanying illustration shows how the S.K.F. Ball Bearing Co. rushed a shipment of 40 tons of bearings from the parent factory in Sweden to the new plant at Hartford, Conn., before which the train of Mack trucks and their trailers are lined up. The bearings were needed to fill rush orders from manufacturers of automobiles, machine tools, textile machinery, etc., and, due to war conditions, hold-ups in the customs and other delays, the company chartered the trucks and trailers, thus saving many precious hours in the delivery of the three hundred cases of bearings at the Hartford factory, whence they were shipped to customers. The new plant will commence making S.K.F. bearings next month, the machinery being practically all installed.



Twelve-cylinder Weidely engine used in the 1917 Pathfinder chassis. Side-by-side connecting-rod bearings are used

1917 Pathfinders All Twelves

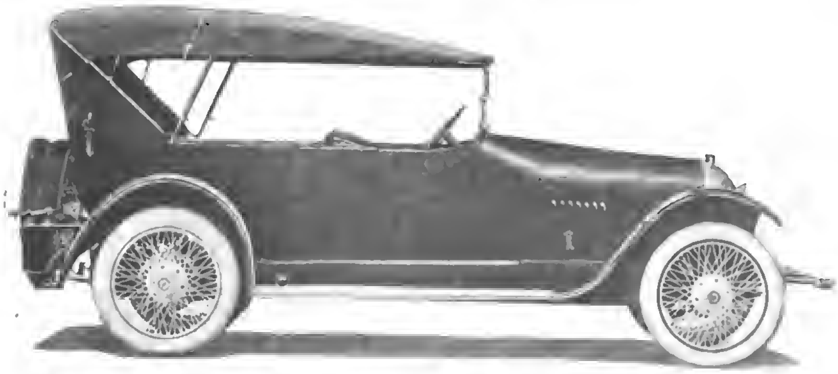
Six-Cylinder Model Discontinued—Weidely 2⅞ by 5 In. Motor with Overhead Valves Employed

PATHFINDER cars for the 1917 season will have twelve-cylinder engines exclusively. The entire chassis has been redesigned to take the new power plant and this model, which is put out in two body forms, touring and cloverleaf, now makes up the entire line of the company.

Probably the most distinctive feature of the car is the power plant which is the Weidely 2⅞ by 5 in. twelve-cylinder unit. This is also manufactured in Indianapolis, not a very great distance from the Pathfinder factory.

The cylinders are cast in blocks of three with the head castings, containing the intake manifolds, water outlets and valve seats, in blocks of six. With this arrangement the stiffness of the block casting is secured and at the same time the cylinder castings themselves are simpler. The right set of cylinders is pushed 1¼ in. forward of the left to provide for side-by-side connecting-rod bearings on the crankshaft.

Cast-iron pistons are used, and they are fitted with patent high-compression rings. There is an oil ring at the bottom and a V-groove cut all around the piston, which is drilled for oil passage. The connecting-rods are elliptical in section. They are drop forged and have the weight reduced to the lowest practical minimum consistent with ample strength.



Pathfinder seven-passenger La Salle touring car which sells for $2,750. Like the Cloverleaf, it is mounted on a 130-in. chassis

A 2⅛-in. crankshaft is used, carried on three main bearings and provided with the curved-cheek counterbalancing system, the oil leads for the pressure system being carried in tubes across the curved cheeks.

A feature of the valve action is in the exceptionally wide faced helical gears. These are so arranged that there is a constant drag on the gears, even at idling speeds, thus preventing them from rattling when not under load. The entire valve drive is taken off a single camshaft which is provided with twenty-four cams. These are integral with the shaft, which is a hardened and ground drop forging. The camshaft is placed directly above the crankshaft. The cams act directly upon mushroom followers, the tappets passing through long guides, the pushrods extending upward behind the cover plates to the rocker arms.

The valve diameter is 1½ in. in the clear. The springs are large in diameter and the rocker arms bear directly on caps on the end of the valve stems. The entire valve mechanism is inclosed by aluminum cover plates which extend over the tops of the cylinders, covering the rocker arm mechanism and also inclosing the push rods at the sides. In working out the oiling system the lower half of the crankcase forms the oil pan in the usual way. This pan is covered with a strainer so that all droppings from the motor are screened before they enter the space below which contains, at its lowest point, the oil pump.

There are four leads from the oil pump. Three of these go to the main bearings, whence the oil enters the drilled crankshaft and is led to the connecting-rod bearings by means of the tubes across the curved cheeks of the crankshaft, as described. The fourth lead carries the oil to the camshaft, and takes care of the bearings for this shaft as well as the tappets. The overflow from the fourth lead also supplies the timing gears with a copious supply of lubricant. Special provision is made for maintaining a supply of oil at the rocker arms so that only infrequent oiling is necessary.

A neat arrangement of the water circulation has been provided, in spite of the natural difficulties presented by the separate castings for valve head and cylinders, and also by the overhead valve action. The water pump is mounted on the generator shaft which is driven off the fourth gear of the timing set. The pump is about the center of the motor on the right side. The water intake is at the lower end of the pump and it is led out through a divided manifold at the top. The water enters the lower part of the cylinder blocks on the right side and is fed directly to the waterjacket of right block.

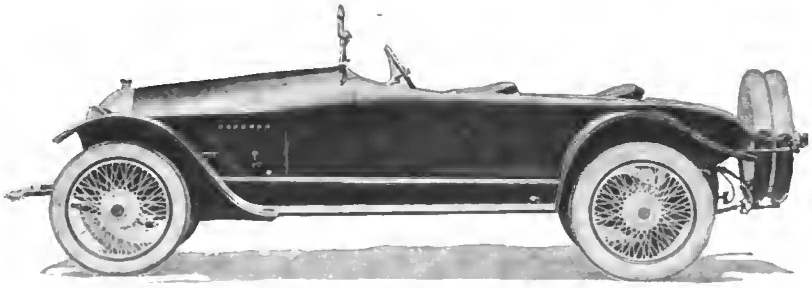
The water for the left block passes through a lead tunnelled through the crankcase and formed by a core in this casting. The aluminum integral tube is lined by a steel tube which is driven through, forming a passage for the water. A Fedders radiator is used, cased with German silver. It is supported on an individual cross member which is detachable and so arranged that the supporting members do not put any strain on the radiator itself. It is maintained in an upright position by stay rods. The edges of the radiator are rounded off in a distinctive style and conform to the shape of the Pathfinder hood. The water capacity is close to 12 gal., the big capacity being obtained by the V-shape and the 4-in. cores.

Manifolds Are Combined

In arranging the manifold work on the car the water outlet from the cylinders and the intake pipe have been merged together. This produces the two-fold effect of the water-jacketed intake and a unit casting which carries both the water and the intake gases. The intake is semi-elliptic in shape, with the carbureter beneath and the flange for the radiator connection in front. This is a ground surface to allow for a tight gasket.

Balanced Gas Flow

Carburetion is provided by a specially arranged Stromberg instrument of the H-type, slung in the center between the two cylinder blocks. The effect is perfectly symmetrical and should give exact balance of the gas flow. The exhaust is led to the outside of the head casting and the manifold is swept low to keep the heat away from the occupants of the car. Separate exhaust headers are provided for each cylinder block, leading to separate mufflers so that the back pressure due to exhaust in one cylinder cannot affect the exhaust of another.



Pathfinder Cloverleaf roadster for 1917 which lists at $2,900. Wire wheels and 35 by 5 tires are standard equipment

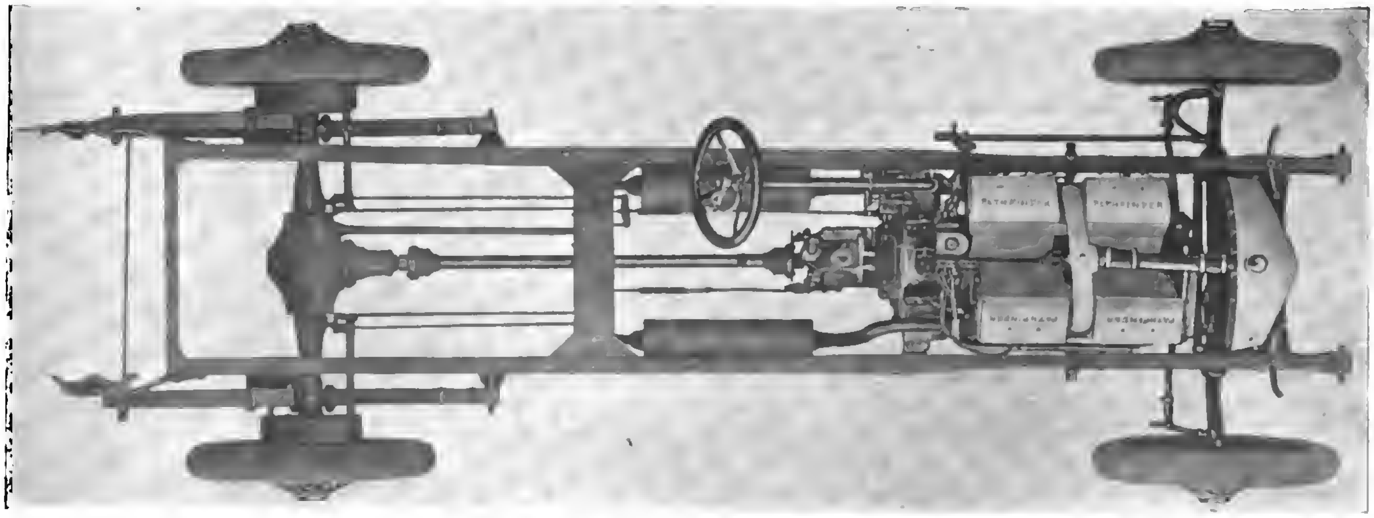
Gasoline feed is provided by the Stewart vacuum system. The tank is suspended on the rear of the car and has a capacity of 21 gal. The manufacturers claim that mileages with this car 14 to the gallon are not exceptional. A detail of interest is that in case of flooding of the carbureter the space between the cylinder blocks is arranged as a drain and carries away the gasoline instead of allowing it to accumulate there as a possible cause of fire.

Electrically the car is entirely Delco, the three-unit system for starting, lighting and ignition being used. Initial current is supplied by a 160-amp.-hr. storage battery floating on the line. This is supported on the right frame side member. The timer-distributer is mounted on the top of the rear end of the crankcase and is driven by a vertical shaft which carries at its lower extremity the oil pump. The drive is taken from the camshaft. There is a centrifugal governor in the base of the timer housing which regulates the spark under normal running conditions. In addition there is a hand advance for setting the spark manually if so desired.

Delco Starting System

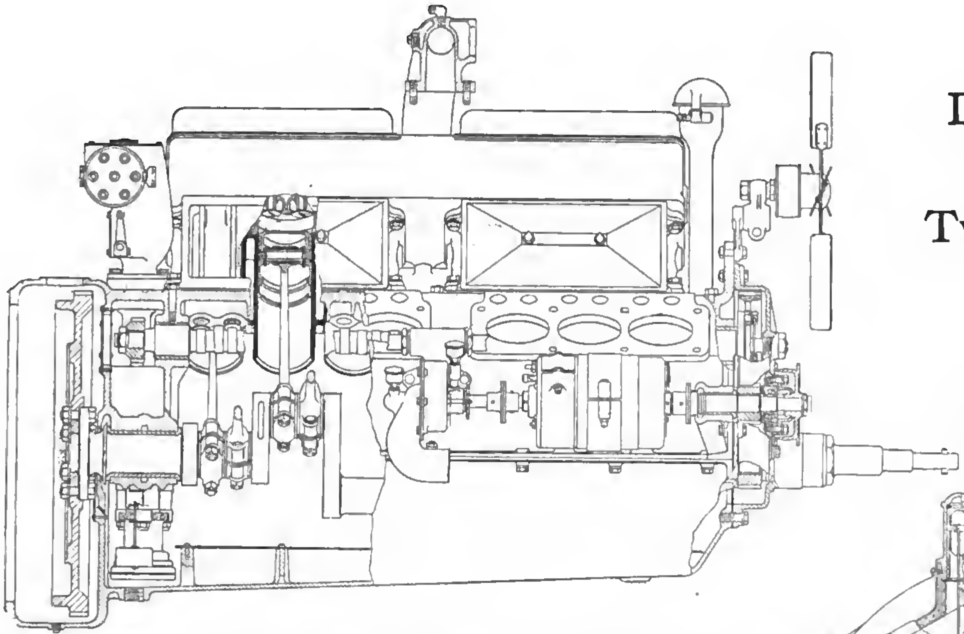
Starting is by the independent series-wound Delco unit so wired that the motor is cranked by pressing a button. A feature of the starting motor is the detachable commutator housing. The capacity of the battery on this car is said by the manufacturers to be such that it is capable under normal conditions of furnishing sufficient current to crank the engine steadily for 25 min. There are only two wires from the starting motor to the battery, the switch being in the line.

Like the remainder of the electrical equipment, the lighting system operates at 6 volts. A feature of this unit, which is also of Delco manufacture, is the ease of reaching the brush assembly by removing the detachable cover plates. This permits of ready inspection of the brushes and also allows the ordinary owner to keep this part of the generator clean with-

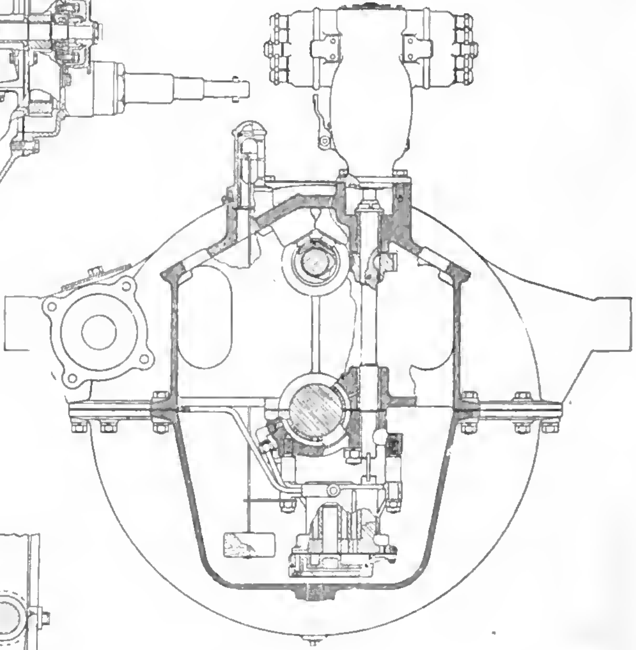


Pathfinder 1917 chassis showing mounting of the twelve-cylinder Weidely unit power plant. This chassis has 130-in. wheelbase and either touring car or roadster body is fitted

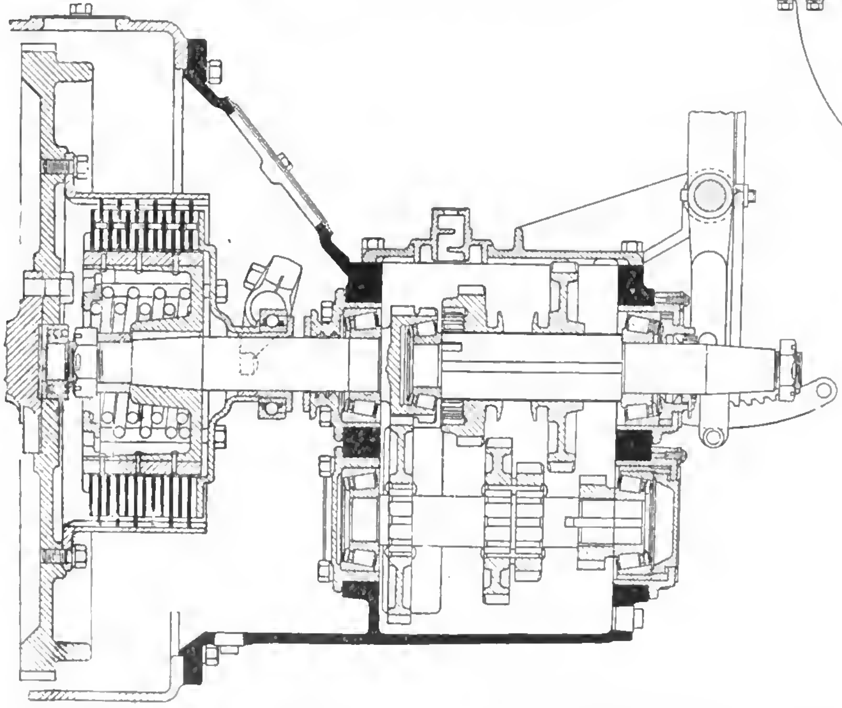
Details of the Pathfinder Twelve Chassis



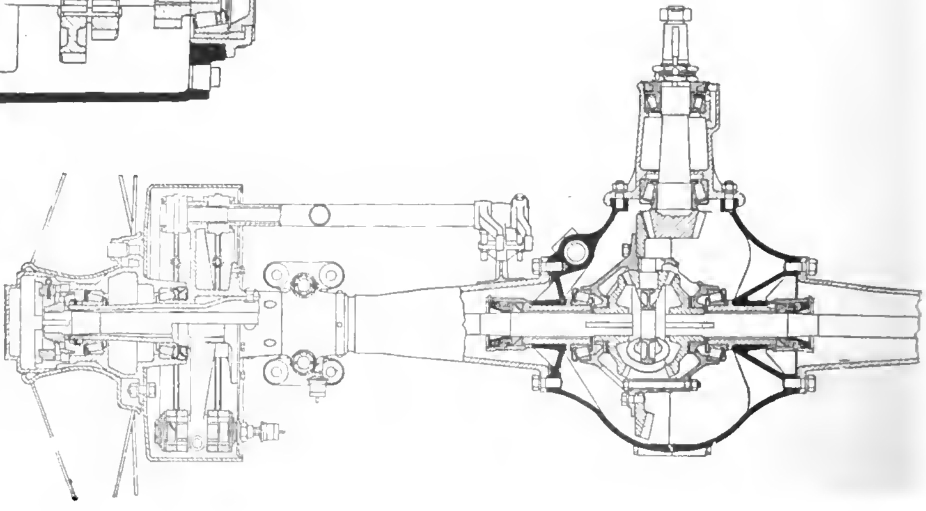
This drawing of the Weidely-Pathfinder twelve-cylinder engine gives a good idea of the internal simplicity and the accessible layout of the engine accessories. There is a cored hole passing right across the crankcase, behind the pump which takes water to the further cylinder block; it is lined with a steel tube to prevent leakage



End section of Weidely engine showing the oil pump and the float for indicating oil level. The distributer and the tappet gear are also shown above. Notice the way in which the oil pump driving shaft is connected to the distributer shaft



Above—Multiple-disk clutch and three-speed transmission used on Pathfinder chassis. Notice the breather on the gearbox cover to allow escape of air and so prevent the expulsion of lubricant through the bearings



Right—The American Ball Bearing Co. axle used by Pathfinder. This is a rugged type with double expanding brakes and uses Bock taper **roller bearings** out having to wait until serious trouble makes a trip to the service station necessary.

Complete Lighting Equipment

The headlights have two sets of bulbs, for country and city driving. There is a rear tonneau light controlled by a convenient switch and also a cigar lighter which is countersunk in the back of the front seats and which is accessible to those in both the front and rear. The headlights are mounted on extra rigid brackets and all the wiring is inclosed in flexible conduits.

Asbestos and steel are used in the dry plate clutch. There are six asbestos faced disks which form the driving member. These act against hardened and ground steel plates which form the driven member. There is one stiff coil spring holding the clutch in engagement. No lubrication is used on the clutch.

Unit Power Plant

A unit power plant is formed by the gearbox, clutch and motor. The bell housing is an S. A. E. type and the plant is supported at three points with a trunnion carrier in front. Timken bearings are used throughout the entire transmission. The gears are held in mesh at any speed by a gear interlock which locks the sector not in use.

The drive is taken to the rear axle through a universal joint and propeller shaft. The rear axle is a floating American type, with 1¼-in. axle shafts of chrome-nickel steel. The central housing is a malleable casting and the external ends of the housing are made up of 3½ per cent nickel steel tubing. The driving gears are spiral bevel and made from nickel steel carried on Bock taper roller bearings.

Rear Springs Underslung

Vanadium steel springs are employed with three-quarter elliptics in the rear. The front springs are 39 in. long and 2¼ in. wide. The rear are the same width and 54 in. long. Bronze bushings are used. The drive is taken through the front ends of the springs, which are shackled only at the rear. The springs are swung under the rear axle, giving the car a low appearance.

Convenient Seating Arrangements

Both body models, the La Salle seven-passenger and the cloverleaf roadster, are mounted on the same 130-in. wheelbase chassis. The front seats on the touring car are divided and the auxiliary seats fold into the backs of the front seats. Touring cars are furnished as standard in blue black, wine and dark green, with white wire wheels. Cloverleaf roadsters are furnished in red, yellow, battleship gray and blue black with red wheels. The wheels are Houk wire and the prices are $2,750 for the touring car and $2,900 for the cloverleaf. The tire size is 35 by 5 and equipment is complete in every particular.

High Spots in S. A. E. History

(*Continued from page* 1011)

sions thereon, except in the matter of their official publication under the Society's imprint as its Transactions. The policy of the Society shall be to give the professional and scientific papers read before it the widest circulation possible, with a view of making the work of the Society known, encouraging engineering progress and extending the professional reputation of its members."

Wide Scope of the Work

It is clear that the Society has performed and is performing an important public duty. It is deserving of very widespread support. Its work is of interest not merely to the technician but to the layman who demands efficiency, safety and comfort, but who has little idea how largely these desired qualities are the fruit of vast research and labor.

Theoretical Side Not Neglected

It is entirely logical that the S. A. E. should have become a real power to which can be referred numberless engineering questions which can be settled definitely only by the official action of some organized non-partisan body. Meanwhile the theoretical work has gone on, and more and better papers have been presented and discussed at its successive semi-annual national meetings.

Its Distinguished Membership

In the words of a veteran critic, "A glance over its membership list confirms the belief that the best inventive and mechanical brains in the country, both in and outside of the automobile industry, are associated in the Society of Automobile Engineers. These men have given their time and service unsparingly and it would be difficult to gage the value of the work they have done. Many of them are at the head of vast industries. It would be almost impossible to put a monetary value on their time which has been given so freely to committee work of the Society."

What the development of the next decade or of the next generation will be, none probably can conceive, but it is clear that the essential necessity of co-operative work will be more and more appreciated. No one can reach his attainable development intellectually or professionally without sharpening his wits through much contact with men in and out of his own station of life. The wise men say that those who give shall receive, and it is indicated strongly that those who do not give to others in some material degree the benefit of their practical and scientific experience, never receive as much as they could and should otherwise; and they can never be assured of being right in deductions as to data which they endeavor tenaciously to hold exclusive to themselves.

Building for the Future

The members of the S. A. E. and the automobile industry and the public in general may well be grateful to the founders of the Society from small beginnings, and to the splendid men who from time to time in recent years have served most effectively and gratuitously in devotion to an idea—the conception of what a properly organized association of talented engineers can and should do toward facilitating the evolution of mechanical transportation in the most efficient manner, toward assisting the younger men in the profession (with whom the future of the industry rests) in a spirit of true altruism, and toward the establishment of the best principles of ethics throughout the fabric of automobile design, production and maintenance.

Society's Services Summarized

The Society of Automobile Engineers has been aggressive, and produced indisputable evidence in many concrete instances, of valuable service rendered which no other body has rendered or perhaps could render. It has brought order out of chaos in the marshalling of group after group of innumerable details of motor car fabrication. Through logical forcefulness of facts, the merit of its standardizing and scientific work is clear to the man who runs.

The FORVM

A SYMPOSIUM ON THE POSSIBILITIES, ADVANTAGES AND DISADVANTAGES OF TWO-STROKE TYPE OF MOTOR—THE IDEAL OBJECTS OF A DIFFERENTIAL—OTHER VIEWS ON SUBJECT

Thinks Time Element Prohibits Two-Stroke

By Finley Robertson Porter
President, Finley Robertson Porter Co., Inc.

IN reference to the return of the two-stroke engine, I can hardly believe that this will ever amount to anything. My impression is that the future motor will be rated by a cubic inch displacement per minute, or firing strokes per minute. In view of the high piston speeds now possible with apparent safety, the greatest factor to be dealt with seems to be the time sufficient to get the gases in and out without a corresponding lowering of the brake mean effective as the result of back pressure. If one would be satisfied with a comparatively low brake M.E.P., piston speeds could be increased without any detrimental results.

In view of this situation I cannot understand a two-stroke engine as being at all possible, because of the fact that the one controlling factor as mentioned above is divided by two, as compared to motor revolutions, and the intake and exhaust periods in relation to one cycle are likewise divided. The answer seems to be a very low power ability and likewise a high heat flow to both the cooling medium and exhaust.

Personally I have never heard of the two-stroke engine even approaching efficiency, so that, unless some decided improvement is brought about, I do not anticipate any great increase in the use of the two-stroke engine.

Two-Stroke Problem Grows Harder

By A. F. Milbrath
Secretary and Engineer, Wisconsin Motor Mfg. Co.

CONCERNING two-stroke engines, the writer does not believe these will come in to any extent in the near future, as it is difficult to get the certain operation out of the two-cycle which the four-cycle will give. One of the main causes of this is the fact that it is impossible to hold the crankcase compression in these engines for any length of time. As soon as the bearings wear slightly, the gases will leak through the bearings and will thus cause weak explosions in the cylinders affected. In order to get good economy, compressions have been going up the last year, and with the higher compressions, it would be more difficult to prevent leakage than with the lower pressure.

Good Two-Stroke Probably Complicated

By F. E. Watts
Chief Engineer, Hupp Motor Car Corp.

I HAVE been rather out of touch with the developments of the two-stroke engine for several years past. I believe, however, that the common form of two-stroke engine using crankcase compression has only the very apparent advantage of simplicity to recommend it for pleasure car work. Its more prominent faults are that it is not possible to fill the cylinders as completely with a fresh charge as in the standard type of four-stroke engine; and, as it is practically a constant compression engine, the charge drawn in is mixed with a large amount of burned gas left from the preceding explosion. This, together with a considerable portion of the fresh charge which passes into exhaust, in most designs, results in very poor fuel economy, and in comparatively slow working speed as compared with recent four-cycle practice.

These same faults are found to a greater or less extent in ordinary modifications of the crankcase compression type, such as the two-diameter piston engines. These modifications, moreover, are even more difficult to get into good running balance than are the ordinary crankcase compression types, which are noticeably more difficult to balance than the standard four-cycle type.

Apparently, the only way to get efficiency in the two-stroke engine is to forget the maximum cheapness. Successful engines can be built by using separate pumps and pre-compressing the charge. Fuel injection with high compression is probably a possibility for commercial cars and for gas-electric cars.

It is, however, very likely that none of these engines may prove attractive enough to be manufactured in quantity, for it is by no means certain that when a two-stroke engine is produced having the flexibility and fuel efficiency of a modern four-stroke engine, that it will be simpler, lighter or cheaper to build than the latter.

The recent book of D. A. M. Low, published by the Temple Press Limited, London, England, covers the development and the possibilities of the small two-stroke engine in a very enlightening and interesting manner.

Thinks Subject Worth More Study

By C. W. McKinley
Engineer, Willys-Overland Co.

THE ordinary type of three-port, two-stroke motor has several points to recommend it on first glance. These are simplicity, due to lack of moving parts, and power due to the two impulses to the four-stroke motor one.

These apparent advantages, however, are more than balanced by operating conditions. For instance, up to the present time no two-stroke motor has been produced successfully that will equal the performance of the four-stroke motor as regards flexibility. While I believe it possible to accomplish this result, it would be by the action of valves and ports in addition to the simple three-port type. These additions, however, would offset the original advantage of the three-port, two-stroke motor.

Secondly, as regards power. The apparent gain is in the best instances about 40 per cent. The consumption of fuel rises to a great degree and the amount of fuel required to produce the same power with the two-stroke as with a four-stroke, would be 30 to 60 per cent greater than with a four-stroke. I believe, however, that if a thorough attempt was made to improve the two-stroke motor it would be well worth while.

Perfecting Two-Stroke Spoils Simplicity

By E. G. Gunn

Chief Engineer, Premier Motor Corp.

I HAVE followed the recent development in two-stroke engines, and while although the underlying principle is simpler in the case of the two-stroke engine, it does not appear to me that the game is worth the candle; in other words, by the time the various devices are put on to make the two-stroke motor operate in a satisfactory manner, a great deal of the attractiveness is lost.

Efficiency Demands Air Pump

By E. Gruenwald

Chief Engineer, Moline Automobile Co.

THE efforts which are being made to bring the two-stroke engine for motor vehicles back to life again, is a task which in my opinion, does not promise ultimate success.

I personally feel that efficient engines of the two-stroke type are only possible if the gases are controlled in the same manner as in the large stationary two-stroke engines, necessitating considerable complication and weight for the automobile engine, while the two-stroke engine without the auxiliary air pump is not efficient enough to compete with the high-grade four-cycle engine of to-day.

I am very much interested to learn of the views of other engineers on the same subject.

Limit of Engine Power Is Heat Developed

By W. R. Strickland

Chief Engineer, Peerless Motor Car Co.

IN regard to agitation in favor of two-stroke engines, I am of the opinion that two-strokes and two-cycles are in somewhat similar relative position, that is, they both tend to over-heated conditions for the development of the extra power which can be more simply and easily obtained by an enlargement of bore or stroke of the present simple design.

The piston design, especially, necessary for two-stroke motors would seem to be impossible from the present standpoint, as you are familiar with the space utilized on the top of our present pistons where increased clearances are necessary to prevent seizing before we reach the point sufficiently cool for natural clearances to be used.

The skirtings even now, where the natural clearances are used, are none too long to carry away the heat from the combustion end and, where two stroke pistons are designed, they have generally resorted to water circulation in order to reduce the size of the piston. I should say that the complications are more than four-fold without attendant compensation.

Two-Stroke Needs Good Gasoline

By F. N. Nutt

Chief Engineer, Haynes Automobile Co.

PERSONALLY, I never did have any love for, or patience with, the two-stroke motor and my experience with it was at a time when gasoline analysis was much different and better than at the present time. I am afraid that the present low-test gasoline will cause considerable trouble with the two-stroke motor.

The Ideal Objects of a Differential

By Lewis H. Scurlock

President M. & S. Gear Co.

BEFORE commencing a discussion of this subject, let it be said that the application of the power to the motor through the wheels to the ground, up to the present time has been largely a matter of theory and guesswork as no one has as yet been reported who could show the actual measurements of the horsepower delivered to the individual driving wheels of a motor under actual road traveling conditions.

The only real facts which we may feel safe in believing are those which stand out most plainly and apparent as obviously true, such, for instance, as where one wheel is permitted to spin in a mud hole or on a slippery pavement.

Until such time as actual measured tests are made to determine the amount of power delivered to each of the rear wheels of an automobile on the road the question of power distribution to the rear wheels will remain somewhat in doubt as to the actual figures.

Let us see what we would require of an ideal differential.

First, a positive pull on both driving wheels when car is traveling in a direct line ahead.

Second, the power equalized on both driving wheels when the car is turning, proportionately to the resistance offered to each of the wheels.

This would give us the following results:

First, a positive drive on both rear wheels.

Second, power equalized on both rear wheels when car is turning, according to the resistance offered to the driving wheels.

Third, increased efficiency of the motor of the car by virtue of the application of all its power which is capable of being absorbed by the resistance of the traction.

Fourth, less wear on the rear set of tires, it being impossible for one wheel to skid or spin in mud holes or sand.

Fifth, the elimination of much of the skidding on wet streets and doing away with the side sway of the car.

It would seem that other minor advantages would come from an ideal differential which would accomplish all of the above results.

Bevel Gear Differential Inefficient

Let us refer to the defects of the bevel and spur type of differential, both of which have been in common use, and we find from a mechanical standpoint that these differentials are both as good as could be desired, but find them weak from a functional use.

First, the bevel gear differential will permit the spinning of one wheel if it encounters less resistance than the other wheel and will lose the power of the motor through the spinning wheel.

Second, it permits unequal differential action when the resistance to either of the driving wheels is materially different.

From these defects it may be observed that the ordinary type of differential can cause a lot of trouble such as getting stuck in mud holes, wearing out of your tires, skidding of wheels which causes car skidding and dangerous accidents, unnecessary use of gasoline, and all of the evil effects which go with the spinning of one wheel and the standing still of the other when unequal traction is encountered. Thus it would seem that had the present type of differential been deliberately designed to accomplish these defects it would have been very successful.

Defects of the Solid Axle

The defects as well as the advantages of the solid axle have been heretofore set forth too elaborately to need further discussion except to add some of the defects which have not as yet been mentioned.

The differential lock which has been used extensively by some of the largest manufacturing concerns and discarded as impractical seem to offer all the advantages of an ideal differential for the solid axle, and at the same time provide for differential action when necessary. The differential lock used to lock together the driving bevel gears of a differential gave the desired effect of a solid axle when pulling out of a mud hole or getting a load out of some place where going is hard, but it happened so frequently that the driver failed to release the lock. Then, when turning a corner or taking up the uneven road play something always broke, which demonstrates the fact beyond question that the strain from a solid driving shock such as was the result when the differential was locked, brought extraordinary strains on different parts of the truck principally, however, in the rear axle, to such an extent that this idea of using a differential lock has been abandoned by most of our manufacturers, although we believe that some few are still holding on to them waiting for the ideal differential.

The experiments made on the solid axle in New York would be valuable were it not for the fact that they were made on good macadam streets and in the season of the year when there was snow or rain on the macadam, which made the retard slipping action on the rear wheels very easy and not condusive to tire wear. Undoubtedly were this experiment conducted under road and travel conditions as exist in hundreds of our inland cities, where good pavements are scarce, it would not have proved quite so satisfactory. The experiments with racing drivers have led most of them to prefer using even the ordinary differential in preference to the solid axle as it makes the car too hard to control on the track.

Turning Corners Unimportant

The statement that a differential is required only 1 per cent of the time while a straightaway pull is required 99 per cent of the time is largely theory and is not based on actual conclusion. Differential action is required many times in road travel when you are not turning corners. The turning of corners is one of the smallest requirements of a differential. It is the constant change of direction and the uneven road play under practical road conditions that requires differential action.

We believe that our spiral gear differential, known as the M. & S. comes as near meeting the *ideal* requirements of the differential as it is possible to conceive at this time. This differential applies the power to both wheels under all conditions and at the same time gives the necessary differential action when turning a corner for the following reasons:

First, the internal gears of the M. & S. differential are irreversible from the power applied by the motor to the driving gear.

Second, the internal gears of the M. & S. differential are reversible from the roll of the wheels in coming in contact with the ground giving the necessary differential action.

These two salient features cover the action of this differential and give the advantages of the solid axle as well as all the advantages of a differential. Unlike the bevel gear differential the M. & S. gives equalized differential action in turning a corner or taking up uneven road play. Many thousands of the M. & S. differentials on the Jeffery quad and light cars are now in use, and it has not been found necessary to increase the size of the axle drive shafts in any instance. Theoretically, it is not possible to apply more than 70 per cent of the entire power of the motor to one wheel even though the other wheel be on soft or slippery ground, and by the steady application of this power to the M. & S. it would not seem possible to deliver as great a shock load to the differential as it would be to a bevel gear differential where one wheel could be spinning rapidly and suddenly checked.

In Detroit there is now being completed a set of instruments for testing the actual power delivered to road wheels under actual road conditions which will undoubtedly determine plainly many of the questions with reference to the application of power to the rear wheels and give some actual facts and data on which to base a conclusion.

That there is a lack of authentic data with reference to power distribution is evident, and it is hoped these experiments will help to clear up the situation and give us facts as a basis on which to prepare future data as to power distribution under actual road traveling conditions.

Built Friction Drive Without Differential

By Charles Guernsey

Engineer, Service Motor Truck Co.

WE have read, with considerable interest, the discussion in THE AUTOMOBILE dealing with the possibilities of eliminating the differential. There are a number of things which have made good in practice which do not look good on paper, and this may be such a proposition.

However, the writer doubts its advisability. He was, at one time, connected with a company making a friction driven truck, in which a separate friction wheel delivered power to each rear wheel. There was no provision made in the job for differential action. In the hands of a capable driver this transmission gave very satisfactory service, but if someone got hold of it who would not release the power in going around a corner a great deal of trouble was experienced on account of breakage of various parts, which trouble we attributed entirely to the lack of a differential.

It is the writer's belief that it would be a constant experience of the same kind of trouble with axle shafts, etc., if the differential be eliminated.

Thinks Differential Doomed

By H. L. Palmer

Director of Sales, Standard Motor Truck Co.

WE believe there is much to be gained by the elimination of the differential although we are not having any trouble along this line, but always have been great believers in simplicity and our experimental department has been trying to eliminate the differential and think that they will do so by construction which is not at present open to public discussion. We believe that the day is not very far distant when this construction will be eliminated from the automobile.

The AUTOMOBILE

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Making History

EACH successive annual summer meeting of the S. A. E. is a milestone in the progress of automobile science. To every such meeting a number of members go with unsettled minds. Conversation, discussion and the chance remarks of others help to determine a course of action, so that the previous hesitancy is replaced by a complete confidence.

To a greater or lesser extent this happens to every individual engineer who attends these great gatherings. We all depend to an immense extent upon others, for modern man is a helpless creature by himself. Our civilization has become so complex that the accumulated experience of thousands is necessary for us previous to making any forward step whatever in science or in engineering.

From the beginning of time till a century ago, mechanical knowledge progressed with extreme slowness, because of the difficulty of transportation; men could not get together, and individuals of engineering bent were forced to work out things alone and unaided. The automobile industry has had a century of growth in 10 years owing to the ever-existing readiness of the engineers to get together. It is not too much to say that the summer meetings of the S. A. E. have been responsible for doubling the pace of development, that had it not been for these gatherings, the car of 1917 would have been advanced no further than the car of 1914.

Mammoth Mergers

THE formation of a $300,000,000 corporation to absorb a large proportion of the automobile industry of America is an event of commercial magnitude seldom if ever equalled in the history of business. Furthermore, there seems good reason to believe that the cause is a new one, that the object of the combination differs somewhat from that of previous amalgamations in the automobile and in other fields.

Co-operative buying is one of the main objects, if not the chief object of all. It is the ambition of the leaders in this latest of mergers to have so big and so rich a body that it can control every stage in the production of an automobile, commencing from the digging of the ore from which the steel is made.

In the cocoa business for years past there have been big corporations owning plantations and mills, so making the cocoa trade self-contained from the planting of the ground to the delivery of the finished product to the consumer. Never before has a manufacturing industry of anything like the complexity of the automobile business attempted an A to Z control of this kind.

To the consumer the effect should contain more of good than of evil. Immense economies in production cost enable huge profits to be made without raising the price of the article; they allow the price of the product to be cut without cutting the profits. Absolute monopoly in these days is almost impossible, with any complex thing it is quite impossible, so a big company may have immense power for economy without any power to inflate price. Probably dealers and users will discover nothing different in their circumstances due to the combination, which should tend to stabilize the value for money now obtainable.

Aviation Engineering

THAT the engineering of aircraft is closely allied to that of road transport vehicles has long been realized, and the tendency has lately been for the two branches to come closer together rather than to separate. This is because automobile engineering experience prepares a man better than anything else for a subsequent divergence into the newer field.

Thus we see automobile engineers becoming more and more interested in aviation, and aeroplane builders more and more confident in the ability of automobile firms to build their engines and help them with the mechanical detail of their planes.

There is no doubt but that the aviation industry of America is going to be a large and important one. Just now the only customer is the Government, but governments the world over are going to absorb a very large output for years to come. Meanwhile, there are many thinking men convinced of the future value of aeroplanes for mail-carrying and even for rapid passenger traffic between certain points. So, cutting out the enthusiasts who foresee the privately owned plane as a pleasure machine, there is ample encouragement to enter the field.

S. A. E. Summer Meeting Program

Details of Activities for Each Day on Lake Cruise Session, June 12-16

Monday

Meeting the incoming members and guests.
Registration headquarters—Pontchartrain Hotel.

8:30 a. m.—*First Business Session — Observation Deck.*

9—*Automobiles to be available for factory visiting, sight-seeing and shopping.*

11:30—*Lunch to be served at headquarters, in the ball room of the Pontchartrain Hotel.*

2 p. m.—*Steamship Noronic Sails.*

2:30-5—*Promenade, Observation Deck.*

3-5—*Standards Committee Meeting—Main Deck.*

6-8—*Dinner—Bugle at 6 and 7.*

8:30—*First Business Session.*
President's Address,
Future Scientific Development of the Automobile—C. F. Kettering.

11-12:30—*Dancing.*

Tuesday

7-10 a. m.—*Breakfast—Bugle at 7:30 and 9.*

9:30-12—*Professional Session—Observation Deck.*
Differential Substitutes—D. D. Ormsby.
High-Speed Engines—A. P. Brush.
Car Performance—Prof. D. L. Gallup.
Possibilities of the Constant Pressure Cycle—A. B. Browne and Herbert Chase.
Straight-Side vs. Clincher Type Pneumatic Tires —J. E. Hale.

12-2 p. m.—*Lunch—Bugle at 12 and 1.*

2—*Arrive Mackinac Island.*

5:30—*Noronic Sails.*

6:30-8:30—*Dinner—Bugle at 6:30 and 7:30.*

8:30—*Entertainment—Pennsylvania Section.*

9:15—*Entertainment—Cleveland Section.*

10—*Dancing Contest.*

Wednesday

7-10 a. m.—*Breakfast—Bugle at 7:30 and 9.*

7:30—*Arrive at Killarney.*
Fishing, Sports and Trip on Waubic.

12-2 p. m.—*Lunch—Bugle at 12 and 1.*

6-8—*Dinner—Bugle 6 and 7.*

8:30-10:30—*Entertainment.*
Detroit Section.

10:30-12:30—*Dancing.*

Thursday

5 a. m.—*Sail from Killarney.*

7-10—*Breakfast—Bugle at 7:30 and 9.*

9:30—*Professional Session—Main Deck.*

Bronze Alloys for Automobile Construction—W. M. Corse and G. F. Comstock.

Recent Aeroplane Engine Developments—Neil MacCoull.

Mechanical Transport Mobilization—A. J. Slade.

Automobile Experiences in the Great War.—W. F. Bradley.

Automobile Engineer and Preparedness—H. E. Coffin.

12-2 p. m.—*Lunch—Bugle at 12 and 1.*

2-4:30 p. m.—*Standards Committee Reports and Transaction of Adjourned Business—Observation Deck.*

4:30-6:30—*Owen Sound.*

6-8—*Dinner—Bugle at 6 and 7.*

8:30-10:30—*Entertainment*

Metropolitan Section.

10:30-12:30—*Dancing.*

Friday

7-10 a. m.—*Breakfast—Bugle 7:30 and 9.*

9:30—*Professional Session—Observation Deck.*

Crystallization in Cold-Drawn and Pressed Steel Parts—R. H. Sherry.

Kerosene vs. Gasoline in Standard Automobile Engines—Prof. C. E. Lucke.

Engine Fuels of the Next Decade—Dr. W. F. Rittman.

Open Discussion on Fuel Situation.

12-2 p. m.—*Lunch—Bugle at 12 and 1.*

2—*Professional Session—Observation Deck.*

Large Single vs. Dual Tires for Truck Rear Wheels—W. H. Allen.

Farm Tractors—C. M. Eason.

Refinements and Generalities in Truck Design.—H. D. Church.

Dynamics of Vehicle Suspensions—Dr. Benj. Liebowitz.

6—*Arrive Detroit.*

Overland, Hudson, Chalmers, Auto-Lite and United Motors in Monster Merger

New Corporation Second Only to U. S. Steel in Magnitude Formed with $223,000,000 Capital—Total Capital May Be Increased to $313,000,000

DETROIT, MICH., June 5—Two hundred and twenty-three million dollars is the capitalization of one of the biggest mergers in the history of commerce. It will cause the automobile industry to rank next in order to the steel trade, as only the United States Steel Corp. will have a larger amount of stock.

The new Willys-Durant merger of four automobile companies, with a substantial interest in a fifth, will start off on the basis of $223,000,000 of capitalization, it was announced yesterday.

It is understood that the name of the new combine will be the American Motors Co., with $70,000,000 preferred stock of $100 par value and 2,000,000 shares of common with no par value. The entire preferred stock issue will probably be apportioned among the companies entering into the merger, with none being offered to the public. Only a limited amount of the common stock is to be sold to the public at large, and at the present time it seems likely that this will be largely over-subscribed.

The company, which represents a union of the Willys-Overland, Hudson, Chalmers, Auto-Lite and United Motors Corp., the latter a combination of five accessory companies, which will supply parts for the cars made by companies in the merger, will make its début with $73,000,000 of 7 per cent preferred stock and 2,500,000 shares of common without par value. As it is proposed to sell the common stock to the public at 60, the capitalization represented by this stock is $150,000,000. The parent company will not be cramped by its capital limitations, however, if the management decides to expand, for the charter provides that the number of common shares may be increased to 4,000,000, which at the issue price would make the total capitalization $313,000,000.

Fisk a Possibility

It was said yesterday that no additional companies are being considered at this time as possible members of the new Willys-Durant family, with the exception of the Fisk Rubber Co., which may be taken in if terms can be agreed upon with holders of the large blocks. L. G. Kaufman, who has been handling the financial end of the merger, said that if the Fisk is purchased it will not be necessary to call upon any of the additional authorized stock, as there will be sufficient cash in the treasury to supplement the stock issued in payment.

John N. Willys, who is understood to have received $90,000,000 for his controlling interest in the Willys-Overland Co., will be paid in preferred stock and cash. It is said that he receives $45,000,000 in cash. He and his associates in Toledo have agreed to take a one-fourth interest in the 2,500,000 shares of common stock to be offered for sale. All of the $93,000,000 of 7 per cent preferred stock will go to the venders of the companies entering the combination.

William Salomon & Co. will head the underwriting syndicate to handle the common stock. Associated with them in the management will be Dominick & Dominick, who underwrote the recent Durant flotation of United Motors; J. S. Bache & Co., who underwrote the Durant Perlman Rim Corp., and W. W. Laird of Wilmington. The powder millionaires of Wilmington will take a very large interest in the company.

Other Mergers Rumored

Simultaneously there are rumors of a possible combination including Chevrolet, General Motors, Packard, Edmunds & Jones and a number of accessory manufacturers. It is claimed that the Timken company may line up with either the Willys-Overland or the Chevrolet group and that it is even possible General Motors, the Chevrolet group and the Willys-Overland group may enter into working agreements which will be almost the equivalent of a single combination.

The reason for these suggested mergers is to be found in the abnormal state of the raw material market. Every large manufacturing concern this year has suffered more or less severely owing to the unexpected rise in the price of steel and many other commodiities. It is felt, therefore, that the best insurance against fluctuations in the cost of raw materials is either for the automobile plants to establish steel mills, etc., of their own or to form combinations of such strength that they can take over existing steel mills, thereby absorbing them into the merger virtually if not actually.

Howard E. Coffin, vice-president of the Hudson Motor Car Co., is the authority for the statement that no automobile manufacturer is wealthy enough or consumes sufficient to make it worth his while to establish an individual steel mill, but that if the automobile industry divided into two or three groups it would be entirely self-supporting from the extraction of the ore to the finished article.

The situation at present is the existence of the General Motors Corp., of which W. C. Durant is president, the United Motors Corp., of which W. C. Durant is president, and the new corporation merging the Willys-Overland, etc., of which John N. Willys will be president. It is firmly believed that there will be at least a close working agreement between the new Willys merger and General Motors. If this proves actually to be true it will mean that W. C. Durant and John N. Willys will jointly control the great bulk of the automobile business of America.

THE THREE COMBINATIONS ARE:

1. New combination includes:
   Willys-Overland Co., Toledo, Ohio.
   Chalmers Motor Co., Detroit.
   Hudson Motor Car Co., Detroit.
   Electric Auto-Lite Co., Toledo.
   United Motors Corp. (Group No. 2).
2. United Motors Corp. includes:
   Dayton Eng. Lab. Co., Dayton, Ohio.
   New Departure Mfg. Co., Bristol, Conn.
   Hyatt Roller Bearing Co., Detroit.
   Remy Electric Co., Detroit.
   Perlman Rim Corp., New York.
   (General Motors, United Motors Corp. and Chevrolet Co. linked together through the common presidency of W. C. Durant.)
3. General Motors Co. includes:
   Buick Motor Co., Flint, Mich.
   Cadillac Motor Car Co., Detroit.
   Oakland Motor Car Co., Pontiac, Mich.
   Olds Motor Works, Lansing, Mich.
   Jackson-Church-Wilcox Co., Jackson, Mich.
   Weston-Mott Co., Flint, Mich.

The five companies which are merged into the new corporation have unfilled orders on hand amounting to $8,000,000, are sold out for over a year in advance, and have contracts for supplies to provide this output.

The officers of the Motor Products Corp. are W. C. Rands, president; C. F. Jensen, president of the Vanguard company, vice-president and supervisor of purchasing; H. H. Seeley, head of the Superior company, is vice-president and sales manager; D. B. Lee, vice-president of the Diamond company, is treasurer and general manager; M. L. Brown, treasurer and manager of the Universal Metal Co., is secretary. The board of directors consists of these men and R. R. Seeley, who is to be the Motor Products Corp. production manager.

Company to Branch Out

W. C. Rands states that while it would appear that windshields would be one of the most important products of the new combine, the intentions are to branch out into several other fields of automobile parts manufacturing. It is planned to build a large drop-forge plant and to add a screw machine department, so that in the end windshield making will only be about one-third of the concern's total activities. Later it is intended that the somewhat scattered plants are to be brought together in one very large institution here, building plans looking to this end already being under way. Some of the concerns in the combine have Canadian plants also, and these will be concentrated eventually to adequately care for business across the border.

J. K. Stewart Dead

NEW YORK CITY, June 2—John K. Stewart, president of the Stewart-Warner Speedometer Co., Chicago, Ill., died to-day at his home, 12 East Eighty-seventh Street, this city, in his forty-seventh year.

Mr. Stewart became president of this company in December, 1913, at the time of the Stewart-Warner merger, when that company purchased the plant and patents of the Stewart & Clark Mfg. Co., maker of the Stewart speedometer, and also the plant and patents of the Warner Instrument Co., Beloit, Wis.

Chrysler Resigns from Briscoe

FLINT, MICH., June 3—Walter Chrysler, who has ably supervised the manufacturing and production departments of the Briscoe Motor Co., has tendered his resignation following the resignation of C. W. Nash as president of General Motors. Nothing has yet been given out regarding Mr. Chrysler's future plans, nor as to who his successor will be. Mr. Chrysler is regarded as one of the foremost production men in the industry and has had much to do with the remarkable expansion and growth of the Buick factories.

Big Parts Makers Combine

Five Companies from Detroit Territory Merge as Motor Products Corp.

DETROIT, MICH., June 3—On the eve of the formation of other great mergers in the industry comes the announcement of the completion of plans whereby several large parts makers in other lines located in Detroit and vicinity are to be combined under the name of the Motor Products Corp., with a capitalization of 100,000 shares of no par value and with W. C. Rands, head of the Rands Mfg. Co., this city, as president. Incorporated under the laws of New York and with a main office in New York City and headquarters here, this corporation as at present outlined takes in the Rands Mfg. Co., the Vanguard Mfg. Co., the Diamond Mfg. Co., and the Universal Metal Co., all of Detroit, and the Superior Mfg. Co., Ann Arbor, Mich.

The Rands Mfg. Co. is a very large concern making at the present time windshields, tops and steering wheels, having begun this activity in 1900. Vanguard makes a specialty of windshields, and has been located in Detroit for about 3 years, during which time it has shown a remarkable growth. The Diamond Mfg. Co. makes metal stampings, such as radiator fittings, radiator shells, hubs, hub caps, manifolds and tubing. In a similar line is the Universal Metal Co., this concern having a large tube mill and making a variety of metal parts as well. The Superior Mfg. Co. is also a big windshield maker, besides doing business in other accessories necessary to motor vehicles.

Stock Oversubscribed

It is understood that the stock of the new holding company will be put upon the market very soon. It is said to have been heavily oversubscribed, there being 100,000 shares of no par value. The underwriting has been done in New York.

Seventy thousand shares of its stock are now being issued, 5000 shares of which are to be designated as Class B stock and have full voting power and the remaining 65,000 shares to be designated as Class A stock and will have full voting power, but will be identical with Class B stock in all other respects. The articles of incorporation will provide that the voting power of Class B stock will pass to all stockholders alike in the event of the failure of the company to earn a minimum of $5 per share per annum for any two consecutive years on all the then outstanding capital stock.

The syndicate, which has been formed by J. S. Bache & Co., is to continue in force for a period of 6 months, but may be extended at the option of the managers for a further period of 60 days.

The stock of the corporation was offered for subscription at $74 per share. Of the total 70,000 shares, 20,000 shares were given to holders of the stocks of the five companies that constituted the merger in part payment for their holdings, leaving 50,000 shares that were purchased by the underwriting syndicate.

1917 Pierce Arrows To Be Sixes

BUFFALO, N. Y., June 3—The Pierce-Arrow Motor Car Co., Buffalo, is out with a direct announcement that it will adhere to the six-cylinder type of power plant in its 1917 output.

The six-cylinder type of engine, according to the company's announcement, is being continued solely because the company finds it most efficient. No question of price, no discussion of selling argument, enters into the verdict. The decision of the engineering staff follows a close observation of motor experiments and tendencies in the United States and Europe.

Pullman to Make Truck

YORK, PA., June 2—The manufacture of a 1000-lb. light delivery truck is the latest venture of the Pullman Motor Car Co., this city. Two standard bodies are provided in its manufacture, the express type, selling for $750, and the panel type, at $775.

The truck is brought out on a special chassis which will hold maximum loads. The wheelbase is 114 in. The four-cylinder motor, 3¾ by 4¼ in., develops 32 hp. The valves are inclosed. The cooling system is of the thermo-syphon type and the radiator of the Pullman honeycomb style.

Left hand drive is provided, with center control and emergency brake lever forward of center. A 9¼-gal. gasoline tank is carried on the cowl.

Van Deusen with Detroiter

DETROIT, MICH., May 31—Walter H. Van Deusen, formerly commercial manager of the E. R. Thomas Motor Co., and assistant general sales manager of the Chalmers Motor Co., and more recently district sales manager for the A. Elliott Ranney Co., New York City, has been appointed director of sales for the Detroiter Motor Car Co.

McMullen Joins Chalmers Sales

DETROIT, MICH., June 1—B. J. McMullen, who was district sales manager on the Pacific Coast for the Willys-Overland Co., has been appointed an assistant sales manager for the Chalmers Motor Co.

S. A. E. Adds Tire Division

Military Committee Created—Truck Division Reorganized—Tire and Rim Division

NEW YORK CITY, June 6—At the April meeting of the standards committee of the S. A. E. in Cleveland it was suggested that a new division be added to deal with all matters in connection with tires and rims. This was discussed briefly by the standards committee and heartily approved. The council of the society at their last meeting in Indianapolis consequently decided to establish the new division to be known as the tire and rim standards division. H. L. Barton, production engineer of the General Motors Co., has accepted the position of chairman of the division and the other members represent the bulk of the tire and rim business. They are: W. H. Allen, C. C. Carlton, J. E. Hale, Russell Hoopes, C. B. Whittelsey, C. E. Bonnett, John Kelsey, J. V. Mowe, J. C. Manternach, C. B. Williams, E. K. Baker, J. C. Cole and Christian Girl.

To Handle Tires and Wheels

The division will take over from the truck standards division questions relating to solid tires, rims and wheels and will also assume responsibility for the pneumatic tire and for pleasure car wheels and rims, thus carrying on the work of the old division which was dropped 4 months ago. It is believed that there is a real opportunity for standardizing passenger car felloe bands in the near future.

Aiding the Army

A special committee to be known as the military transport committee, was also appointed by the Council. This committee is not a part of the standards committee, but will co-operate with committees of other societies and with Government officials in the development of a military transport scheme. It will also have a close relationship with the truck standards division of the standards committee. It is composed of men who are not connected with any truck manufacturing companies. Its membership is as follows: C. F. Clarkson, Chairman; Geo. W. Dunham; E. A. Deeds; Henry Souther, and W. P. Kennedy.

The appointment of the military transport committee means the creation of a new body, as this committee will be independent of the standards committee, having the right to call upon the latter in work required. The recent conferences held between army engineers and truck makers under the auspices of the society prove conclusively how greatly the S. A. E. could help the military authorities in the creation of the military transport committee and provide a ready means of communication between the society and the military.

Reorganize Truck Division

Owing to the creation of the tire division and the fact that the truck standards division will probably be mainly occupied with military work the council decided to reorganize the truck standards division so that its membership consists solely of truck engineers connected directly with the manufacture. W. P. Kennedy, formerly chairman of this division, has been appointed a member of the military transport division and his place has been taken by H. D. Church, chief engineer of the truck department of the Packard company, the other members of the division being: B. B. Bachman, L. P. Kalb, W. T. Norton, Jr., A. L. Riker, W. R. Strickland, Geo. W. Smith, A. J. Scaife, F. A. Whitten, John Younger and E. R. Whitney. This increases the number of divisions of the standards committee to fourteen.

24,000 Carloads of Automobiles Shipped in May

NEW YORK CITY, June 7—The National Automobile Chamber of Commerce at its monthly meeting to-day reported a return to normal conditions in shipments. May shipments amounted to more than 24,000 carloads, as compared with 15,392 in May last year. Conditions have so improved that the use of flat cars is no longer necessary.

The truck interests met to-day in convention, the meeting being attended by about forty makers with Windsor T. White, chairman. Policies of service and repair were adopted, so as to better the conditions of the truck users.

There will be no truck show this year.

The truck committee adopted at its meeting the definition of standard type chassis. Just what is included under the definition has not as yet been completed.

108,286 Cars in Minnesota

ST. PAUL, Minn., June 3—Secretary of State J. S. Schmahl turned into the State treasury in May $11,902 covering automobile licenses at $1.50 each. The office issued 6900, at times at the rate of 500 a day. The total for the year is 108,286 cars.

230,000 Registration For Ohio

COLUMBUS, OHIO, June 3—W. H. Walker, Ohio Registrar of Automobiles, in a recent report showed that 165,000 gasoline automobiles have been registered since the first of the year. The number of electrics registered is 4100, and dealers and manufacturers 2650.

Breaks Chicago-to-N. Y. Record

B. F. Durham in Chalmers 6-30 Roadster Covers 1047 Miles in 31 Hr.

NEW YORK CITY, June 7—Chicago to New York City in 31 hr. exactly, is the new record set by a Chalmers 6-30 fully equipped roadster, which negotiated in that time just 1047 miles. This record compares with that established by E. C. Patterson in his Packard 3-38 last July, when he covered 1015 miles in 35 hr. and 43 min. Thus Durham, who drove the record-breaking Chalmers, beat the old record by 4 hr. 43 min. and averaged 33.7 m.p.h. for the entire distance.

Durham and his observer, B. Harris, left Chicago yesterday at 3 a. m. and arrived here to-day at 11 a. m. The car went through the trip without any mishaps or punctures, the only stops being those for replenishment of fuel, oil and water. The car averaged about 14 m.p.g. on gasoline.

The route followed was through South Bend, Goshen, Kendelville, Bryan, Ohio, Fremont, Cleveland, Erie, Buffalo, Elmira, Binghamton, Middletown, Ft. Lee and into New York. The car reached Bryan at 8:30. Cleveland was made in 11.4 hr., a distance of 371 miles. The car up to this time averaged about 33 m.p.h. Last night at 8:47, the car left Buffalo and reached Middletown this morning at 8:30. Durham was relieved as driver by Al Walden from Cleveland to Elmira.

The car was equipped with A C spark plugs, Silvertown cord tires, Stromberg carbureter, Atwater Kent ignition, Westinghouse starter, and a Motometer.

Fiat Factory in Hungary

BUDAPEST, April 18—A branch of the Fiat Automobile Works has been founded in this city by the local branch of the Anglo-Austrian Bank and the Fiat Works, Ltd., Co. of Vienna. The capital stock of the company is 1,000,000 crowns, $203,000. A factory building situated at Kelenfold, in the suburbs of Budapest, has been rented.

Willys a Bank Director

BUFFALO, N. Y., June 6—John N. Willys, president of the Willys-Overland Co., Toledo, Ohio, was elected a director of the Third National Bank of Buffalo to-day.

Jacoby Overland Service Director

TOLEDO, OHIO, June 6—K. R. Jacoby, who has been Toledo zone district manager of the Willys-Overland Co., has been appointed director of service, succeeding Herbert J. Finch.

Mid-West Section S. A. E. Meets

Re-elects Officers and Discusses Body Design, Trucks and Blakeley Motor

CHICAGO, ILL., June 3—The old officers of the Mid-West Section of the Society of Automobile Engineers were re-elected unanimously at the quarterly meeting of the section at the Chicago Automobile Club last night. Inasmuch as the section has been organized for less than a year, the first administrative year was less than 12 mo., and the old officers therefore were eligible. Those re-elected were F. E. Place of the Buda Motor Co., chairman; J. DeCou of the Thos. B. Jeffery Co., vice-chairman; Darwin S. Hatch, *Motor Age*, secretary; C. W. Stiger, Stromberg Motor Devices, treasurer.

Art and Body Design

The relation of Art to Motor Car Body Design formed the subject of a paper presented by W. B. Stout of the Scripps-Booth Co., Detroit, Mich., and in the discussion that followed the paper the point was brought out by Mr. Stone of C. Stone & Sons, Chicago, body builders, that there was room for great improvement by builders of chassis along the lines of making better arrangements for high-class, custom-built bodies. Such things as the angle of the steering wheel, the arrangement of the pedals, etc., often limited very much the scope of the body builder in working individual designs. To refute this a number of representatives of the car makers arose to the occasion with the statement that in most instances the angle of the steering column was changeable and the pedals were adjustable.

Buying a Truck

Henry Farrington, Thomas B. Jeffery Co., Kenosha, Wis., presented a paper entitled Problems Involved in the Choice of a Motor Truck, and discussed the points that the prospective truck buyer should take into consideration in selecting a commercial vehicle for his particular service. Mr. Farrington presented the advantages of the four-wheel drive as against the rear drive truck and in closing made a plea against manufacturers and salesmen rating the carrying capacity of their vehicles at too high a mark for all conditions of service, as it is the tendency of the user to load it to this capacity no matter what the operating conditions might be.

The Blakeley Motor

E. D. Blakeley of Sears, Roebuck & Co., this city, presented a description of a new type of high-compression engine of his own design which at present is applicable only for stationary use and is developed for small isolated plants, but which has possibilities of adaptation to truck service. Although of high compression it varies from the Diesel type, but like the latter is capable of running satisfactorily on very low-grade fuels.

Mr. Blakeley gave a demonstration of his design with a motor temporarily installed in the Automobile Club garage, in which he started it cold on kerosene and later ran it on very low-grade of oil and also on olive oil. The unusual features of the engine are that it has neither carbureter, electric ignition, or any special ignition features. Even with the low-grade fuel there was practically no smoke and very little odor. A description of the engine will be published in a later issue.

Gamble Goes to Duplex Co.

NEW YORK CITY, June 4—D. E. Gamble, for the past 3 years designer and assistant chief engineer of the Herschell-Spillman Co., North Tonawanda, N. Y., has resigned to become chief engineer and superintendent of the Duplex Engine-Governor Co., this city. On May 26, the officers and department heads of the Herschell-Spillman company gave a theatre party and banquet in honor of Mr. Gamble at which Guy White, general manager, acted as toastmaster.

Manson Succeeds Ilse on Jiffy

DETROIT, MICH., June 3—Frank H. Ilse, inventor of the well-known quick-acting curtain for automobiles, and president of the Jiffy Curtain Co., licensor of patent rights under Ilse's patents, has disposed of his interest in the concern to R. C. Manson, also connected with the company, and has retired as president. Mr. Manson becomes president and treasurer.

Clarkson Comes to United States

NEW YORK CITY, June 2—J. B. Clarkson of the firm of Messrs. J. B. Clarkson & Co., Ltd., New Zealand, will arrive in this city June 15. Mr. Clarkson is one of the leading New Zealand importers of automobiles. He will first visit Chicago, which he will reach June 9. From there he will go to Detroit, reaching that city on June 12.

Bindbeutel Leaves Motor Print

NEW YORK CITY, June 3—George T. Bindbeutel has resigned as editor of *Motor Print* to become active in the field of literary endeavor. John Chapman Hilder is his successor. Mr. Bindbeutel had been editor of *Motor Print* since December, 1914.

Norma Co. Plans New Factory

Buys 10-Acre Site at Elmhurst—To Build Four-Story Building

NEW YORK CITY, June 2—The Norma Co. of America, manufacturer of Norma high-precision anti-friction bearings, announces through its president, W. M. Nones, the purchase of a 10-acre factory site at Elmhurst, on the outskirts of Long Island City. The property fronts on Queens Boulevard and has a depth of about 1000 ft., abutting in the rear upon the main line of the Long Island Railroad, from which a siding will be built directly into the plant.

The company has, in 5 years, become prominently identified with the American automobile industry. Beginning as importer of bearings, the merit of its product gained quick recognition among the manufacturers of ball-bearing automobile accessories.

The latest move is made in response to an imperative demand for a still larger immediate output, with facilities for extension with the future growth of the business. The plans now under way provide for a four-story building, 70 by 350 ft., to be erected immediately in reinforced concrete. Every modern improvement will be embodied, looking toward the maximum of production efficiency. The location was determined upon, not alone for the excellent shipping facilities afforded but also for its ready access to the labor markets and home sections grouped around Long Island City—surface and subway lines running close to the property giving quick communication with neighboring Long Island towns as well as with Manhattan Island via the Queensboro Bridge.

Chandler Employees to Share Profits

CLEVELAND, OHIO, June 2—A share in the profits earned by the Chandler Motor Car Co., this city, will be given to the employees of the company. It is indicated that a sum equal to 5 per cent on all wages paid, including overtime, commencing July 1, 1915, and ending June 30, 1916, will be paid with the July 20 payroll.

Splitdorf Employees Get 10% Bonus

NEWARK, N. J., June 1—The Splitdorf Electrical Co., this city, has announced a 10 per cent monthly bonus to all employees to take effect at once. Over 1600 employees will be affected by the increase, which will amount to about $150,000 a year. The increase was given voluntarily on the part of the company.

Both piece-workers and day-workers will receive the bonus.

According to the bonus plan, every man or boy in the production end of the plant will receive the increase. A man employed at an hourly rate with a weekly wage of $20, at the end of the month will receive $8 extra. If he is a piece-worker the bonus will be figured on the total amount of wages he receives for the entire month.

Two Shifts Working

This is the first of a series of improvements in the working conditions of the employees, many of which will not go into effect until the completion of the new building of the company on Aug. 1, when many of the departments will be rearranged. At the present time two shifts are working at the plant, an open shop.

Profit-sharing for Lee Rubber

New York City, June 2—A profit-sharing plan has been adopted by the management of the Lee Rubber & Tire Corp. Under this plan the important employees of the company will receive the benefit of a certain percentage which is to be taken from the net earnings over and above the $300,000 required for the payment of the present dividends of 50 cents regular and 25 cents extra quarterly. The plan provides for the distribution of the bonuses to the employees who are beneficiaries in proportion to the salaries received.

Enlarge White Tractor Plant

Cleveland, Ohio, June 1—Rollin H. White has purchased 18 acres of land fronting on St. Clair Avenue, giving a total of 61 acres for the manufacture of tractors. It has been announced that the farm tractor plant is eventually to be a $1,000,000 plant.

The parcel of land just bought is directly in the rear of 43 acres fronting on Euclid Avenue, just east of the Baltimore & Ohio railroad's Bluestone quarry branch railway, which Mr. White purchased last fall. Mr. White has had plans made for gradual development of the tract and eventually expects to use the whole of it for factory buildings and storage yards.

To Sell Great Western Co. Assets

Detroit, Mich., June 5—Samuel Levy & Co., commercial auctioneers of this city, have purchased the entire assets of the Great Western Automobile Co., Peru, Ind., including all stock, material, real estate, etc. The service department of the concern will be continued for the time being but all material as well as the real estate is to be sold at auction within the next 6 weeks.

Kissel Brings Out New Six

Hundred-Point Model to Sell at $1,095—4-32, 4-36 and 6-42 Discontinued

Hartford, Wis., June 3—The Kissel Motor Car Co., this city, has brought out the Hundred Point Six. It is a light six with a 3¼ by 5-in. motor, developing 52 hp. The price for the three-passenger roadster, four- or five-passenger touring body is $1,095. All-year bodies with detachable tops are made in sedan, coupe and town car styles at additional prices. The new car takes the place of the four-cylinder model which sold at $1,050, the 4-32 and 4-36 and the 6-42 models being discontinued.

The new model resembles in a general way the larger six-cylinder model, which will be continued. The block motor is L-head and its S. A. E. horsepower rating is 25.4. A few of the features are: Remy ignition and lighting; Kissel-Stromberg carbureter; three-speed gearset; Leak-Proof piston rings; Non-Gran bronze bushings; Timken bearings; Willard storage battery; and Stewart vacuum fuel feed system. The wheelbase of the new car is 117 in. and the tires are 32 by 4.

Ten-Story Building for Packard in Long Island City

New York City, June 2—The Packard Motor Car Co., Detroit, has purchased the block fronting in Queens Boulevard, between Hill and Rawson Streets, Long Island City. This block adjoins the site now occupied by the Packard Building and it is to be utilized for the erection of a building for the use of the company. According to present plans the building will be ten stories in height and will be double the capacity of the present building between Hill and Van Dam Streets.

Plans are already prepared for another addition to the building in Van Dam Street and Queens Boulevard. It will be eight stories high and will contain 90,000 sq. ft. and its cost will be about $350,000. This addition will front on Van Dam Street. An addition costing $50,000 is just about completed, fronting in Hill Street.

Sterns Tire & Tube Co. to Manufacture in St. Louis

St. Louis, Mo., June 1—Plans have been completed by Edward Sterns, president of the Efficiency Oil Corp., and the inventor of the Sterns automobile inner tube, to establish in this city a plant for the Sterns Tire & Tube Co.

The Sterns tube in appearance is like other inner tubes, but is constructed of a patented black rubber material which is said to be proof against punctures and blow-outs. It is said to be sold to motorists under a factory guarantee of 20,000 miles, at a price slightly higher than that charged for other tubes.

These tubes require 40 per cent less air in inflation and there is but a slight difference in their weight and the weight of other tubes.

It is the intention of the officials of the company to begin operation as soon as possible. The erection of a plant will be started on a 10-acre tract in the fall. This plant will adjoin the Efficiency Oil Corp. plant near Suburban Garden, in St. Louis County.

Dodge Acquires More Land

Detroit, Mich., June 2—Dodge Bros. continue to expand their plants, as evidenced by the purchase this week of property along Whiting Avenue adjoining present buildings. An effort is being made to close this thoroughfare, but so far this action has not been approved by the Hamtramck council, the Detroit suburb in which the Dodge property is located. Just what the new factory additions that will be erected on this land will be utilized for is not stated, but it is expected that the added floorspace will make possible the augmenting of the Dodge payroll by some 3000 men.

Oakes to Add 50 Per Cent Floorspace

Indianapolis, Ind., June 3—The Oakes Co., this city, maker of automobile horns, accessories and metal stampings, will build a one-story, reinforced concrete building alongside its present plant, giving it 50 per cent more floorspace. This building will also contain the new offices and will be ready for occupancy about Sept. 1.

American Motor Plans Plant

Plainfield, N. J., June 1—Tentative plans have been completed by the American Motor Co., for a factory group in this city. The main building will be 860 ft. long by 60 ft. wide and several smaller buildings are to be built.

Jordan Takes Title to Land

Cleveland, Ohio, June 1—The Jordan Motor Car Co., this city, has taken title to a tract of 5 acres it recently purchased in East 152d Street, south of St. Clair Avenue. The first building, a $50,000 structure, now is being erected on the land.

New Booklet on Willys-Knight

Toledo, Ohio, June 2—The Willys-Overland Co., this city, has issued its new booklet on the Willys-Knight car, in which it gives valuable information on the operation and construction of the Knight engine.

S.S.E.Co. Will Make Complete Car

$5,000,000 Philadelphia Company Formed To Build $5,000 Chassis

PHILADELPHIA, PA., June 3—The S. S. E. Co., a $5,000,000 corporation, composed of New York and Chicago capitalists, has purchased ground in the vicinity of the Hess-Bright plant in Kensington on which it will build a large plant for the manufacture of high grade automobiles.

The Organizers

In back of the new Philadelphia industry are: Victor Lee Emerson, designer of the Emerson engine, formerly president of the Emerson Marine Engine Co., and holder of a number of patents covering gasoline engines; E. E. Smathers, a New York capitalist of prominence, and C. B. Shaeffer, of Chicago and head of the Shaeffer-Smathers Oil Co. Mr. Emerson is general manager, Mr. Smathers president and Mr. Shaeffer vice-president. Temporary offices have been opened at Twenty-third and Chestnut Streets, this city.

Capital All Paid Up

The company was brought here through the efforts of the industrial bureau of the Philadelphia Chamber of Commerce, which is also negotiating for several other automobile plants. It is capitalized at $5,000,000 all paid up.

Buildings and equipment alone will cost close to $1,000,000 in addition to $250,000 already spent in getting the enterprise under way. The company owns and controls its own patents and will make everything going into the finished car except the tire and electrical equipment. This, Mr. Emerson said, is practically the first attempt anywhere to make a complete car. He estimates the value of the first year's output to be $5,000,000.

20-Acre Plant Site

The plant will be located on a piece of ground having a frontage of 2000 ft. on the main line of the Pennsylvania Railroad. It will cover approximately 20 acres. The buildings will be of concrete and steel and one story high.

Everything will be made on the ground floor under a saw-tooth roof. The equipment will be along most modern lines and will be electrically operated throughout.

It is claimed that the car will be the highest-priced of any made either in this country or in Europe. The chassis alone will cost in excess of $5,000. The body will be made in a number of styles and will be both open and closed.

None but the highest grade of workmanship and material will be used and the main idea will be to turn out a highly-scientific and flawless car regardless of price. Two of the principal features will be nimbleness and lightness. So pronounced is the latter feature that it will move while standing with a pressure of hardly more than 3 lb.

New Gasoline-Saving Device Burns Crude Oil

DALLAS, TEX., June 2—T. S. Causey, 3303 Oak Lawn Avenue, Dallas, has invented a gasoline-saving device for an automobile which is claimed to burn crude oil successfully. Patents are pending for the device. It will be called a Thermal generator.

With gasoline selling at 20 cents per gal. and crude oil at 5 cents per gal., Mr. Causey believes he has an invention which will mean more to the automobile world than any other one thing.

"The proposition has been thoroughly tested and if it accomplishes nothing more than to save the fuel expense for gasoline cars it will prove the greatest boon the automobile world has known for some time," Mr. Causey says.

Speaking further of the device Mr. Causey said: "It controls the heat of the exhaust in a manner to get any amount of the heat desired and by it the gasoline is fed into a generator through a very fine needle valve. The oil comes into contact with the heated surface and is generated into gas, while at the same time the air is admitted in an automatic way that thoroughly mixes with the gas which is taken into the cylinders in the highest condition to produce the result needed."

Mr. Causey said that several big firms have offered him a handsome price for the exclusive rights on the device. He expects as soon as his patent is received to interest Dallas capital and establish a factory here. It will be several weeks, he said, before this can be done.

May Issue Gasoline Cards in England

LONDON, ENGLAND, June 1—New regulations limiting the use of gasoline, which is scarce in England on account of the large consumption by the army and navy, will be issued next week. The regulations will take effect as soon as published.

It is said that the amount of gasoline used by the British army in France is equal to the entire consumption of the British Isles in times of peace. The use of automobiles on Sunday, except under special licenses, will be prohibited in the new regulations, which aim at the suppression of pleasure riding in the United Kingdom. It is probable that even the omnibus lines will be included in the new regulations. The use of gasoline cards, similar to the Berlin bread cards, is being considered.

To Open Mexican Oil Fields

Large Scale Development Under Way—Present Political Conditions Only Hindrance

TAMPICO, MEX., June 3—As an evidence that the larger foreign interests which have oil holdings in Mexico are confident that the present depressed condition of the industry will soon be relieved by an improvement in the political and financial situation of this country several large purchases of oil land leases have been made by them during the last few weeks. These transactions were given the official approval of the de facto government, as was recently decreed by Venustiano Carranza. It is stated here that the Texas Co., which now obtains a daily output of about 10,000 barrels of oil from its wells in the Tampico region, plans to enter the Mexico field on a big scale as soon as conditions here become more settled. It has obtained options on large tracts of oil producing land which it will develop. It is said that it also has under consideration the erection of a refinery here.

Big Developments

Development operations upon a scale such as was never before witnessed in any oil region in the world will be inaugurated in this part of Mexico as soon as assurances are felt by the investment interests that political and industrial peace has come to Mexico to stay and that the government will not overburden them with taxes and restrictions. It is authoritatively announced by the Lord Cowdray syndicate of London, Eng., which is operating in Mexico under the names of the Mexican Eagle Oil Co. and S. Pearson & Son, Ltd., that it has appropriated $75,000,000 American gold or £15,000,000 sterling for expanding its oil industry in Mexico. This vast sum will be spent in boring wells, laying pipe lines, enlarging its two refineries and the building of at least one additional, and the construction of oil-tank steamers.

The Mexican Petroleum Co., which is at this time the largest producer of oil in Mexico, has adopted tentative plans for the enlargement of its business that call for the expenditure of more than $50,000,000 gold, it is announced by its representatives here. This company recently closed a contract for supplying the Standard Oil Co. with 6,000,000 barrels of crude oil.

Many millions of dollars are to be spent in development work in the different fields of the Gulf coast region by the Pierce Oil Corp., the Dutch-Shell Trading and Transport Co., the Magnolia Petroleum Co., the Gulf Refining

Co., the Penn-Mex Fuel Oil Co. and other operating concerns. All of the older companies in Mexico are operating under concessions that were granted them by the Diaz administration. There is some uncertainty as to what standing these contracts have with the existing de facto government, but it is the opinion of oil men here that no attempt will be made to forfeit the concessions which have been standing so long.

No New Work

So far as undertaking new work in the different fields at present, nothing is being done. Everything in the way of opening up possibly new producing territory is at a standstill, pending the establishment of a stable government. The Mexican Petroleum Co. and the Mexican Eagle Oil Co. have a few rigs still at work putting down holes, and wells of enormous production have been bought in by both of these companies recently.

German Gasoline Scarcity Stops Use of Private Cars

AMSTERDAM, June 1—Owing to the alarming scarcity of gasoline, the German authorities have practically put a stop to the use of automobiles, not only by private individuals, but also by members of the neutral Diplomatic Corps in Berlin.

Report Reduced Manufacture of Carriages and Wagons

NEW YORK CITY, June 2—The inroads of the automobile into the carriage and wagon industry during the period from 1909 to 1914 were greater in respect to passenger vehicles than those used for business purposes. In 1909, according to statistics gathered by the United States Bureau of Census, carriages represented 53.2 per cent and wagons 39.7 per cent of all vehicles made, but in 1914 the proportion represented by carriages had declined to 47 per cent, while that represented by wagons had increased to 48.2 per cent.

293 Fewer Makers

In the preparation of the 1914 census of manufactures for the manufacture of carriages and wagons and of bodies, tops, cushions, hubs, felloes, spokes, wheels, and other materials used in the production of the complete vehicles, reports were received from 5320 establishments, which manufactured 1,187,002 vehicles of all classes, valued at $72,283,898. At the 1909 census there were reported 5613 establishments, with an output of 1,584,571 vehicles, valued at $94,037,900. The number of establishments thus decreased during the 5-year period by 293, the number of vehicles by 397,569, and the value by $21,754,002.

Gasoline Hearings June 12-13

Federal Trade Commission Meets in Washington to Complete Its Information

WASHINGTON, D. C., June 3—An opportunity to explain the rise in the price of gasoline will be given various oil companies on June 12 and 13, when the Federal Trade Commission will hold a series of meetings in this city. The commission is investigating the price increase in gasoline under a Senate resolution. It is announced by the commission that a report will be submitted within a few days after the hearings.

Data Collected

The commission has sent letters to refiners, jobbers, pipe-line companies and crude oil producing companies throughout the country, asking them for any information they might care to present in addition to that already uncovered by the commission.

The Letter Sent

The letter sets forth that "It is the Federal Trade Commission's desire in every inquiry to secure all the facts and to draw the correct conclusions therefrom. To this end, having completed a preliminary tabulation and analysis of the data concerning the gasoline situation, as furnished by your company and others, the commission will now give to interested parties an opportunity for discussing the facts of the situation before reaching its conclusion."

Information Desired

The commission further sets forth in its letter that at the time of the hearings any company that may care to present, in addition to any information already submitted, any further information, it will be received and "any statement concerning your company's cost of production and the increase therein, as compared with the increase in prices, will be welcomed."

Investigate Competition

The commission also says it will be glad to have the various companies submit at the hearings a concise statement concerning competitive conditions in the petroleum industry, especially in regard to gasoline.

The commission's letter says in conclusion that "at this hearing the commission would desire to ask certain questions concerning these matters of your representatives, and to that end it is suggested that in case your company desires to appear it should be represented by officers thoroughly familiar with the executive, accounting, operating and marketing departments of your business."

It is believed in Washington that the gasoline quiz on June 12-13 will bring out a lot of interesting information about the high cost of gasoline and the real reasons for it.

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120 Trucks Displace 60,000 Oxen with Bulgarian Army

WITH THE BULGARIAN ARMY, MACEDONIAN FRONT, May 10—The motor truck has revolutionized transportation for the Bulgarian army. Figures have been given proving that each truck used by that army has been doing the work of 500 oxen and 250 wagons each day.

In the past the Bulgarian army has depended entirely upon the ox wagon for the transportation of its food, supplies and ammunition.

The truck carries a crew of two, is able to transport 3000 kg. at an average speed of 15 m.p.h. and runs 16 hr. a day if necessary. This means that each truck replaces, at a 16-hr. run, 180 ox wagons, 360 animals and about 200 men, as the ox wagon is in charge of one driver and carries an average load of 300 kg. and moves at a speed of about 2½ m.p.h. for 8 hr. each day. Considering that the truck, with a capacity of more than 3000 kg., is by no means rare at the Macedonian front, and taking into consideration the length of the various lines of supply, the average for each truck is 250 wagons, 500 animals and about 300 men.

These figures indicate that only about 120 trucks are necessary to permit the Bulgarian general staff to restore to the farms the 30,000 oxen which were furloughed some time ago. The change also liberated from the military service 30,000 men who had been drivers.

Oxidation of Cylinder Oils in United States Bureau Paper

NEW YORK CITY, June 1—The United States Bureau of Standards has issued a pamphlet, Technological Paper No. 73, giving data relative to the oxidation of automobile cylinder oils, which has been made the subject of a recent study of that bureau.

The rate of oxidation of three oils when exposed to sunlight and air was studied, and the increase in weight, acidity, and carbonization value, as well as changes in the Maumene and iodine numbers and in the demulsibility were determined. Changes in the carbonization values of these three oils and of eight others, when heated for different lengths of time at a given temperature, and for the same time at different temperatures, were studied and are discussed very fully in the paper.

Durant Heads Gen. Motors Co.

Succeeds C. W. Nash, Resigned—W. C. Leland Takes Place of Strauss on Board

DETROIT, MICH., June 1—All doubt as to where the control of the General Motors Co. lies was dispelled by the election of W. C. Durant to the presidency at the meeting of the directors in New York City to-day, succeeding C. W. Nash, resigned. Coincident with this action came the election of W. C. Leland, vice-president and general manager of the Cadillac Motor Car Co., to the board of directors of the giant combine to fill a vacancy occasioned by the resignation of Albert Strauss, of the banking firm of J. & W. Seligman & Co., one of the banking interests which financed the General Motors following its difficulties several years ago and which was not favorable to the Durant faction. Another director, J. J. Starrow, of the firm of Lee, Higginson & Co., another of the banking interests opposed to the new control, has also resigned. Mr. Starrow did not attend the meeting.

Mr. Nash a Director

Mr. Nash remains a director of the concern, although his resignation as president comes as no surprise to those in a position to know, since dominance by the new interests is understood to have made his retention of the presidency untenable for certain reasons. Mr. Nash's connection with General Motors dates back to 1910, when, coming from the carriage and implement business, he was made vice-president and general manager of the Buick Motor Co., replacing Mr. Durant in that position. In 1912 Mr. Nash was elected president of the entire combine, and the remarkable growth and prosperity of General Motors is ample proof of his ability as an organizer and manager of so large a combination. He is regarded as one of the foremost figures in the industry today and he is at the present time closely identified with other interests in the field.

It is now believed that merging of General Motors and Chevrolet is forecast by this latest development. Mr. Durant's election to the presidency is his second incumbency in that office, and comes as a result of the regaining of control from the group of banking houses which carried the concern over its period of depression some years ago.

Overland Common Stock Quartered

TOLEDO, OHIO, June 2—Sanction has just been secured from the State of Ohio and the New York Stock Exchange to reduce the par value of each share of common capital stock of the Willys-Overland Co., this city, from $100 to $25 a share. This change has been made in order to create a wider market and more general distribution of the stock.

The Willys-Overland stock, which has been steadily advancing during the past 6 months, reached its highest point during the past week, when it climbed to 276 3-4.

A notice of the reduction in par value will be sent to all holders of common stock, requesting a return of the old certificates in order that a reissue of the new paper can be made—four $25 par value shares being exchanged for each $100 par value share.

Markets Steady

NEW YORK CITY, June 6—Prices of automobile materials last week were steady with few changes. Antimony dropped ½ cent a pound, lead went down 25 cents per 100 lb., and tin was $2.50 per 100 lb. lower.

The rest of the prices were unchanged. Fine up-river Para rubber fluctuated throughout the week, dropping to 65 cents a pound, it lowest quotation, and rising to 68 cents, its highest. Yesterday it closed at 66.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb	58	.58	.58	.58	.58	.58	...
Antimony, lb	.25	.25	.25	.24½	.24½	.24½	—.00½
Beams & Channels, 100 lb	2.77	2.77	2.77	2.77	2.77	2.77	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl	10.90	10.95	10.93	10.78	10.85	10.90	...
Fish Oil, Menhaden, Brown, gal	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb	7.25	7.25	7.20	7.20	7.00	7.00	—.25
Linseed Oil, gal	.70	.70	.70	.68	.68	.68	—.02
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude, gal	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude, gal	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para, lb	.66	.65	.65	.65	.68	.66	...
Rubber, Ceylon, First Latex, lb	.70	.70	.70	.70	.70	.70	...
Sulphuric Acid, 60 Baume, 100 lb	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb	47.00	45.75	45.00	45.00	45.00	44.50	—2.50
Tire Scrap, lb	.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	...

K. C. Conditions Excellent

Crops Increased and Dealers Are Optimistic—Record Sales for 1916 Predicted

KANSAS CITY, MO., June 3—The June report of the Kansas City branch of the Federal Reserve Bank states that conditions have been extremely good in that territory and the outlook is for an unbroken continuance of prosperity. Crop conditions are excellent, there is a large increase in corn acreage, the valuable alfalfa crop is in the finest shape, stock and feeding cattle are money makers, there is a big movement of cattle from Texas and New Mexico to the Kansas and Oklahoma pastures, and altogether the situation and the prospects are highly satisfactory. "Banks have difficulty in keeping surplus funds profitably employed," the report concludes.

Automobile dealers and branch managers apparently can concur in this optimistic report. Their situation this year is far better than last year; for they have more cars to distribute.

"There can be no comparison between May, 1915, and May, 1916," said J. F. Martin, manager of the Buick Motor Co. "Our business was ten times the volume we had last year. But that was because we had the cars to deliver. Conditions are very fine in this territory, there is a good demand for cars, and I understand all the leading companies are looking forward to a record-breaking trade. The people are able to buy and pay for cars, the roads are being improved rapidly to make the use of cars even more desirable, and there seems nothing to prevent the continued expansion of the business in this district."

Electrics Gain

A. T. Clark, manager of the factory branch of the Anderson Electric Car Co., said that his company had an increase of 281 per cent in business in the Kansas City district the first 5 months of this year. There were forty-one cars sold in 1915, this period, and 164 this year. The interesting part of this record is that electric cars are going into the small towns, where previously salesmen had no idea they could sell—or it was considered hardly worth while working.

Portage Rubber to Increase Capital $1,750,000

AKRON, OHIO, June 1—The directors of the Portage Rubber Co., Barberton, at its annual meeting on May 29, declared a quarterly dividend of 2 per cent on the common stock, the first to be paid common stockholders since the organization of the company. The regular quarterly dividend of 1¾ per cent, will be paid on the preferred stock.

The directors adopted a resolution calling for a meeting of stockholders on July 11 to consider a proposed increase from $1,250,000 to $3,000,000 in capital stock. It is proposed that $1,500,000 of the increase be disposed of as common stock. If the increase is approved all stockholders will have the privilege of purchasing the increase in common at 105. It was announced that the company increased its business this year by 100 per cent over that of 1915.

Packard $5,000,000 Capital Increase Authorized

DETROIT, MICH., June 3—To-day the stockholders of the Packard Motor Car Co. authorized an increase of $5,000,000 in the common stock of the concern, bringing the total capitalization to $21,000,000, of which $8,000,000 is in preferred stock.

At this meeting a new office was created, this being chairman of the board of directors, which new position will be filled by Henry B. Joy, who retires from the presidency in favor of Alvin Macauley, formerly vice-president.

Sparton Stock for Cleveland

CLEVELAND, OHIO, June 6—Application has been made to list the stock of the Sparks-Withington Co., Jackson, Mich., on the Cleveland exchange.

Sensational Rise in Stocks

New High Marks with Phenomenal Strength—Millions Made on Advance

NEW YORK CITY, June 7—Automobile and accessory securities on the New York Stock Exchange and the Curb Market closed on Saturday after one of the most sensational rises ever recorded in this city. Yesterday, automobile issues had a day of greatest activity and millions of dollars were passed back and forth as rumors of gigantic mergers were verified. The easily-won fortunes in the munition business have played a prominent part in the spread of automobile speculation.

General Motors Up

The Bethlehem Steel movement which carried that stock to $600 a share is outmatched in the matter of fluctuations by General Motors, which opened last week with a drop of nearly 60 points between sales, and on Saturday rose 87 points to the accompaniment of rumors of the $200,000,000 merger. Willys-Overland, the nucleus of the merger, made a new high record of 314 and closed 6 points up on the day. Other gains in the motor shares were Chandler with 11 points, and Studebaker, 3¾ points. On the curb Chevrolet sold up to the new record price of 272 and closed at 270, a net gain of 9 points.

The advances recorded for the week were as follows: Chalmers common, 30 points; Chevrolet, 20 points; General Motors, 33 points; Goodrich, 121¼ points; Packard, 15 points; Portage, 25 points; Willys-Overland, 45 points; Chandler, 18 points, and United Motor Corp., 10¾ points.

Fully 10 per cent of the whole week's dealings on the New York Stock Exchange were in motor stocks. In the Curb Market the transactions were still larger. The turnover in the brand new United Motors amounted to nearly 190,000 shares. White Motors were dealt in to the extent of nearly 90,000 and Chevrolet had a turn-over of 42,600 shares.

Many of the more conservative brokerage houses are refusing to carry the higher-priced motor stocks on margin except for customers who they know have ample means, and then only on big margins, which must be kept good.

The appreciation which has taken place in the shares of automobile, tire and accessory companies, has added hundreds of millions of dollars to the market value of these properties. Many of these concerns have been stock corporations for only a few months, and the owners who sold a controlling interest in them have in some cases seen the value of their minority holdings surpass the value of the greater interest which they sold, as appraised at the time of incorporation, less than a year ago.

Munitions Profits Factors

Bankers state that the rapid rise in automobile stocks has been due very

Automobile Securities Quotations on the New York and Detroit Exchanges

	*1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
jax Rubber Co. (new)	..	..	68	69½	+1½
luminum Castings pfd	98	100	..	..	..
I. Case pfd	..	..	88	90	+2
halmers Motor Co. com	90¼	92¼	200	210	+30
halmers Motor Co. pfd	95	98¼	99	101	+2
handler Motor Car Co	..	..	120	130	+18
ievrolet Motor Co	..	..	262	264	+20
ectric Storage Battery Co	..	..	64	66	+2
restone Tire & Rubber Co. com	480	485	840	860	..
restone Tire & Rubber Co. pfd	110	113	113	114	..
ineral Motors Co. com	137	138½	548	565	+33
neral Motors Co. pfd	97	99	115	117	+1
F. Goodrich Co. com	44	45½	197	200	+121¼
F. Goodrich Co. pfd	101½	102	105¼	106	—9¾
odyear Tire & Rubber Co. com	245	248	197	200	—195
odyear Tire & Rubber Co. pfd	105	106	105¼	106	+¼
ant Motor Car Co	..	..	12	13	+½
ay & Davis, Inc., pfd	..	..	..	..	..
ernational Motor Co. com	14	15	10	14	..
ernational Motor Co. pfd	36	37	21	27	—1
lly-Springfield Tire Co. com	126	130	74¼	75	+2¼
lly-Springfield Tire Co. 1st pfd	81	83	96	98	+1
ly-Springfield Tire Co. 2d pfd	120	135	..	..	..
xwell Motor Co. com	42	43½	85¾	86	+¼
xwell Motor Co. 1st pfd	86	87	89¼	89¾	+¼
xwell Motor Co. 2d pfd	37	38	58	58½	+1
ler Rubber Co. com	180	185	300	..	..
ler Rubber Co. pfd	104	105	104	106	—11
v Departure Mfg. Co. com	..	..	275	..	..
v Departure Mfg. Co. pfd	..	..	112	115	—1
kard Motor Car Co. com	102	104	240	..	+15
kard Motor Car Co. pfd	†96¼	..	101	105	+1
ge-Detroit Motor Car	..	..	56	..	+11
rless Motor & Truck Corp	..	..	25	26	—½
man Rim Corp	..	..	149	152	+1
age Rubber Co. com	35	38	110	113	+25
age Rubber Co. pfd	85	88	112	114	+4½
al Motor Co. pfd	..	..	22	..	+2
Motor Truck Co	15	16¾	37	37½	—1
Motor Car Co	32¾	33¾	44½	45	+2½
n Motor Car Co	..	..	81	83	—2
dorf Electric Co. pfd	..	..	..	..	..
dard Motor Co	..	..	8	8½	..
art-Warner Speed. Corp. com	65½	66½	86	90	—2½
Stewart-Warner Speed. Corp. pfd	103	105	108	110	—1
Studebaker Corp. com	65	67	141½	142½	+4½
Studebaker Corp. pfd	97½	100	108	112	+1
Swinebart Tire & Rubber Co	80	90	83	84	..
Texas Co.	..	..	190	192	—2
United Motor Corp	..	..	88¾	89	+10¾
U. S. Rubber Co. com	62	63½	55¾	56¼	+½
U. S. Rubber Co. pfd	106	107	109½	110	+½
Vacuum Oil Co	..	..	248	253	—1
White Motor Co. (new)	..	..	57⅞	58⅛	+7⅜
Willys-Overland Co. com	114	116	310	320	+45
Willys-Overland Co. pfd	99½	101	111	112	+5

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co	..	..	35½	..	+1
Chalmers Motor Co. com	..	92	210	230	+31
Chalmers Motor Co. pfd	95	98	96	100	..
Continental Motor Co. com	180	200	37¼	38¼	—½
Continental Motor Co. pfd	84½	86	9¼	10⅛	—¼
Ford Motor Co. of Canada	950	..	..	405	..
General Motors Co. com	146	150	470	525	+40
General Motors Co. pfd	99	100	115	118	..
Maxwell Motor Co. com	43	46	84	86½	—½
Maxwell Motor Co. 1st pfd	86	88	88	91	—½
Maxwell Motor Co. 2d pfd	38	40	56	58½	—1½
Packard Motor Car Co. com	102	104	240	..	+10
Packard Motor Car Co. pfd	96¼	..	101	104	..
Paige-Detroit Motor Car Co	..	..	55½	56¾	+½
*W. K. Prudden Co	19½	21	40	45	..
*Reo Motor Car Co	32½	33½	44½	45½	+2½
*Reo Motor Truck Co	14⅝	15½	36¾	..	—¾
Studebaker Corp. com	67	69	139	141½	+2½
Studebaker Corp. pfd	..	100	110	..	..

INACTIVE STOCKS

*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	200	..	..	350	..
Regal Motor Car Co. pfd	..	25	17	..	..

*Par value, $10. †Ex dividend.

largely to the prosperity enjoyed by persons engaged in the manufacture of automobiles or in allied industries and to the immense sums for investment accumulated by the owners of companies engaged in the munitions business.

The following table listing a number of the companies whose stocks have been particularly active during the past week, shows the large appreciation caused by the wild speculation. All of the issues are new, with the exception of Willys-Overland and General Motors and in these issues the price of a year ago is used:

Company	Issued at	Yesterday's High	Appreciation
General Motors.....	150	560	$66,400,000
Willys-Overland ...	130	325	40,950,000
Chandler	85	131	3,220,000
Lee Tire	50	56½	650,000
Chevrolet	85	278	154,400,000
United Motors......	62	94	38,400,000
Perlman Rim.......	120	162½	4,250,000
White	51	60	2,880,000
Total advance			$311,240,000

Dividends Declared

Rubber Goods Mfg. Co.; quarterly of 1¾ per cent on preferred, payable June 15 to stock of record of June 9.

Kelly-Springfield Tire Co., quarterly of 1½ per cent on preferred, payable July 1 to stock of record June 17.

Yale & Towne Mfg. Co., quarterly of 1¾ per cent, payable July 1 to stock of record June 23, and an extra dividend of 10 per cent, payable June 7 to stock of record May 31.

$20,000 Prize Money for Twin City Meet

MINNEAPOLIS, Minn., June 5—With $20,000 in cash prizes, four races are open to professionals on the Twin City Speedway for July 4. The Mid-Continent races are for 150 miles, 50, 20 and 10 miles. For the first race seven prizes are hung up ranging from $6,000 to $400. For the second are five prizes from $1,000 to $200, and for the third five prizes from $600 to $100. The final race is a consolation handicap for non-winners. First prize is $400, second is $200, third is $175 and fourth is $125 and fifth $100.

Correction

In THE AUTOMOBILE for Jan. 27, 1916, an article was published entitled Working Out the Rolls-Royce Brake. We have just been informed by the Rolls-Royce company that the experiments therein described were not conducted by any member of its staff. In justice to the author it should be explained that the mistake was due to no fault of his but a confusion between his name and that of a recent member of the Rolls-Royce engineering force.

Oldfield Sets Record for 2 Miles

Drives Front-Drive Christie Racer at 113 M.P.H. on Chicago Speedway

CHICAGO, ILL., June 5—Barney Oldfield, driving his front-drive Christie car, established a new American speedway record for 2 miles on the Chicago speedway here to-day, averaging 113 m.p.h. in an unsuccessful attempt to break the world's record for the distance. The best previous American speedway record for the distance was that made by Caleb Bragg in a Fiat on the Los Angeles 1-mile speedway April 13, 1910, in 1:15.96, or at 95 m.p.h.

Harkness Delage Team and Peusun Out of Chicago Race

CHICAGO, ILL., June 2—The Harry Harkness racing team, composed of the Delage cars and the Peusun, will not race at Chicago. They are being shipped to New York City instead and will be rebuilt. The cars are top heavy for track work as they have the gasoline too high. The tails will be taken off and the tanks underslung. Another fault in the cars is in the baffling of the gasoline. There is only one baffle plate in the tanks and the gasoline has a tendency to rush to the outside under the influence of centrifugal force, on the curves. The result is that the cars are not suited for track work.

It is expected, according to Gaston Morris, who is traveling with the team in an advisory capacity and who is well known for his track generalship, that the cars will be ready for Minneapolis.

Studebaker Convention Opens

DETROIT, MICH., June 3—More than fifty branch managers and assistant branch managers of the Studebaker Corp. reached Detroit this week for the convention which is scheduled to be in session from June 6 to June 9. They came from all parts of the country, as far East as Boston and as far West as San Francisco.

Daily meetings are on the program to be held at the Studebaker factory, at which L. J. Ollier, vice-president and director of sales, will preside. A. R. Erskine, president of the corporation, came over from South Bend, to be present throughout the week. Talks by heads of the sales, service, engineering and production departments, along with inspections of the factories, will complete the business session.

One of the events of the program will be a view of the factory improvements which were announced at the last convention in December and have since become a reality. These improvements have been made with a view to increasing the production of Studebaker cars, making possible an output of 100,000 cars.

Reports from the branch managers and retail sales managers on conditions in their territories are expected to furnish a good gage on the prospects for the remainder of the year. Among the branch managers who attended are F. R. Bump, New York; Henri Neubauer, Philadelphia; G. N. Jordan, Boston; A. H. Pearsall, Chicago; L. B. Alford, Dallas; W. S. Williams, Kansas City; R. D. Maxwell, Los Angeles; E. R. Carpenter, San Francisco; J. A. Graham, Minneapolis; R. H. Williams, Detroit; L. A. Keller, Omaha; L. S. Weeks, Atlanta; A. H. Brown, Portland, Ore.; C. J. Simons, St. Louis; T. W. Naylor, Salt Lake City; J. B. Renshaw, South Bend. The following district managers are also in attendance: J. O. Hahn, Cleveland; E. W. Gans, Indianapolis; J. A. Haskell, Des Moines.

C. A. C. Calls for Cars

CHICAGO, ILL., June 6—The National Committee of Home Defense motorists have appointed a committee from the members of the Chicago Automobile Club headed by Joseph E. Callender as chairman to organize a motor reserve corps in Chicago. As its initial effort this committee will transport the First Infantry of the Illinois National guards to their annual camp at Fort Sheridan and to do this the services of 200 touring cars and fifteen trucks will be required.

King Establishes New York Branch

NEW YORK CITY, June 2—The King Motor Car Co., Detroit, Mich., has bought out the King holdings of the A. Elliott Ranney Co., this city, and is now managing the sale of the King Eight at Broadway and Fifty-second Street. At the present time the business is being handled by factory representatives under the direction of Joseph Porter. The service department will be located at 250 West Fifty-fourth Street.

Christiaens Used Rajah Plugs

NEW YORK CITY, June 6—Joseph Christiaens, whose Sunbeam car finished fourth in the Indianapolis 300-mile race last week, used standard Rajah spark plugs. Eight out of the ten cars to finish the race were equipped with Rajah plugs.

Lexington Speedway Co. Formed

LEXINGTON, Ky., June 2—The Lexington Speedway Co., this city, has been organized for the purpose of building a $300,000 automobile speedway. The incorporators are J. T. McKee, Rosedale, Ky., and G. M. McCarthy, Louisville.

Question Benefit of Ga. Law

State Finds Owners Are Not Paying Ad Valorem Tax—33,840 Cars Registered

SAVANNAH, GA., June 2—Whether the several counties of the State get any more out of the new automobile law or not, there are more automobiles registered this year in Georgia than last by about 33 1/3 per cent. The manner in which the statistics will be compiled under the new law will, too, show exactly how many automobile owners in just what counties are not returning their cars to the county for ad valorem taxation—and exactly who they are.

A Gain of 11,630 Cars

At the opening of business in the office of the Secretary of State on the first day of May, 1915, the last automobile registered was 22,210. The 1916 record for the same date shows that the last number sold was 33,840, or 11,630 more cars registered up to the close of business on the last day of April this year than last year. After the first of May last year there were approximately 3000 more cars registered, and secretary Cook believes the final registration this year will add 5000 to 6000 more cars to the 1916 list.

States Loses $30,698 on Fords

On Ford cars alone the State has, this year, lost $30,698, as compared to the return on the same number of Ford cars under the fixed fee of the old law. Heretofore a State tag cost as much for a car of that class as for any other, $5, while under the new law that class of automobiles has been graded down, the present fee being $3, and the list shows that there are 15,349 Ford automobiles registered in Georgia this year. There are 237 pleasure electric and 1140 delivery wagons and motor trucks registered. In both the latter class, however, it is evident that added registrations will have to be made, since there are more of both classes in operation in the State than the record shows.

The New Law

The new law provides that, on or before May 1, the board of commissioners in each county of the State shall report to the Secretary of State the official number of miles of public roads in the county, outside the incorporated cities and towns, the correct number of motor vehicles returned for taxation in the county in 1915, as shown by the county tax books, and certify that 90 per cent. of the motor vehicles owned in the county have complied with the State law requiring registration in the office of the Secretary of State, and have 1916 license numbers attached to their cars. On the basis of this report the Secretary of State apportions the fund derived from the sale of 1916 license tags among the several counties, provided they have complied with the 90 per cent. registration and other features of the new law.

New York State to Tax Motor Vehicles on Road Wear

ALBANY, N. Y., June 1—All owners of automobiles and motor trucks will have to pay additional fees to the State within a year because of the wear and tear of the vehicles on the highways. Governor Whitman has signed the Hewitt bill providing for the levy of the fees by Feb. 1, next year.

The Hewitt bill directs the commissioner of highway, superintendent of public works and the State engineer to adopt a schedule of fees for the registration of omnibuses that carry passengers and trucks for the transportation of freight. They are to classify the vehicles upon the basis of time and extent of use upon the highways relative to the wear and tear of the roads. The schedule is to be turned over to the Secretary of State by the first of next year.

Lift Massachusetts Blue-Law Ban

SPRINGFIELD, Mass., June 4—Motorists in this city in particular and throughout Massachusetts in general are breathing easier, and so are the garage men as a result of Chief of Police William J. Quity delving more deeply into the law of Sunday sales. He had notified the garage men that the sale of gasoline was illegal on Sunday. There had been a prosecution, and as the Legislature had refused to make a change in the law there seemed to be a deadlock with the prospect of the trouble spreading throughout the State. Then some of the automobile officials got busy and claimed that as gasoline is derived from gas, and the latter can be sold on Sunday, gasoline could be retailed.

Safety First Society Urges New Rules

NEW YORK CITY, June 2—At a meeting, yesterday, before the General Welfare Committee of the Aldermen, this city, four ordinances in the interests of Safety First, were proposed by the Safety First Society of New York. The meeting was also attended by members of the Automobile Dealers' Assn. and the Police Department. The proposed ordinances introduced were: To guard unprotected side chains on motor vehicles; to prevent trespassing upon or hitching on motor vehicles and wagons; to safeguard properly motor vehicles when left unattended in the streets; and to eliminate the glare of automobile headlights.

Tractor Engineers Convene

Problems of Growing Industry Discussed at Session in Minneapolis, Minn.

MINNEAPOLIS, MINN., June 2—The Society of Tractor Engineers met May 29 at the Andrews in convention.

Two papers were read. C. D. Meyers of the Timken-David Brown Co. discussed "Worm Gearing and Its Application to Tractors." The Ford Tractor Co. has applied the gear and other companies are reported adopting or considering the application of the same gear. Meyers discussed this in a technical way.

Haulage a New Field

A. W. Scarrett of the Minneapolis Steel & Machinery Co. read a paper on "Tractor Haulage." This is a comparatively new field, and the limitations and advantages of the tractor for this work were ventilated. The speaker used charts and statistics to show what disadvantage to the tractor in road work is even a light grade and bad conditions of the track.

Robert Gaylord of the Gray Tractor Mfg. Co., secretary of the society, said that the whole field of tractor discussion is a new one and is capable of indefinite development and discussion. In particular the question of tractor haulage is capable of infinite elaboration and study. He said Minneapolis is now the greatest tractor city in the country and that the society is therefore growing rapidly.

Plan National Extension

Plans for national extension are working out, and any tractor engineer, tractor factory firm or accessory manufacturer in the tractor line is eligible for membership.

Officers of the new organization are: President, G. T. Strite; vice-president, W. J. McVicker; secretary-treasurer, Robert Gaylord; additional directors, H. A. Buffington, C. C. Cavanaugh, G. C. Andrews and O. B. Kinnard.

To become a national organization is the purpose of the society. The local association has fifty members, which is a rapid gain from a modest start last winter.

Patterned After S. A. E.

It was announced at the meeting that the society is for tractor engineers and tractor firms, with an associate membership for manufacturers of tractor accessories. It is patterned after the S. A. E. on a smaller scale.

Outside memberships are coming in rapidly and it is probable societies will be organized in other large tractor centers.

Factory Miscellany

Ideal Wheel Plant in Massillon—The Ideal Wheel Co. has planned to construct a factory in Massillon, Ohio. The company recently increased its capital from $50,000 to $150,000.

Kressler to Add—The Kressler Auto Co. is planning the construction of a two-story, 100 by 200-ft. addition to its plant at Fostoria, Ohio.

Kankakee Welding to Reconstruct Plant—The Kankakee Universal Welding Co., maker of wire wheels for automobiles, will reconstruct its plant at St. Anne, Ill., which was recently destroyed by fire with a loss of $100,000.

J and D Tire to Build—The contract has been awarded for the construction of a factory for the J and D Tire and Rubber Co., Charlotte, N. C., at an estimated cost of $500,000.

To Build Motors—The Davies-Mitchell Engineering Co., 220 Union Bldg., Cleveland, Ohio, has been organized to build six- and twelve-cylinder automobile motors and expects to begin the erection of a plant in about 90 days.

Limousine Top Acquires Bldg.—The Limousine Top Co., Kalamazoo, Mich., maker of automobile tops, has acquired an additional building and will increase its output considerably.

To Make Bodies in Savannah—F. C. Kramer of Savannah, Ga., will shortly begin the erection of a factory, 150 by 200 ft., of steel and reinforced concrete, for the manufacture of bodies for commercial automobiles, automobile wheels, etc. The equipment has been bought and will have a daily capacity of 600 wheels from 24 to 28 in. in diameter. A site has been purchased on Dale Avenue and it is expected that the plant will be ready for operation April 1, 1917.

To Make Parts—The Lawndale Mfg. Co., Elkhart, Ind., has been formed with a capital of $75,000 and has secured factory space in which equipment is being installed for the manufacture of automobile parts. A. H. Beardsley, W. H. Foster and J. A. Bell are the directors.

Newark Stamping Adds—The Newark Stamping & Foundry Co., Newark, Ohio, has let a contract for a second addition to plant No. 2, foundry department. This is the second addition since Feb. 1. The company manufactures gray iron castings, brass or aluminum. The stamping department is working nights making the Thompson hose clamps.

Ogren Adds—The Ogren Motor Car Co., Chicago, Ill., is constructing a three-story mill on Sacramento Boulevard, between Chicago and Grand Avenues, at an estimated cost of $85,000.

Jeffery to Add—The Thomas B. Jeffery Co. has awarded the contract for the construction of a foundry and manufacturing building at Kenosha, Wis.

Akron Tire Co. Acquires Site—The Punctureless Auto Tire Co., Akron, Ohio, has acquired a site in Barberton on which it will erect a plant, 60 by 400 ft., and a powerhouse.

Detroit Heating Co. to Add—The Detroit Heating & Lighting Co., Detroit, Mich., maker of sheet-metal specialties for automobiles, has completed plans for the erection of additional buildings to double its present capacity.

Wadsworth Body to Build—Plans have been prepared for the construction of a two-story, 95 by 350-ft. factory in Detroit, Mich., for the Wadsworth Mfg. Co., maker of automobile bodies. The estimated cost is $60,000.

Double Service Tire for Barberton—The Double Service Tire and Rubber Co., Akron, Ohio, is coming to Barberton. The company has bought 4 acres of land and work has been started on the new buildings.

General Tire Adds—The General Tire & Rubber Co. is building a large addition to its plant in Akron, Ohio. The company was formerly the Western Tire & Rubber Co., Kansas City, Mo.

The Automobile Calendar

ASSOCIATIONS

June 12-16—S. A. E. Summer Trip on Great Lakes.
July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Dec. 2-9—Electricians' Country-wide Celebration.

CONTESTS

June 10 — Chicago Speedway Race. International 300-Mile Race, Speedway Park, Speedway Park Association.
June 17—Newark, N. J., Track Race, Olympia Park, Auto Racing Assn.
June 20—Galesburg, Ill., Track Race, 100 miles.
June 22-23—Chicago, Interclub Reliability Run, Chicago Automobile Club.
June 26—Des Moines, Iowa. Speedway Race, Price Speedway Co.
June 28 — Des Moines, Iowa, Speedway Free-for-All, 300-Mile Race.
July—LaGrande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300-Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 4—Newark, N. J., Track Race, Olympic Park, Auto Racing Assn.
July 4—Visalia, Cal., Road Race, Tulare Co. Auto Club.
July 4—Spokane, Coeur D'Alene, Track Race, Reigel-Hiller Co.*
July 4—Benton Harbor, Mich., Track Race, F. E. Fitzsimmons.
July 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
July — Burlington, Iowa, 100-Mile Track Race, Tri-State Fair.
July 15—Portland, Ore., Track Race, Northwest Auto Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept. 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7—Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

MISCELLANEOUS

June 8—New York City, Orphans' Day Outing at Donnelly's Grove, College Point, L. I. Orphans' Automobile Day Outing Assn.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo. Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa Tractor Demonstration.
Aug. 21-25—Bloomington, Ill. Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis. Fall Show. Wisconsin State Fair. Milwaukee Automobile Dealers.

The Week in the Industry

Trade Happenings

Oregon Items—The Scripps-Booth line will hereafter be distributed in Portland and throughout Oregon by the Braly Auto Co. Coincident with this announcement is the news that H. W. Lyons has returned to the Braly Auto Co. as sales manager.

The Oregon Oakland Motor Car Co. has been named representative for the Vim truck in Portland and vicinity.

Washington Items—Turnley & Rathke, Rosalia, have contracted to handle the Oakland line in that territory.

The Traders Tire & Motor Suppy Co., Spokane, has been appointed distributor for eastern Washington and part of Idaho for Smith Form-a-truck.

The Washington Automobile Chamber of Commerce at a recent meeting in Seattle perfected a plan of organization for automobile dealers in all the cities and counties of the Northwest.

To Make Automobile Sleepers—The Bradley Manufacturing Co. has recently been incorporated in Tacoma, Wash., to produce a folding berth or automobile sleeper that can be quickly adjusted to any model of automobile, and used for sleeping quarters.

The bed can be adjusted in from 3 to 5 min. and weighs only 30 lb. It folds up so it can be conveniently placed on the running board of an automobile.

A three-story building near Tacoma will house the new manufacturing plant, and the automobile beds will be shipped to all parts of the world.

Philadelphia Tire Co. Opens Branch—Carrier & Harlan, Philadelphia, Pa., have opened a branch store in West Philadelphia at 3322 Chestnut Street under the supervision of C. W. Glose. The Philadelphia store is at 263 N. Fifteenth Street. They specialize in repairing and vulcanizing and also carry U. S. tires and other automobile accessories.

Changes in San Diego, Cal.—San Diego's automobile row has shifted to lower Broadway. During the past week automobile houses have sprung up like mushrooms on the busy street.

The first Broadway automobile house was the Pacific Kissel Kar branch which opened up in a location at Broadway and Union Street. Then F. B. Naylor, Buick distributor, moved into the new Naylor building directly across the street.

A few days later, the San Diego Motor Co. opened up on the corner of Broadway and State Street, with the agency for the Chevrolet. This move was followed by the opening of a tire store on one corner by a firm operating under the name of Higgins & Shaw, and the Pacific Auto Sales Co. on another corner. The Pacific Auto Sales Co. has the San Diego agency for the National, Oldsmobile and Oakland, and the new location is one of the finest corners of the many new automobile houses erected in San Diego during the past few months.

Mead Cornell and Ed. Caley then opened a tire store at 311 Broadway, next to the Pacific Kissel Kar branch and the Paige and Peerless agency moved into a location three doors south. There are more to come; and all the places on Broadway are about as attractive as any in California. The Mitchell agent is erecting a new garage, and Green & Fleming, Chandler and Grant dealers, are soon to occupy their new home.

New York City Items—The Hudson Motor Car Co., New York City, has just opened its new six-story service building at 243-249 West Sixty-seventh Street. The building contains more than 60,000 sq. ft., is fireproof, and the exterior is of white glazed brick and terra cotta. At the present time there are about 3500 Hudson cars in this territory. The Hudson Sales Co., in Philadelphia, Pa., will also have a new service station and salesroom. This building will be a two-story brick structure, 22 by 66 ft.

The Ford Motor Co. has purchased a site for a salesroom on the northeast corner of Fifty-fourth Street and Broadway, adjoining the Hotel Woodward. The property, which brought close to $600,000, is 129.6 by 54.7 ft. on Fifty-fourth Street, and has a depth of 86.8 ft. on the northerly line adjoining the Hotel Woodward. The present buildings will be replaced by a sixteen-story structure.

J. C. Nichols, factory distributor for the Compensating Vapor Plug, is placing extra orders for the device. Since the plug was introduced last January more than 600,000 have been sold.

Stevens & Co., 375 Broadway, have introduced an automatic blow cock and cleaner for garages and machine shops. It is used in connection with the air service system, and is convenient for dusting out cars, cleaning engines, etc. The valve is furnished with a ground-in metal-to-metal seat.

Charles E. Reiss & Co., handling the Stearns-Knight and Hupmobile, have opened a service department at 226-234 West Fifty-sixth Street. This will occupy the entire top floor of the building.

Longenecker & Sanders, handling the Abbott-Detroit, have inaugurated a service department at 245-247 West Fifty-fifth Street.

Scharps Promoted—C. E. T. Scharps, who recently joined the C. T. Silver Motor Co., New York City, as advertising manager and assistant to Mr. Silver, has been promoted to the position of manager of the Newark, N. J., branch. Mr. Silver, who handles the Overland, Willys-Knight and Peerless business in this territory, has also made G. Franklin Bailey director of branches. W. E. White has been put in charge of the service department.

New Agencies for Braender Tires—The following new agencies are reported by the Braender Rubber & Tire Co., Rutherford, N. J., manufacturer of Braender tires and tubes: American Motor & Equipment Co., 181 Massachusetts Avenue, Boston, Mass.; The Kassler Motor Co., Fifth and White Streets, Dubuque, Iowa, and H. B. Herr, 30 West King Street, Lancaster, Pa.

Mountain Trade—C. V. Swenson, proprietor of the East End Garage, 2325 Larimer Street, Denver, has secured the Colorado and Wyoming distributing agency for the Republic Truck, and has opened a salesroom in a central location at 1940 Champa Street, opposite the new Federal and Postoffice Building. A service station is maintained at both the garage and the downtown salesroom.

The Wm. Thorney Auto Co., Apperson distributor for Colorado and Wyoming, has moved from 1443 Cleveland Place, Denver, to 1133 Broadway.

Cassell Brothers Music Co., 205 Sixteenth Street, Denver, has secured the Abbott-Detroit distributing agency for Colorado and Wyoming, and has remodeled its piano business quarters by adding an automobile salesroom around the corner to front on 1607 Broadway.

The Plains Automobile Co., 1605-1607 Central Avenue, Cheyenne, Wyo., Buick and Packard agency, has been sold by H. A. Andrews to F. H. Gleason.

The Colorado Motor Car Co., 1520 Broadway, Denver, Saxon, Reo and Cole distributor for Colorado and Wyoming, has taken the Hesse Trailer distributing agency for the same territory.

The Chalmers Exchange is the name of a new concern at 1443 Cleveland Place, Denver, which handles used cars traded in upon Chalmers sales, and also operates a garage and service station.

James A. Nisbet, 1551 Broadway, Denver, Scripps-Booth distributer for Colorado and Wyoming, has secured the Glide distributing agency for the same territory.

Mulnix & Rarie, East Colfax Avenue and Lincoln Street, Denver, Grant and Pathfinder distributors for Colorado and Wyoming, have secured the distributing agency for the Atterbury truck for the same territory.

D. S. Eddins, recently Rocky Mountain district supervisor for the Maxwell, with headquarters in Denver, has been transferred to the Detroit district, where he is special traveling representative.

The Rocky Mountain Motor Co., a new Denver concern, has secured the Case distributing agency for Colorado, Wyoming and New Mexico, and is remodeling its quarters at 1635 Broadway to provide a car salesroom.

De War Brothers, Denver, have bought Earle H. Frazier's garage at 741-747 Broadway, and have taken over the Detroit Electric agency for Denver and vicinity.

The B. F. Goodrich Rubber Co.'s Denver branch, 1422-1424 Court Place, is now in charge of C. A. Cotter, formerly chief adjuster at the St. Louis branch. H. E. White, whom Cotter succeeds as manager, has been transferred to a factory position. J. K. Laird, formerly Kansas City adjuster, is the new assistant manager of the Denver branch, and C. L. Harding is new chief clerk.

The Philadelphia Storage Battery Co. has closed its Denver factory branch at 1435 Cleveland Place, and the business for this territory has been taken over on an agency basis by De War Brothers, 741-747 Broadway.

New England Trade Items—An agency for the Elkar line has been placed in Boston with the Paine-Krogman Company, Commonwealth Avenue.

F. S. Brewer, Springfield, Mass., has taken the agency for Empire cars for central Massachusetts.

An agency for Pullman cars has been placed with Mosher & Fimbell, Springfield, Mass.

The Elite Garage, New Haven, Conn., has taken on the Halliday line.

M. H. Chase, Owen Magnetic dealer at Boston, has leased 20,000 sq. ft. in a new service building in that city.

The Crane & Bratish Motor Co., Providence, R. I., has been dissolved and the garage it conducted sold to A. J. Howard, agent for Scripps-Booth.

A. S. Holley, formerly manager of the New England branch of the R. E. Taylor Corporation, Garford dealer, has accepted a position as retail sales manager for the New England agency for Jackson cars.

Firestone Factory Branch in Springfield—The Firestone Tire & Rubber Co. has established a factory branch at Springfield, Mass., with headquarters at 44-50 Hillman Street. It is in charge of G. I. Engle and he will direct Firestone sales in Vermont, southwestern New Hampshire, northern Connecticut and central and western Massachusetts. The local agency for the tires will still remain with F. N. Sauers.

Columbus Items—A. J. Adams, formerly an engineer with the General Electric Co., has opened a repair shop at Lafayette and Lazell Streets under the name of the Adams Auto-Electric Service Co. He will specialize on the repair of electric systems on automobiles.

The Dixie Flyer Sales Co. has been organized at State and Front Streets to handle the Dixie Flyer in central Ohio territory.

The Ohio Auto Brass Co. has removed from 27 West Russell Street to larger quarters at 36 and 38 West Swan Street.

The Overland Agency in Columbus was taken over June 1 by Willys-Overland, Inc. The agency was held by the O. G. Roberts Co. for about 6 years. The service station of the branch will remain at 933 East Gay Street, while the salesrooms will be moved down town in automobile row, located at Gay and Fourth Streets. C. T. Dunkle is Columbus branch manager.

The Brashner Motor Car Co. has been moved from Fourth and Gay Streets to 167 North Fourth Street. It handles the Studebaker in central territory.

Connecticut News—S. A. Miner, Hartford, distributor of Pierce-Arrow cars in northern Connecticut, has opened a new service station on Spruce Street. The building is of steel and brick one story high and fully equipped. The floor space is nearly 100 ft. square.

E. C. Andrews, Hartford, formerly of the Overland-Hartford Co., in the wholesale department has accepted a position as Connecticut district manager of the Chevrolet Motor Co., Inc.

The Williams sales stables, Hartford, have been torn down to make way for a new building to be erected by W. W. Walker which is to adjoin the service and sales building of R. P. Taber, Reo distributor, now in course of construction.

The R. D. Britton Co., Hartford, Conn., has doubled its salesroom capacity by utilizing the west side of the garage proper. The change gives the concern one of the very largest show rooms in the city.

E. H. Harris, Hartford, treasurer of the Charter Oak Motor Car Co., Chandler and Hupmobile distributor, has acquired the old local factory of the National Biscuit Co., at 99-103 Albany Avenue. Upward of $100,000 will be expended in the improvement of the property. The building will be remodeled and the main floor will be dropped to the street level and will be changed to accommodate two stores. A modern service station will be provided in the course of alterations. This acquisition adjoins property owned by Mr. Harris.

News from the S. W.—The Lexington K. C. Co., Kansas City, Mo., has moved from 1729 McGee Street to 1924 Grand Avenue.

The Ramsey Auto Co., Kansas City, Mo., has taken the agency for Western Missouri and Kansas of the Detroiter Six.

Roy and Elmer Chamberlain, Smith Center, Kan., have bought the garage of Will Bell, and taken his agency for the Maxwell and Overland in that section of the State.

The Shawnee Motor Co., Topeka, Kan., has the North Topeka agency for the Overland.

The H. A. Dougherty Motor Co., Kansas City, Mo., distributor of the Republic truck and the Smith Form-a-Truck truck of Chicago, will soon be established in its new quarters at 1701 to 1707 McGee Street. It has a new brick and concrete building 105 by 122; on the McGee Street frontage is a display room and the offices, 50 by 105 ft. In the rear is the service department and a parts department. The basement is also to be used for shops, with complete equipment for gear cutting, in fact, equipment with which an entire automobile could be built. There are numerous skylights serving the first floor. A private garage is entered from Seventeenth Street, for the automobiles of the heads of departments. Across Seventeenth Street a two-story building 100 by 100 has been leased for storage and paint shop. The company retains its former quarters, 1808-10 Grand Avenue, for a body factory, and machinery for woodworking is being installed there. Mr. Dougherty was for 7 years manager of the Overland company at Kansas City. H. M. Genung, manager of the Dougherty company, was also with the Overland before the branch was established in Kansas City.

Edwards & Standish, Larned, Kan., are opening a new salesroom which will be the headquarters for the Inter-State.

J. T. Tough & Son, Metz, Mo., have bought a garage at Mound City, Mo., and have taken the Ford agency.

Charles Scherrer, Admiral and Independence boulevards, Kansas City, Mo., are now agents for the New Era.

The Buick Garage, Sweet Springs, Mo., will henceforth be operated by John Eckhoff and his son Harry, Mr. Eckhoff having bought the interest of his partner, Des Haggard.

Lester Cadman and Mr. T. Bird, Joplin, Mo., have been transferred to the Kansas City branch of the United States Tire Co., the Joplin branch having been discontinued.

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The AUTOMOBILE

Vol. XXXIV
No. 24

NEW YORK, JUNE 15, 1916

Ten cents a copy
Three dollars a year

HUDSON
SUPER
SIX
TRADE
NAME
REG.

The Verdict on the Hudson Super-Six

THE Super-Six at this writing—May 25—has been on the market five months. Over 7000 of the cars are now running. The resultant demand exceeds anything ever known among high-grade cars.

All our general advertising on the Super-Six has been stopped for months, because of the over-demand. For months the Hudson factory has run in three shifts, 24 hours per day.

We have been steadily building new factory additions. Scores of big machines to equip them have been brought in by express. We are now equipped to turn out 4000 cars per month.

We prepared in advance for a doubled demand, but the demand for the Hudson has quadrupled. And every day increases it as new cars go into service.

Still the demand for the Super-Six is only beginning. It will be a year before men in general realize its supremacy. This has always been true, and will ever be true, of every great advance.

But the man who buys a fine car would do himself a vast injustice if he failed to get the Super-Six. A lesser car will mean years of regret. It will mean a car which is far outclassed in performance and endurance. It will mean less pride of ownership.

We urge you, for your own sake, to consider these things and to prove them.

HUDSON MOTOR CAR COMPANY
DETROIT, MICHIGAN

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Suggestion No. 22

Costly Explanations

Many and many a retail car sale has been lost because the dealer had to "explain" the unknown speedometer on his car.

It can't be done, for car buyers know the Stewart—know that it is their safest guide as to the quality of a car as a whole—know that 95% of all car manufacturers use it as standard equipment—know that a manufacturer who doesn't use the Stewart is not willing to pay the little extra for quality.

Why buck the stone wall of public sentiment?

For every penny saved on a cheap speedometer, dollars are lost in retail sales.

Insist that the car you sell be equipped with Stewart Products.

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Vol. XXXIV New York—Thursday, June 15, 1916—Chicago No. 24

S. A. E. Off On Lake Cruise

550 Members Leave Detroit on S. S. Noronic for Record-Breaking Summer Session—Complete Nomenclature Report Accepted—Dunham Is Nominated for President

MACKINAC ISLAND, MICH., June 13—*Special Telegram*—Just a little over 24-hr. old is the Society of Automobile Engineers' annual convention and midsummer meeting, but already it has written itself upon the annals of the Society as one of the most successful events it has ever held. To-day, at 3 p. m., the party landed at Mackinac Island and paraded ashore in groups made up by the six sections of which the Society is composed, and the members unattached to any of the geographical sections. Gayly-colored hats, bands and banners arrayed against the verdant background of historic Mackinac made a brilliant picture which will long live in the memories of those fortunate enough to be present. The vessel is running very closely to the schedule which had been announced and the professional sessions have been going on with methodical progress. The waters of Lake Huron have been exceptionally placid, the weather beautiful and the 550 members of the party have been enthusiastic over the success of the trip, which is only passing its first quarter with 3 more days to go.

Many Interesting Points

Mackinac Island offers some interesting points to the sightseer. Its historic forts and old Indian camping and burying grounds are still to be seen and the party of engineers soon covered the entire island, driving to the more removed points and searching out the places of interest. As the group paraded ashore a moving picture man recorded the antics of the party, so that those at home will have an opportunity of seeing what they were unfortunate enough to miss. The first affair was in the way of a get-together event in which the members of the party searched for various unknown Raffles who were disguised as ordinary members of the party. This served to make the party acquainted with each other, and in the evening after the professional session, there was dancing and later a midnight luncheon.

Meetings Well Attended

The engineering meetings are all well attended, the space on the observation deck being crowded at every session. After Russell Huff had made the principal address at the opening of the meeting yesterday, C. F. Kettering, engineer of the Delco company, gave a talk on the accomplishments in pure science within the last few years. His lecture, which served as a curtain-raiser, was far from abstruse and was very spectacular with experiments of a very interesting nature with such materials as radium and liquid air. Even some of the ladies found this talk so interesting that they lingered on the balcony above the speaker to watch and listen. This morning papers were read by D. D. Ormsby on Differential Substitutes, A. P. Brush on High-Speed Engines, Herbert Chase on Possibilities of the Constant Pressure Cycle, and K. W. Zimmerschied read the paper by Professor Gallup on Car Performance. The discussions on these papers appear in the following pages.

Entertainments Planned

The boat is due to leave here at 5.30 p. m., and this evening, after supper, there will be an entertainment by the members of the Pennsylvania section and another by the Cleveland section. Henry Hess, on behalf of the Pennsylvania section, it is understood, will show his examples of color photography, an art which he has been experimenting with for some years. The entertainment of the Cleveland section is being kept a secret. After the entertainments a dancing contest will be held. Everything points at the present time to a highly successful convention from a social as well as from an engineering standpoint. The professional program is well arranged and the papers are of such importance to the industry and indeed, to the entire automobile-buying public that every engineer who could possibly afford to be on board is here or is represented. The eagerness with which the sessions are attended and the spirit of the meetings show that the importance of the program is realized, and in all probability by the time the vessel docks at Detroit next Friday, the entire program will have been gone through with, as arranged. To-morrow is a picnic day for the whole party with nothing scheduled except a day of enjoyment, and in all probability many of the members will take advantage of the opportunity to fish in the far-famed waters of Killarney and Georgian Bay. There will be a side trip on the steamer Waubic through the scattered islands in the bay, and also games and athletic contests, giving the engineers an opportunity to relax.

Important Standards Work

S.S. NORONIC, GREAT LAKES, June 12—*Special Telegram*—Punctuality has been the watchword of the first day's work of the largest meeting the Society of Automobile Engineers has ever held. With 550 members on board, the Noronic pulled out from the dock shortly after 3 p. m. and was well on her way to Lake St. Clair by the time the standards committee meeting was due to begin. The various committees of the Detroit section who undertook to care for the many needs of so large a party have done their work in a way that has earned the unstinted praise of every member of the party. On the lowest deck a theater has been arranged and it was here that the standards committee was called to order by Chairman Clayden this afternoon.

Nomenclature Report Accepted

Owing to the fact that the last meeting was held at the end of May, there have not been many division meetings, and no great quantity of new business was before the house. Reports had been prepared by the chairmen of most of the divisions, however, and one subject of the utmost importance was accepted by the committee. This was the complete report of the nomenclature division containing a name for every principal part of an automobile. The work of compilation has been difficult and has taken over a year of constant hard work on the part of the chairman of the division, K. W. Zimmerschied, of his many helpers and of the recorder, A. C. Woodbury.

Already the names chosen are appearing in the manufacturers' parts lists, and the old-time confusion should be a thing of the past before another year has gone. The ready way in which the industry has accepted the work even before it was complete is the greatest testimony to its value. On behalf of the electrical equipment division the most important parts of the report were a complete list of sizes and dimensions for flexible steel conduit for incasing electric wires. This includes fifteen sizes from 3/16 to 1 in. inside diameter.

Standard Headlamp Bracket

A standard headlamp bracket was accepted in three sizes which cover all requirements, this being first fruit of the subcommittee which has been at work on lamp standardization generally. It was reported that the sub-committee had conducted a number of tests of lamps and bulbs at the National Lamp Works and had discovered certain important facts with respect to the shape of filaments and reflectors. This work is to be continued and it is hoped to complete it by Winter. Other resolutions suggested by the lamp committee and accepted were: Sockets for bulbs should be so set in lamps that the pins on the bulb base are vertical; that lamps should be mounted not less than 3 ft. high, measuring from the ground to the center of the lamp, and *that dimming devices are not to be recommended for the purpose of eliminating glare.* Standards presented by the carbureter fittings division were accepted for throttle lever throw, for throttle lever rod ends and for gasoline pipe sizes, this phase being converted to pipe tap sizes for gasoline tube unions. The throw of the throttle lever end is to be as follows: 1½ for the three smallest standard carbureter sizes, 1¾ for the next five sizes and 2½ for the three largest sizes.

The electric vehicle division reported progress and recommended some specified dimensions for charging plugs which were accepted.

Speedometer Connection Standard Impossible

The miscellaneous division reported that the hoped-for standard speedometer drive connected had proved impossible at the present time. New recommendations accepted included standards for taper sockets for fender irons, the formula and standard dimensions for piston ring grooves previously reported, and an increase of ¼ in. in the length of thread of the standard S. A. E. bolt. Progress was reported in the many other matters before the division.

The iron and steel division added little to the report given at the Cleveland meeting. A new steel was added and it was also recommended that: It is inadvisable to advocate standard colors for designating steel bars in stock because the difficulties seem insurmountable. The number of permanent colors available is limited, and the range of steels large. As each user requires only a limited number of steels it is not so difficult for him to select colors adapted to his own needs.

From the other divisions only progress reports were presented, but these show great activity and many matters rapidly approaching the final report stage. There was little discussion on the reports which is testimony to the thorough work of the division.

Aeronautic Standards

Henry Souther spoke on the new division for aeronautic standardization, outlining the great need for standards in military machines. It is obvious that the other divisions of the standards committee will be kept busy by the consultative demands of the new division. Howard Coffin also spoke on the same subject, saying that there were 30,000 men being trained by the allied armies and that the allowance was four aeroplanes per man at the front. He added that the number destroyed daily was greater than all in America.

The evening session opened by President Russell Huff who made a short address.

Should Have More Members

He said that though the membership of the Society was now nearly 2000, this was far short of what it ought to be. At the council meeting held that morning the matter of affliating some other allied societies with the S. A. E. was discussed. Mr. Huff said that the aeroplane, the passenger car, the truck and the tractor, even the motor boat, all had much in common and that a natural bond bound together engineers in all these professions. There were about 900 different firms represented by the membership of the Society, and lists which had been compiled showed 5000 firms which could fittingly have such representation. At present the number of men per firm shown on the membership list was 2.2, though some firms had as many as ten representatives. Even figuring on only one per firm, the Society's roll ought to contain 5000 names. Continuing, the president thanked the different committees, mentioning that the membership committee had met with wonderful success; that the finance committee had the accounts of the Society in splendid condition, and that the standards committee was showing a still greater activity and doing most satisfactory work. He added that the excellent papers offered had gone far to increase the power and importance of the sections which showed a remarkable growth. Mr. Huff mentioned the fact that the war department had twice called upon the Society for conference work in connection with the army truck specifications, and that much good had resulted. He also drew attention to the fact that there were two past presidents of the S. A. E. on the naval consulting board, A. L. Riker and Howard Coffin, the latter also being chairman of the industrial preparedness committee, while a third past president, Henry Souther, was consulting engineer to the aviation corps by government appointment.

$47,000 in the Treasury

Concluding his address, Mr. Huff called upon Herbert Chase to read the treasurer's report. This showed a balance in hand of $47,000 and contained the information that unexpected demands upon the funds had been more than met by uncalculated increase in the membership. Mr. Chase stated that the finance committee hope soon to be able to place all initiation fees in the reserve fund as is done by some other societies. Meanwhile a considerable sum is being held as a reserve.

1910 Members

Next came the report of the membership committee, read by R. C. Combs. This was a brief statement showing that the present membership was 1910 with ninety-seven applications on file. This is considerably higher than the previous high-water mark of 1852 in 1914.

Nominations of Officers

George W. Dunham, consulting engineer, was nominated for president of the Society for the coming year with J. G. Vincent, Packard Motor Car Co., as vice-president, and B. B. Bachman, Autocar Co., and F. E. Moskovics, Nordyke & Marmon Co., as councilors. Herbert Chase remains treasurer. The nominating committee held at the business meeting consists of K. W. Zimmerschied, Detroit section; F. E. Place, Mid-West section; G. P. Dorris, Indiana section; E. S. Foljambe, Pennsylvania section, and David Fergusson, member at large.

Before closing the business meeting, two presentations were made. K. W. Zimmerschied was made a life member of the Society without the payment of further dues, in recognition of his valuable work as chairman of the standards committee up to last January. Captain Foote of the steamship Noronic was presented with a clock as a token of friendship and admiration for the masterful way in which he has handled his vessel on the S. A. E. cruises and for his seamanship in negotiating the tortuous and rocky passages of Georgian Bay with the large steamship.

A movement being on foot to ally the activities of the Society with the marine, tractor, stationary and aeronautical fields may mean the addition of four vice-presidents to the governing staff of the organization and two additional members of the council. The societies which represent the activities of these four kindred industries have made a move toward consolidation with the S. A. E. and this gives prominence to the thought that in a very short time the membership of the Society will be greatly increased and its power and influence also greatly expanded.

Kettering Opens Professional Session

Never has a more interesting talk been given the Society than that by C. F. Kettering, Delco engineer, in opening the professional session. Mr. Kettering offered the rare and happy combination of a fascinating subject and a clever lecturer, and consequently kept the 300 attending members spellbound as he led them through some of the wonderful developments in materials recently obtained through the medium of pure science. He spoke of how our close attention to the work of production has allowed us to forget to a large extent the work of the experimental scientists who are forever searching through the medium of pure science for new materials and new methods. As a concrete example he mentioned alloy steels and rubber. Our cars would be ponderous affairs if it were not for the alloy steels which compose the principal parts. It would be impossible to make them anywhere near as economically if it were not for the alloy steels that are necessary in the tools that turn out the metal parts. Vulcanization was discovered in the laboratory and from this seemingly unimportant discovery the entire art of rubber working with all its importance to the human race came into being. Another simple discovery, if regarded superficially, was that of mixing tungsten with other metals. This discovery has revolutionized the manufacture of automobiles, as it is the basis of high-speed steel, without which present manufacturing schedules would be impossible. Mr. Kettering related the development of the tungsten filament lamp. He spoke of how it was once a draw between the Welsbach gas mantle and the electric lamp. The question was to secure more light for the same expenditure of energy. The carbon lamp was improved and then the tantalum lamp was introduced. This in turn was succeeded by the tungsten filament. The carbon filaments were first manufactured by squirting cellulose through a die and then carbonizing the cellulose. After this the cellulose was removed, leaving the carbon filament. The reason of this method of manufacture was that the filament was very fragile and of unequal thickness with the reason that its life was short and great care had to be used to protect it against jar and vibration.

When the tungsten arrived it was first manufactured by the same process, being mixed with a binder and then squirted through a minute opening. The binder was then removed, leaving the tungsten filament. This was very delicate and had to be handled with the greatest amount of care, but it did have three times the illuminating power for the same amount of energy consumption.

Drawing Tungsten Wire

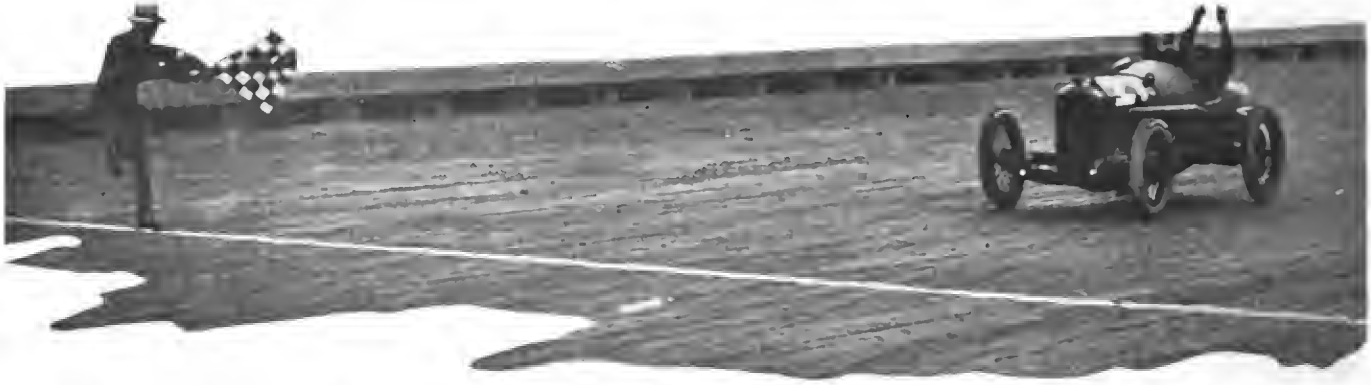
How to draw the tungsten into a wire filament was the next subject of study. In order to make the dies it was necessary to pierce the diamond—the only material hard enough—with a hole 2/1000 in. in diameter. This was finally accomplished and the experimenters were at last able to produce 2200 ft. of wire before the die broke. The bulbs at first were made of vacuum type, but it was discovered that if an inert gas were introduced into the bulb the illumination was greater, hence nitrogen was used. But it was discovered that after a while the nitrogen went into combination with the tungsten, forming nitrides of the metal, so that now argon is used. Without tungsten we would not have the wireless telephone receivers which allow us to talk nearly across the Pacific Ocean.

Bakelite was the next example of a new material. Mr. Kettering spoke of how it had been discovered in the laboratory, that two chemicals—carbolic acid and formaldehyde—if heated under pressure, reacted together to form a new

(*Continued on page* 1103)

Resta Captures Chicago Derby

Covers 300 Miles in Peugeot at 98.7 M.P.H.—De Palma Second After Terrific Speed Duel with Leader—Christiaens Third in Sunbeam



Resta, in the Peugeot, getting the checkered flag as he roared across the finish line, winner of the Chicago Derby

By L. V. Spencer

CHICAGO MOTOR SPEEDWAY, June 10—Thundering over the finish line in his blue Peugeot, Dario Resta, fresh from winning the Indianapolis classic, to-day repeated his victory of a year ago in capturing the 300-mile International Derby on the Chicago speedway at an average speed of 98.61 m.p.h., his time for the three centuries being 3:02:31.64, or bettering his last year's mark made here, when he covered this distance at an average speed of 98.2 m.p.h. Although no speedway records fell before the onslaught of the French-built racer, Gil. Anderson's mark of 102 m.p.h made last Fall in the Stutz at Sheepshead Bay still standing, the thrilling battle of brain, muscle and machine between Resta's Peugeot and De Palma's Mercedes will long be remembered by every one of the 90,000 spectators who thronged the stands and field.

Although Resta added another to his list of victories, neither he nor the crowd was sure of that victory until there remained but two laps to go. Ralph De Palma, driving his cream-colored Mercedes, seemed to be about as certain to get the checkered flag first as did the eventual winner, until a spark plug interfered in the 296th mile.

Resta and De Palma had been fighting, fighting for over 150 miles, almost hub to hub the entire time, and it looked as if the winner would lead by less than a car length, when on the back stretch the eager crowd saw De Palma slow down and Resta shoot ahead as he had not been able to do since he had left the procession and come into the front rank back in the 120th mile of the race.

Then the crowd knew that De Palma's jinx had come to him again, just as it did in 1912, when, in the Indianapolis 500-mile race of that year, he had been robbed of practically certain victory with about two laps to go because of a broken piston.

De Palma, who finished second, snapped with Resta, the winner, after the race. De Palma, who drove a Mercedes, has his hand on Resta, Peugeot pilot

And to-day, as on that day 4 years ago, De Palma proved himself to be the gamiest of the game. For he smiled philosophically as he rolled by in second place, after having stopped at the pit to change that $6,000 spark plug on his green-flag lap. De Palma has tasted defeat before when victory was almost within his grasp, and he knows a race is not finished until the last lap has been completed.

De Palma covered the 300 miles in 3:04:25.37, or at an average speed of 97.6 m.p.h., and was well ahead of Christiaens, who was third in a Sunbeam, one of the two English sixes which were among the staunchest in the race. Christiaens made the three centuries in 3:07:55.48; and less than a minute behind him was O'Donnell in a Duesenberg, who finished in 3:08:30.46, at an average speed of 95.48 m.p.h. Next came Galvin in the other Sunbeam, whose time was 3:10:23.45. Close on his heels was Vail driving a Hudson, about 7 sec. behind, with a time of 3:10:30.65.

The other four who came within the money were farther apart, although all were running well as they crossed the tape for the last time. D'Alene, driving the Duesenberg that gave him second money at Indianapolis this year, drove it to seventh place to-day, finishing in 3:13:2.85. Two minutes later Gable ended his grind in a Burman Special, with a final time of 3:15:51.31; and ninth place went to McCarthy in another Hudson Special, doing the distance in 3:19:10.73. He had about a 5-min. lead over Lewis in the Crawford Special, the latter getting tenth money with a time of 3:24:58.07.

Oldfield Goes Out Early

Early in the race Barney Oldfield looked to be a serious contender in his shiny blue Delage, but it broke a driveshaft after 18 miles and left the veteran driver a spectator. Eddie Rickenbacher, who was among the first three for over 100 miles, and who was driving Mulford's Peugeot, was forced to drop out with a broken valve after he looked to be a favorite with many for first money. After the withdrawal of all of the Indianapolis cars on Carl Fisher's edict against Sunday driving, Rickenbacher, who was to have driven his formidable Maxwell, received permission to drive Mulford's car, the latter also having scruples against contending in a Sunday race.

Winners of Chicago Derby

Car	Driver	Time	M.P.H.	Prize
Peugeot	Resta	3:02:31.64	98.70	$13,000
Mercedes	De Palma	3:04:25.37	97.60	6,500
Sunbeam	Christiaens	3:07:55.48	95.78	3,000
Duesenberg	O'Donnell	3:08:30.46	95.48	1.500
Sunbeam	Galvin	3:10:23.45	94.54	1,300
Hudson	Vail	3:10:30.65	94.48	1,200
Duesenberg	D'Alene	3:13:02.85	93.24	1,100
Burman	Gable	3:15:51.31	91.90	900
Hudson	McCarthy	3:19:10.73	90.03	800
Crawford	Lewis	3:24:58.07	87.80	700

As is always the case, the winning cars made the fewest pit stops. Resta stopped only once, changing a right rear tire and taking on supplies of gasoline, water and oil. This was in his 121st mile. Likewise De Palma had been forced to make but one stop up to the time his spark plug trouble came. In his 105th mile he stopped for a left rear tire change and for supplies, and it looked as though he was going to equal Resta's one-stop record when his disappointment came. Coming slowly back to his pit after ignition had cost him a possible $6,000, he lost no time in removing the defective plug and getting away again for second place. But it was too late, when he was under way once more, for him to catch the fleeting Resta.

Twenty-one Starters in the Race

Twenty-one cars started. Starter Wagner and his able coadjutor, Chairman Edwards of the technical committee, gave each driver his position, and then final instructions were doled out to each crew. Amid stirring music from the band, drivers, mechanics and officials lined up before the camera men and moving picture operators for the customary photographs. Then, with De Palma as the pacemaker—he had the pole—the cars circled the track once at a mile-a-minute clip, and being fairly well bunched when they again passed the line, the signal was given and they were off for Chicago's second race and perhaps one of the most thrilling speed duels the sport has ever known.

The crowd knew it would be a fierce struggle between Resta, De palma and Rickenbacher, at all times mindfull of the stamina of the English Sunbeams, of the dark-horse possibilities of Oldfield and the fight that was in the Duesenbergs. Never was a gathering of over 90,000 persons treated to greater thrills than in the terrific speed battle that was to follow the thrillingly swift send-off.

Resta Takes the Lead

At 20 miles Resta was in the lead, with De Palma about half a lap behind and O'Donnell in his Duesenberg a close third. Back of him came Rickenbacher, driving in characteristic style, and then the two Sunbeams appeared, Christiaens leading his team-mate by a few yards. The rest of the field was spread out somewhat; but before another ten laps had been covered Rickenbacher was stepping on his accelerator and climbing toward second position, fighting it out strenuously with Resta. O'Donnell was a little ahead of De Palma, now in fourth place, and the Sunbeams hung together fifth and sixth. Several of the drivers were doing their utmost to capture the coveted first position but others hung back for strategic reasons.

Rickenbacher in the Van

Driving at a terrific pace, Rickenbacher forged into the lead and Resta, perhaps a little more conservative, clung to his set pace just behind, leaving the others in about the same relative positions they had held 20 miles before. But O'Donnell had to stop for a tire change and this put him in seventh place at 80 miles, with Resta leading and Ricken-

Sending off the cars in the running start of the 300-mile International Derby on the Chicago Speedway

Times Made by Cars in the Chicago Derby at 20-Mile Intervals

Car	Driver	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	M.P.H
Peugeot	Resta	12:09	24:05	36:11	47:52	59:34	1:11:15	1:25:54	1:38:04	1:50:10	2:02:16	2:14:26	2:26:35	2:38:41	2:50:43	3:02:31.64	98.61
Mercedes	De Palma	12:11	24:21	36:24	48:35	1:00:43	1:13:59	1:25:55	1:38:04	1:50:13	2:02:17	2:14:26	2:26:32	2:38:40	2:50:42	3:04:25.37	97.60
Sunbeam	Christiaens	12:25	24:48	37:19	49:44	1:02:04	1:14:23	1:26:36	1:40:14	1:52:25	2:04:46	2:17:16	2:30:04	2:42:54	2:55:28	3:07:55.48	95.78
Duesenberg	O'Donnell	12:11	24:17	36:20	50:19	1:02:38	1:14:52	1:28:37	1:40:46	1:52:51	2:06:45	2:18:49	2:32:43	2:44:41	2:56:39	3:08:30.46	95.48
Sunbeam	Galvin	12:40	25:06	37:25	49:45	1:02:05	1:14:24	1:26:41	1:39:03	1:55:17	2:07:32	2:21:20	2:33:55	2:46:08	2:58:14	3:10:23.45	94.54
Hudson	Vail	12:48	25:36	38:23	51:01	1:03:25	1:15:08	1:29:51	1:42:14	1:54:44	2:07:10	2:19:37	2:32:28	2:45:15	2:57:56	3:10:30.65	94.48
Duesenberg	D'Alene	13:26	25:34	37:42	49:53	1:01:54	1:16:23	1:32:01	1:44:49	1:56:09	2:08:25	2:20:33	2:32:57	2:48:23	3:00:41	3:13:02.85	93.24
Burman	Gable	12:48	25:38	38:47	51:32	1:03:59	1:16:21	1:28:36	1:40:58	1:53:31	2:06:26	2:23:22	2:35:44	2:48:12	3:01:47	3:15:51.31	91.90
Hudson	McCarthy	12:51	25:39	38:21	53:01	1:07:40	1:21:37	1:34:42	1:47:23	2:00:11	2:12:55	2:25:42	2:38:26	2:51:22	3:06:04	3:19:10.73	90.03
Crawford	Lewis	14:00	26:35	41:34	54:02	1:06:32	1:20:08	1:32:25	1:44:43	1:57:11	2:09:40	2:24:26	2:37:03	2:49:22	3:05:32	3:24:58.07	87.80
Peugeot	Rickenbacher	12:11	24:06	36:11	47:53	59:35	1:11:14										

bacher at his heels. De Palma then went into third position, and for the next 40 miles the three tore along, alternately striving to get the pole so as to gain the advantage. The illustration at the top of the opposite page gives an idea of this excitingly close struggle.

De Palma Grasps His Opportunity

Trailing the two Peugeots, which were fighting it out for the lead, Resta having it at 80 miles and 100 miles and Rickenbacher getting the upper hand at 120 miles, De Palma soon had his chance to come to the front. Like the super-driver that he is, he soon saw his opportunity. Having stopped at his pit on the 104th mile, where he replaced a tire and took on oil and gas, he was driving like mad to regain lost ground, when suddenly Resta hove in sight and limped to his pit. This was in his 120th mile, and a right rear tire was the cause. But before he could get away Rickenbacher, too, stopped, he being in the lead and on his 122d mile. This was De Palma's chance. With the two Peugeots at a standstill, he put on some more speed and clipped many seconds off the gap between himself and the Peugeots.

Rickenbacher Is Out

But Rickenbacher was not to trouble him further. A broken valve meant that the race would be between the cream-colored Mercedes and the blue Peugeot. Resta was soon on his way again, and then the day's real excitement began. Almost from that minute the immense crowd was treated to real racing. It was the kind they had paid to see, and one minute Resta had the lead, then De Palma, by a master spurt, had overtaken him. The spectotars never knew which car would be ahead until they were directly in front of them.

A Terrific Speed Grind

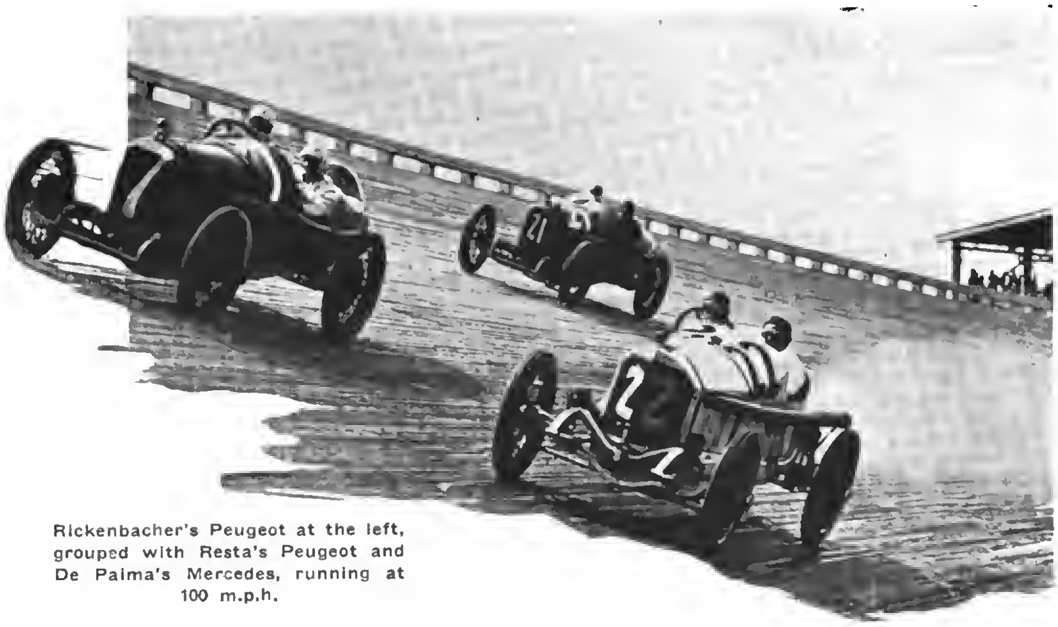
On they sped, lap after lap; now Resta was two car lengths ahead of the Mercedes, now he was trailing it by the same amount or more. It was evident to all that if they kept it up it was simply a matter of which car would withstand the grind the longest. At 280 miles De Palma took the lead again, after Resta, by terrific bursts of speed, had snatched it from him time and again. There never seemed to be much advantage for either car; they passed each other at intervals amid the cheering of the crowd.

Resta Regains First Place

The rest of the field, all running well, was forgotten for the time being in the breathless excitement of that great duel of speed and nerve. Now another car would get in the way of De Palma and he would bow before Resta's better position on the track or the turns; then Resta would have to relinquish his place to De Palma's more advantageous location.

With only 24 miles more to go, and with neither driver able to shake off the other, it promised to be a finish the like of which American speed fans had never before witnessed. But De Palma was allowed to hold the lead for only 6 miles more, when Resta again forged ahead on a terrific sprint on the home stretch. For 10 miles more Resta clung to his place by barely a car length. It seemed as if the Mercedes would run into its rival at each moment, until at the tape on the 292d mile they were almost abreast. De Palma getting the lead at the turn by nosing the Peugeot out of the pole position. Now De Palma had the race, the crowd thought; but, almost as they said it, the Peugeot was seen to

Resta leading De Palma at the 290th mile of their thrilling speed duel for first place in the Chicago Derby shoot ahead on the back stretch. Something had happened to Ralph, for he slowed down in front of the far grandstand and came home to his pit at a moderate pace. All was over, for there was no stopping Resta. Almost before De Palma could change the plug that had done the damage Resta had the green flag, and a few seconds later was cheered as the winner once more.



Rickenbacher's Peugeot at the left, grouped with Resta's Peugeot and De Palma's Mercedes, running at 100 m.p.h.

Sunbeam Third

Christiaens, who had clung to third place ever since his 180th mile, was quick to see his advantage and gave his mount every ounce of speed it had in an effort to take the unfortunate De Palma's lead away from him for second money; but the Mercedes was too far ahead for that. The Sunbeam proved itself a car of stamina, for it covered the distance with much credit and had reserve power for a brilliant finish. O'Donnell's Duesenberg also made a great showing. Taking the fourth position away from Vail's Hudson in the 240th mile, it held to its acquired berth to the end. Galvin's Sunbeam also bested Vail in the last 20 miles for fifth money, but the Hudson was not to be shaken from sixth position.

Two Cars Flagged

Only one other car finished the full 300 miles. This was Buzane's Duesenberg, which came in eleventh and at least had the credit for going the distance. Two cars were flagged —Johnson's Crawford, on its 290th mile, and Henning's Ogren, at the 246th mile. No accidents marred the day, leaving Chicago's track still unblemished by a fatality. There was a chance for trouble, however, when Galvin's Sunbeam skidded just after finshing its last lap and on the southern turn. The car whirled around and crashed into the inner guard rail, but neither driver nor mechanician was injured. Henning threw a tire on a turn also, but he retained control of his machine.

$30.000 in Prizes

The cash purses amounted to $30,000. Resta won $13,000; De Palma, $6,500; Christiaens, $3,000; O'Donnell, $1,500; Galvin, $1,300; Vail, $1,200; D'Alene, $1,100; Gable $900; McCarthy, $800, and Lewis, $700. Of the $500 prizes for leaders at 100, 200 and 250 miles, Resta secured two and De Palma one, for his lead at 250 miles.

Too Many Tire Changes

Studying the tire situation, as developed in this race, one cannot but feel that too many tires are blown in these races. Tire changes before the shoes were actually blown were down around 10 per cent of the total. It not only endangers the drivers, but also the cars when these shoes are blown on the turns at speeds around 100 m.p.h. The tendency for the car to spin about one of the wheels is great, especially on the cars fitted with the heavy and long tails which carry the center of gravity some distance to the rear.

Nineteen Right Rears Changed

A right front shoe, blowing at a critical moment, makes the car very difficult to handle in the counter clockwise direction used in the races. There were five right front tire changes in the race and all of these were blown. Of course the majority of changed tires were right rears. A total of nineteen of these were made, of about two-thirds of all the tire changes. This is lower than the average percentage in these races where generally over 75 per cent are right rears.

Too Much Smoke

Another feature which may be criticised is the over-lubrication which was common, to the detriment of plugs and valves and the enjoyment of the spectators. The smoke was particularly bad when the cars drew up at the pits and, naurally, in getting under way. At times the track was clouded over to such an extent that it was difficult to drive through.

Resta Adds 900 Points to Lead for Championship

22 DRIVERS COMPETE FOR HONOR

New York City, June 12—A total of 1800 points is placed to Dario Resta's credit in the championship table of 1916. By winning the 300-mile race at Chicago yesterday, 900 points more was added to a like number made by winning the 300-mile race at Indianapolis on Memorial Day. So far he has a tight grip on the title of champion driver of the year and for the leader's share of the $10,000 purse hung up by the B. F. Goodrich Co. and the $3,500 donated by the Bosch Magneto Co., including the $1,000 Bosch trophy.

Resta has increased his lead over Rickenbacher by 1185 points, the latter adding only fifteen points in the Chicago race in which he was placed in eleventh position. D'Alene held on to third place and De Palma moved into fourth place. Christiaens passed Vail, Mulford and Devigne by recording 240 points more, thus pulling him from seventh to fifth place in the table.

Twenty-two drivers now figure in the championship table, the standing being as follows:

Resta	1800
Rickenbacher	615
D'Alene	510
De Palma	470
Christiaens	370
Devigne	320
Mulford	240
Vail	220
O'Donnell	130
Devlin	90
Oldfield	80
Galvin	80
Adams	55
Wilcox	40
Watson	35
Gable	30
Johnson	30
Chandler	25
McCarthy	25
Henderson	22
Haibe	20
Lewis	20

Over 70 Stops Made at the Pits

The pits at the Chicago Speedway during the race. Resta is stopping for gasoline and tire

OVER seventy stops at the pits made this one of the liveliest races that has ever been witnessed from a technical standpoint.

Twenty-nine worn and blown shoes were changed, fifteen stops were made for gasoline, eight for plugs, eight for water and eight for oil. The other miscellaneous stops including those which from their nature were permanent totaled fifteen.

Henning was king of the tire changers, as he went the entire circuit on his car, changing both fronts and both rears in rapid succession and then shortly afterward changing the right rear twice again, making a total of six tire changes. There never was any doubt about his having to change any of his shoes either, as they generally resembled a bunch of rags whenever he rolled up to the pits to make a change.

Oil Adjustment Important

Outside of tires, the question of oil adjustment is the one that had the most to do with success or failure. A little too much oil meant sooted plugs which soon brought cars to the pits for time-consuming changes; a little too fine an adjustment meant burned and seized bearings which destroyed the chances of the car permanently. Thus this question of oil adjustment is paramount. It varies even with the track, and it is the one point upon which all the drivers have to work with the keenest appreciation for conditions in the race, in order to keep the car on the track and away from the apron along the pit wall.

The eight stops for plugs represent a very small percentage of the cars, as three of these were made by Johnson in his Crawford and three by Buzane in the Duesenberg. Thompson also stopped once for a plug change and De Palma, with the demon of ill-luck still pursuing him, had to make a plug change when he had an even chance for first money. The delay cost him the opportunity for the final battle across the finishing line and spoiled what should have been the prettiest sprint ever seen on a speedway.

Eight stops were made for oil. Altogether the drivers played on the generous side with the oil supply. The smoke on the track was more than has been seen in some time and very often the officials were almost in doubt whether or not to rule off cars that gave forth too much of the blue-gray vapor. The race was only a few minutes old when Tom Alley was flagged off for excessive smoke.

Few Stops for Water

A sidelight on the plug changes of Buzanne may be noted in his stops for water. These also numbered three, and from the two factors, plugs and water, it can be inferred that overheating was the cause of the stops made by him. This trouble was due to the fact that the packing gland at the water pump connection was leaking.

The greatest number of stops during the day was made by Henning in the Ogren. He drew up at the pits nine times.

Barney Oldfield was out early in the race. For some time he was in doubt as to the exact nature of the trouble, but finally traced it back to the transmission drive members. Broken connecting-rods destroyed the chances of Thompson, Rawlings and Watson. A broken valve put Mulford's Peugeot driven by Rickenbacher out of the running and finally, Frank Galvin broke a steering link on his last circuit and crashed through the retaining wall into the infield. Luckily neither he nor his mechanic were injured.

Haibe in the Osteweg started with a sticking valve and ended prematurely with the same trouble. He rolled into the pits several times to apply oil to the stem of the valve, but the sticking finally became so bad, due to the added expansion when the motor became hot, that he had to withdraw.

Equipment and Specification Details of Cars in 300-Mile Chicago-Derby

Car	Driver	Bore and Stroke	Cyl.	Disp	Carb.	Ignition	Plugs	No.	Pistons	Oil	Wheels	TIRES			W. B.
												Make	Front	Rear	
Peugeot	Resta	3.70x6.65	4	224.3	Miller	Bosch	KLG	8	Levett	Oilzum	R.W.	Silvertown	34x4½	35x5	106
Mercedes	DePalma	3.70x6.49	4	178.0	Mercedes	Bosch	Rajah	8	Levett	Monogram	R.W.	Silvertown	32x4½	33x5	112
Sunbeam	Christiaens	3.21x6.14	6	299.8	Miller	Bosch	KLG	6	Levett	Castorol	R.W.	Silvertown	35x5	35x5	106
uesenberg	O'Donnell	3.75x6.75	4	298.2	Miller	Bosch	Rajah	8	Levett	Oilsum	R.W.	Silvertown	32x4½	33x5	106
unbeam	Galvin	3.21x6.14	6	299.8	Miller	Bosch	Rajah	6	Levett	Castorol	R.W.	Silvertown	35x5	35x5	106
udson	Vail	3.50x5.00	6	288.6	Hudson	Delco	Rajah	6	C.I.	Veedol	R.W.	Silvertown	34x4½	35x5	105
esenberg	D'Alene	3.75x6.75	4	298.2	Miller	Bosch	Rajah	8	Levett	Oilsum	R.W.	Silvertown	33x4½	33x4½	106
rman	Gable	3.63x7.93	4	279.8	Miller	Bosch	KLG	4	Alloynaem	Castorol	R.W.	Silvertown	33x4½	34x4½	104
dson	McCarthy	3.75x6.75	6	288.7	Hudson	Delco	Rajah	6	C.I.	Castorol	R.W.	Silvertown	33x4½	33x4½	102
wford	Lewis	3.75x6.75	4	298.0	Miller	Bosch	Rajah	8	Levett	Oilsum	R.W.	Nassau	32x4	34x4½	106
senberg	Buzanne	3.98x6.00	4	300.0	Miller	Bosch	Rajah	8	Levett	Oilsum	R.W.	Silvertown	32x4½	33x5	106
geot	Rickenbacher	3.74x6.65	4	292.6	Miller	Bosch	Rajah	4	Levett	Castorol	R.W.	Silvertown	34x4½	35x5	106
ge	Oldfield	3.74x6.29	4	275.0	Miller	Bosch	Rajah	4	Alloynaem	Oilzum	R.W	Firestone	34x4½	35x5	104
Sp.	Alley	3.98x6.00	4	300.0	Miller	Bosch	Rajah	8	Levett	Monogram	R.W.	Silvertown	32x4½	33x5	102
Sp.	Kline	3.98x6.00	4	300.0	Miller	Bosch	Rajah	8	Levett	Monogram	R.W.	Silvertown	33x4½	33x4½	106
	Henning	3.98x6.00	4	300.0	Miller	Bosch	Rajah	8	Levett	Castorol	Houk	Nassau	33x4½	34x5	106
rd	Johnson	3.75x6.75	4	298.2	Miller	Bosch	Rajah	8	Levett	Castorol	R.W.	Nassau	32x4½	32x4½	106
s	Haibe	4.34x5.00	4	296.0	Miller	Bosch	Answer	8	Levett	Oilsum	Houk	Silvertown	32x4½	33x5	102
	Thompson	3.50x5.00	4	192.4	Miller	Bosch	Rajah	8	Levett	Sexton	R.W.	Silvertown	32x4	33x4½	108
	Watson	3.75x6.75	4	298.2	H & N	Bosch	Rajah	8	Levett	Oilsum	R.W.	Silvertown	33x4½	33x4½	101
luth	Rawlings	3.75x6.75	4	298.2	Miller	Bosch	Rajah	8	Levett	Castor-Sexton	R.W.	Silvertown	33x4½	33x4½	106

l cars equipped with Boyce Motometers except D'Alene's Duesenberg and Rawlings' West Duluth. All cars equipped with Hartford shock absorbers except DePalma's Mercedes.

Stops at the Pits in Chicago Race

Peugeot—Rickenbacher.

iles. Out. Broken valve.

irman Sp.—Gable. Five stops.

m., 30 sec. Changed right rear.
m., 1 min. Changed right rear and

m., 1 min. 15 sec. Took on gas and

m., 34 sec. Tightened right rear

m., 18 sec. Took on gas.

Olsen—Olsen. Six stops.

n., 34 sec. Consultation.
n., 1 min. 17 sec. Tightened hood
nsultation.
n., 2 min. 59 sec. Adjusted car-

ı., 1 min. 41 sec. Took on gas.
ı., 3 min. 30 sec. Changed drivers.
wheel. Changed right front tire.
n. Out. Broken connecting-rod.

berg—O'Donnell. Five stops.

ı., 1 min. Changed right front

35 sec. Changed right rear tire.
, 1 min. Took on oil, adjusted

1 min. Changed right rear tire;

1 min. Changed right rear
ed gas supply.

Sp.—Haibe. Seven stops.

1 min. 32 sec. Oiled stuck

min. 42 sec. Oiled stuck valve

3 min. 2 sec. Oiled stuck valve

4 min. 35 sec. Adjusted car-
d valve stems.
min. 35 sec. Oiled stuck valve

14 min. 22 sec. Oiled valve
ed plugs.
Out. Valve trouble.

Crawford—Johnson. Five stops.

2:22 p. m., 48 sec. Changed plug.
2:48 p. m., 33 sec. Changed left rear tire.
3:24 p. m., 5 min. 30 sec. Changed spark plugs.
4:05 p. m., 25 sec. Changed left rear tire.
5:13 p. m., 32 sec. Took on gasoline.

Hudson Sp.—McCarthy. Three stops.

3:06 p. m., 42 sec. Changed right rear tire, took on gas.
3:23 p. m., 42 sec. Changed left rear tire.
5:17 p. m., 38 sec. Changed right rear tire.

Duesenberg—Buzanne. Five stops.

3:34 p. m., 3 min. 22 sec. Tightened water pump packing nut; took on water and oil.
3:54 p. m., 3 min. 10 sec. Changed plugs and repaired leaking pump gland.
4:37 p. m., 3 min. 34 sec. Took on water and oil; repaired leaking pump gland.
5:16 p. m., 2 min. 10 sec. Changed spark plugs.
5:39 p. m., 1 min. 7 sec. Took on water; changed plug.

Sunbeam—Galvin. Two stops.

4:01 p. m., 1 min. 4 sec. Took on gas.
4:32 p. m., 24 sec. Changed right rear tire.

Duluth Sp.—Rawlings.

3:18 p. m. Out. Broken connecting-rod.

Duesenberg—D'Alene. Three stops.

3:19 p. m., 22 sec. Changed right rear tire.
3:41 p. m., 2 min. Tightened nut on steering knuckle.
4:57 p. m., 1 min. Adjusted carbureter.

J. J. R.—Watson. Three stops.

3:27 p. m., 38 sec. Changed right rear tire.
3:56 p. m., 1 min. 11 sec. Took on gas; consultation.
4:15 p. m. Out. Broken connecting-rod.

Peugeot—Resta. One stop.

3:27 p. m., 2 min. Changed right rear tire; took on water and gas.

Mercedes—De Palma. Two stops.

3:22 p. m., 59 sec. Left rear tire and oil.
5:14 p. m., 1 min. 4 sec. Changed spark plug.

Kline Sp.—Alley.

2:23 p. m. Ruled out by officials for smoking.

Hudson—Vail. One stop.

3:41 p. m., 36 sec. Changed left rear tire.

Kline Sp.—Kline. One stop.

3:11 p. m., 2 min. 59 sec. Took on water, oil and gas; adjusted carbureter.

Crawford—Lewis. Five stops.

2e20 p. m., 25 sec. Changed right front tire.
2:45 p. m., 1 min. 33 sec. Changed right rear tire; consultation.
3:25 p. m., 34 sec. Changed right rear tire.
4:28 p. m., 1 min. 18 sec. Changed left rear tire; took on gas and oil.
5:15 p. m., 2 min. 25 sec. Took on water and oil.

Ogren—Henning. Eight stops.

2:31 p. m., 40 sec. Changed right rear tire.
2:43 p. m., 40 sec. Changed left rear tire.
2:49 p. m., 2 min. 30 sec. Changed right front tire; consultation.
3:13 p. m., 50 sec. Changed right rear tire.
3:36 p. m., 1 min. 22 sec. Changed right rear tire.
4:06 p. m., 5 min. Repacked water pump; took on water.
4:31 p. m., 9 min. Wires broken water pump bracket in place; took water.
4:58 p. m., 4 min. 3 sec. Repacked water pump gland; changed left rear tire.

Sunbeam—Christiaens. One stop.

3:47 p. m., 35 sec. Took on gas.

Delage—Oldfield.

2:25 p. m. Out; broken transmission.

A Study of High-Speed Engines

Reviewing the Reasons for Their Existence and Analyzing Several Important Problems of Their Design Including Lubrication and the Elimination of Balancing

By A. P. Brush
Consulting Engineer

THIS paper is a review of the reasons for the existence of high-speed engines and touches upon several of the problems in connection with their design, notably lubrication and the elimination of balancing. The author's analysis of the reasons which have brought the high speed engine into prominence are very interesting and admit of small debate, and his championing of the interconnected throttle and oil supply is also a matter with which few can disagree. The portion of the paper reprinted herewith deals with the problems of crankshaft balance, and is about as clear an explanation as could be devised. The paper follows:

We now come to a phase of engine design the effect of which increases as the square of the engine speed. In any rotating mass three kinds of balance are involved. For comparison and analysis I shall call them static balance, running clear an explanation as could be devised. The paper follows:

Static balance is secured whenever the axis of a rotatable mass passes through its center of mass, but such a mass need not necessarily be in either running or distortion balance.

Any mass in either running or distortion balance must however be in static balance; that is, running balance and distortion balance are each a special condition or form of static balance.

Running balance can be described as that condition or form of static balance in which any centrifugal couples are equal and opposed, and therefore neutralize each other.

Distortion balance can be described as that condition or form of *static and running balance* in which all centrifugal forces within any plane at right angles to the axis (that is, within any plane of rotation) are balanced.

For purposes of illustration and analysis, let us consider the diagrams of rotatable masses, Figs. 1, 2 and 3, in which A represents the axis, M any specified mass, R any specified distance between M and the axis, and C the center of mass of the system.

In Fig. 1 we have a case of static balance, inasmuch as A passes through C, but we have not running balance, since M and M' upon rotation about A will form an unneutralized centrifugal couple tending to force A out of position.

In Fig. 2 we have a condition of static balance (inasmuch as A passes through C) that is also running balance; that is the centrifugal couple between M and M' is equal and opposed to the centrifugal couple between M'' and M''', and there is no tendency to displace A as a whole. Fig. 2 does not, however, represent a condition of distortion balance, as the opposed centrifugal couples tend to bend the axis A.

If, however, our masses be arranged as in Fig. 3, so that M' and M lie in the same plane of rotation as do also M'' and M''', we have the special form or condition of static balance (inasmuch as A passes through C) that also represents running and distortion balance.

Balance in Four- and Six-Throw Crankshafts

As applied to conventional four- and six-throw crankshafts, static and running balance are, or should be, always achieved within the limits of workmanship.

For reasons I shall point out later, a single-throw crankshaft, for best results in service, should not be in either static or running balance; a two-throw crankshaft with the throws opposed, for best results in service, should be in static, but not in running balance.

It is only within the present period of high-speed engine developments that the importance of distortion balance, so nearly as it can be achieved in a crankshaft, has begun to be understood. Inasmuch as its functions exercise a certain control over the form of a crankshaft, what is commonly known as counterbalancing is required to bring any crankshaft into any condition of static balance.

Running balance in conventional four- and six-throw crankshafts, by means of counterbalancing, can readily be and, as I have said, is almost universally secured. Distortion balance in a crankshaft can never be absolute, because of the effect of its functions upon its form. The closest possible approximation to distortion balance that can be secured in any crankshaft was commonly known and used before the advent of the automobile.

Irreducible Minimum Distortion Couple

Fig. 4 represents a single-throw crankshaft in which M and M' are counterweights, having a common centrifugal effect equal to the centrifugal effect of the crank-cheeks and -pin. There is obviously a slight distortion tendency here, due to the fact that the pin mass lies between the counterweights M and M', with a slight resultant tendency to bend the crankpin. This approximation of distortion balance in a crankshaft can be properly described as the irreducible minimum or single-throw distortion couple, and will be recognized by all of you as ancient mechanical practice.

I shall hereafter refer to a crankshaft which has a single-throw distortion couple, as being in complete distortion balance. Of course no condition of static balance can be achieved in a single-throw crankshaft without resorting to the addition of counterbalancing masses, as represented in Fig. 4. In Fig. 5 however (representing a single-plane two-throw crankshaft) we find a condition of static balance (not of running balance) apparently without the use of counterbalancing. The counterbalancing exists, inasmuch as each throw acts as a counterbalance for the other. This is also true in Fig. 6, which represents the conventional three-bearing four-throw four-cylinder crankshaft. In Fig. 6 however (which like Fig. 5 is automatically counterbalanced without the addition of extra counterbalancing masses) we have a natural condition of running balance, but not complete distortion balance, and the center bearing is required to help resist the bending tendency due to the lack of distortion balance. This load on the center bearing, while negligible in low-speed engines, is by no means negligible in the modern high-speed engines, and it is not unusual to see counterbalancing masses added to shafts of this type as in Fig. 7 to bring them to complete distortion balance.

Two-Bearing Four-Cylinder Crankshafts

In small-bore high-speed engines the lack of distortion balance causes much greater load upon the center bearing than

Illustrating Various Phases of Crankshaft Balance in High-Speed Engines

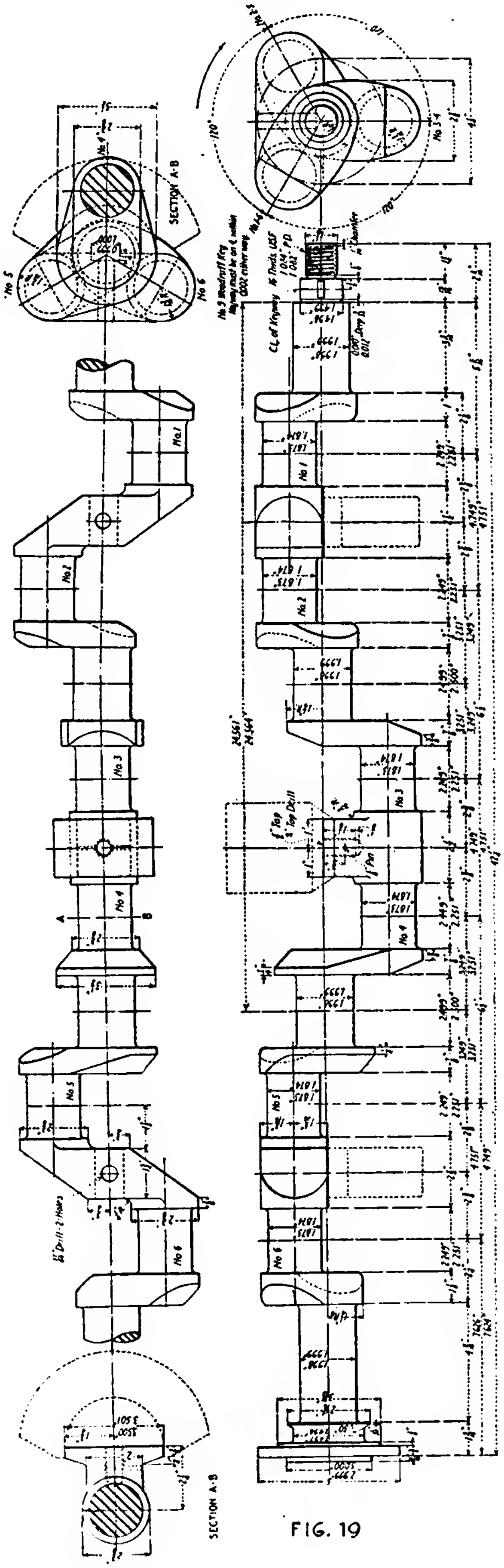


FIG. 19

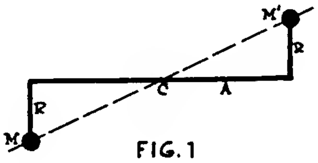


FIG. 1

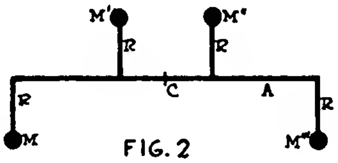


FIG. 2

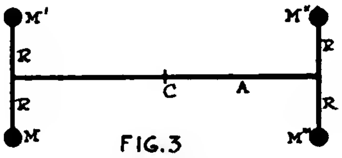


FIG. 3

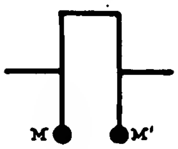


FIG. 4

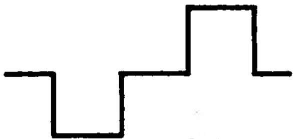


FIG. 5

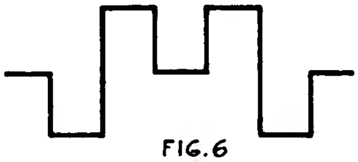


FIG. 6

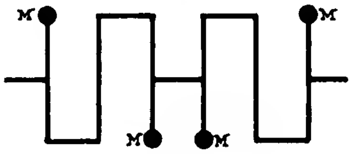


FIG. 7

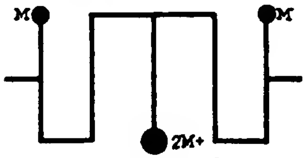


FIG. 8

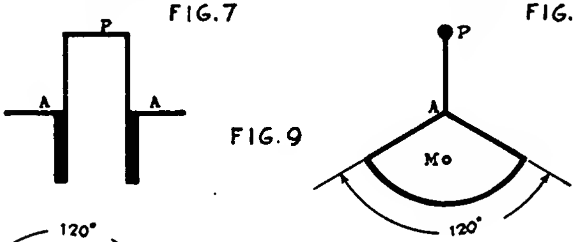


FIG. 9

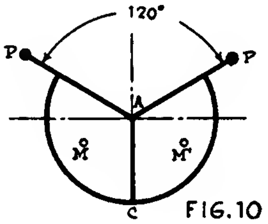


FIG. 10

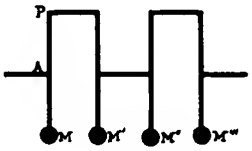


FIG. 11

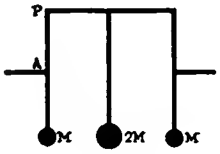


FIG. 12

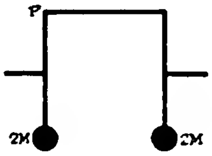


FIG. 13

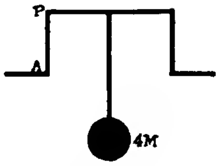


FIG. 14

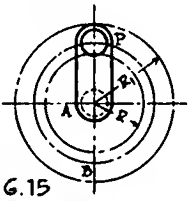


FIG. 15

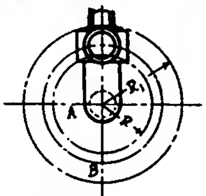


FIG. 16

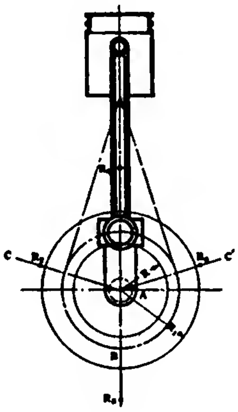


FIG. 17

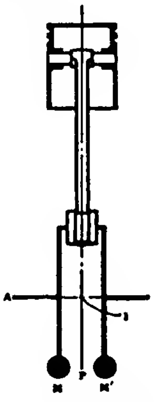


FIG. 18

does the explosion pressure in the cylinders. This fact accounts for some of the troubles encountered in two-bearing four-cylinder crankshafts. Two-bearing four-cylinder crankshafts for small-bore high-speed engines are entirely feasible, provided counterbalancing masses are added to the crankshaft as indicated diagrammatically in Fig. 8. In this figure the value given for the center counterbalancing mass is $2M+$, since the center crankpin carrying two connecting-rods is always longer than the two end pins. This difference in length and weight should be considered in determining the centrifugal value of the center counterbalancing mass.

In both Figs. 7 and 8 the distortion couple is reduced to the minimum of a single throw, although a counterbalancing mass is added only at one side of each throw. A counterbalancing mass might be added at each side of each throw, as shown in Fig. 4, but inasmuch as the crankshafts so far considered are all single-plane crankshafts (that is crankshafts in which the axes of all crankpins and the axis of the crankshaft lie in a single plane) the mathematical merging of two counterbalancing masses, opposed and in the same plane of rotation, results in a cancellation of their centrifugal forces and therefore *permits* the elimination of such masses. So far as the single-plane crankshaft is concerned, the securing of complete triple balance (that is, static and running balance with distortion couples reduced to the irreducible minimum of a single throw) is mathematically identical with the counterbalancing of a single-throw crankshaft.

Six- and Twelve-Cylinder Crankshafts

Let us now consider the three-plane crankshaft as used in modern six- and twelve-cylinder automobile engines. Fig. 9 shows a side and end view of a counterbalanced single-throw crankshaft, in which, as is obviously possible, the applied counterbalancing mass has a contour such that the included angle between its sides when viewed from the end is 120 deg., P representing the center of crankpin, A the axis of the crankshaft, and M the center of mass of the counterweight. If six of these throws are formed into one shaft with a bearing on each side of each throw, we can obviously have a conventional seven-bearing six- or twelve-cylinder crankshaft in complete triple balance.

If we omit a bearing between any two throws, one cheek and one counterbalance of each of these throws will lie in the same plane, as illustrated in the end view in Fig. 10. In this type of shaft the angle between each pair of adjacent crankpins, except the two center ones, is 120 deg. As in Fig. 9, P represents the center of the pin, A the axis of the shaft, and M and M' the centers of mass of the counterweights. Inasmuch as the specified included angle between the sides of each counterweight is 120 deg., these two counterweights when brought into the same plane by the elimination of an intermediate bearing, will have their adjacent edges in contact as shown along the line C. This means that the two counterweights can be merged into one having an included angle between the sides equal to the sum of the included angles of both weights, with the common center of mass lying in the line of union C of their adjacent sides, and having a mass equal to the sum of the two counterweights. Any form of counterweight can be used whose center of mass lies in this same line (C in Fig. 10), the centrifugal value of which is the same as the combined counterweights shown. For obvious mechanical reasons it will always be desirable to adopt a counterweight form with an included angle of less than 240 deg. between its sides, but the adoption of such a different form of counterweight in no way alters the mathematical fact that it is and must be the exact centrifugal equivalent of the two combined counterweights, as illustrated in Fig. 10.

Six-Throw Shaft with Two Center Throws

Now let us consider the special case of the two center throws in the conventional three-plane six-throw crankshaft. Fig. 11 shows these two center throws in the seven-bearing form of this type of crankshaft (that is, with a bearing on each side of each throw), in which A represents the axis of the crankshaft, P the center line of the pins, and M, M', M'' and M''' the counterbalancing masses. If, as in the four-bearing conventional three-plane six-throw crankshaft, the center bearing be omitted, this central portion of the shaft takes the form illustrated in Fig. 12, in which case complete triple balance can be secured for these two center throws with three counterbalancing masses instead of four, the center counterbalancing mass of the three obviously having a value of $2M$. An expedient that secures a close approximation to distortion balance is shown in Fig. 13, in which only two counterbalancing masses are required, each having the value of $2M$. In this case the distortion couple is two throws long and therefore not the minimum, but is a sufficiently close approximation for all practical purposes.

Fig. 14 shows a still further simplification (which has been used) of securing approximate triple balance of the two coincident center throws of a four-bearing three-plane six-throw crankshaft, in which these two center crankpins are counterbalanced by the use of a single counterbalancing mass, having a value of $4M$. The conventional four-bearing three-plane six-throw crankshaft in Fig. 19 was designed under the writer's supervision early in 1912. Approximate triple balance was secured by merging the three center counterbalancing masses in Fig. 12 into one, as shown in Fig. 14, and also by a mathematical merging of the three counterbalancing masses, theoretically necessary for each of the two end throws, into two counterbalancing masses as shown in Fig. 19.

To secure what I have described as complete triple balance in conventional three-plane six-throw crankshafts, the seven-bearing type requires twelve counterbalancing masses, and the four-bearing type obviously requires nine counterbalancing masses, in which case each of two of these masses is the centrifugal equivalent of two 120-deg. merged weights, and one of them is a coincident merged weight as in Fig. 12, the others being simply single-throw counterbalancing masses. The four-bearing crankshaft can however, as I have already pointed out, be in complete triple balance, except the center throws, with eight weights.

The conventional three-bearing three-plane six-throw crankshaft is in some ways the simplest crankshaft of this type in which to secure what I have described as complete triple balance. In this case only eight weights are required; that is, four single-throw weights on the cheeks adjacent to ends of the center line bearings and four 120-deg. merged weights on each of the four merged crankthrow arms where center line bearings are omitted.

Single-Throw Shaft Basis of Balancing

From the foregoing description of the fundamentals of crankshaft counterbalancing it becomes apparent that the science of counterbalancing a crankshaft of any number of throws, or of any form, is only the science of counterbalancing a single-throw crankshaft, inasmuch as the mathematical merging of two counterbalancing masses lying in the same plane of rotation, is an obvious mechanical expedient. Bearing this in mind, it is evident that we can examine the whole science of crankshaft counterbalancing by an analysis of correct counterbalanced values for a single-throw crank. In the remainder of this discussion of crankshaft counterbalancing, I shall therefore confine myself to consideration of the single-throw form of crankshaft.

We have so far considered the counterbalancing problem as regards the crankshaft itself. This is not sufficient, however, if counterbalancing is to achieve the desired result of minimizing pressure on the center line crankshaft bearings due to tendencies to distort under service conditions, espe-

(*Continued on page* 1100)

Self-Tensing Springs for Varying Loads Compared with Adjustable

With Special Reference to the North Cantilever Spring with Adjustable Fulcrum

By Marius C. Krarup

ARGE variations of speed cause auxiliary devices to
play a prominent part in the spring equipment for
speedy vehicles, while adjustment of spring flexibility
constantly contemplated as an obvious improvement for
icles whose loads vary greatly. The best ultimate value
cantilever springs may perhaps be found in the readiness
h which they lend themselves to adjustment by varying
location of their fulcrums and to an effective combination
auxiliary devices at their free ends. These considera-
s form in themselves a very large subject, which is men-
ed here only to bring into proper perspective the rela-
y small and limited question as to whether it is prefer-
to adjust a spring in advance to load and speed varia-
or to have the variations of load, as they occur, auto-
ally result in different rates of flexibility. There could
doubt of the automatic arrangement being preferable,
vere demonstrated that the adjustments effected in this
er may be closely in accordance with the most important
rage requirements.

North cantilever spring with adjustable fulcrum,
was described in THE AUTOMOBILE of June 1 represents,
other hand, the conviction that adjustment by hand
es results which are sufficiently superior to warrant
ption of the system where adjustments are not so
tly required as, for example, for trucks and omni-
The claim for superiority over automatic adjustment
on the fact that, in case of road shock, the rate of
y of the North spring remains the same throughout
ection caused by the shock while the "compound"
eing *"incapable of distinguishing, in its mode of*
etween the deflection caused by a change of load
caused by a *brickbat lying in the road,"* shortens the
by its increasing rate of stiffness and at the same
avates the rebound by its increasing flexibility at
end of the spring stroke. There is added also the
in practice "compound" springs have never been
omfortable as ordinary springs working with the
d for which they have been designed, but this claim
narrow scope and is also, of course, not conclusive
long as "compound" springs have only been tried
riations of design and without suitable provisions
g rebound. In comparing the two types it should
so be kept in mind that adjustment by hand for
lated condition of operation is more practical for
onditions than for the rough streets and roads
d States, where one must always be prepared to
e unexpected.

e with Heavy Loads

to the North system a considerable advantage
entioned to which no reference is made in the
unt of it taken from *The Automobile Engineer.*
between axle and vehicle frame can remain ap-
he same at different adjustments of the springs,
ange of action with a heavy load is not mate-
d, and no special provisions need to be made in
f the vehicle for more than ordinary range of action. If a minimum load of 800 pounds produces, for example, an initial deflection of 4 inches at a flexibility rate of 1 inch per 200 pounds, and the maximum load is 600 pounds more, to which corresponds an adjustment giving an 80 per cent decrease of flexibility, which makes the rate 1 inch per 350 pounds, the total load on the spring of 1400 pounds supported at this rate produces again a deflection of 4 inches. It is learned that the designer, the late Mr. North, was strongly conscious of this advantage.

To be compared with the North system the automatic system must be viewed in its possibilities, rather than with reference to any form actually placed in the market, as the need of special construction or special auxiliary devices for use in conjunction with it has not been widely realized. To get away from the ambiguous terms "compound" or "progressive," which do not describe this system well, it is suggested that "self-tensing" springs might be adopted as a term designating springs whose rate of flexibility is decreased automatically to suit (though not necessarily in exact proportion to) the load they carry at any given moment; this leaving the question open as to whether it is a necessary feature—as claimed in favor of the North system—that the deflection caused by a jolt shall have exactly the same effect as the much slower action of a load change.

"Self-Tensing" Springs

As examples of simple self-tensing springs there may be mentioned: The coil spring with coils of varying diameter, which becomes self-tensing when the most flexible coils begin to collapse; the elliptic spring so curved that active length shortens by deflection; the cantilever spring whose free end shortens by deflection, as by automatic change of fulcrum.

Strong Rebound and Other Objections

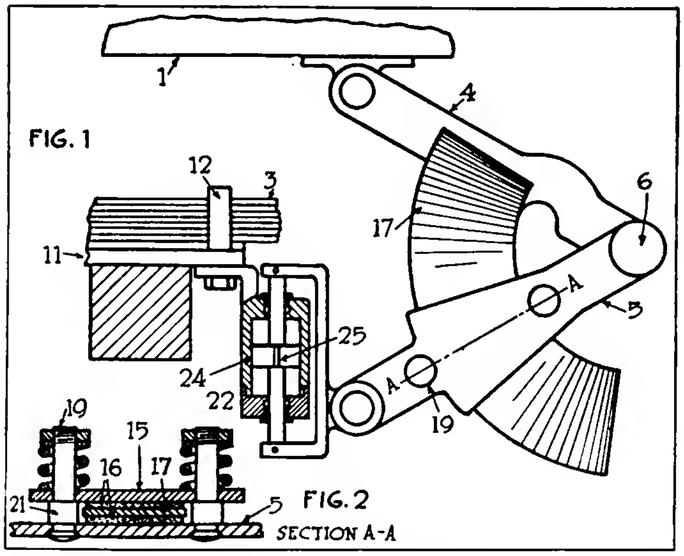
Beginning with the most serious objection raised against self-tensing springs, to wit, excessive rebound, it may first be mentioned that the need of rebound checks for all springs, and of course especially for rough roads, is becoming more and more widely recognized, and that the need of special rebound checks or shock absorbers in conjunction with self-tensing springs is therefore not a strong objection, provided they accomplish what is necessary in order to remove the principal objection to self-tensing springs under all circumstances of service. The other objection, relating to shortened deflection for a shock of given force, may be met by a higher rate of flexibility throughout the normal range of spring action in vehicles whose design admits of increased total range of spring action, while for other vehicles the objection must probably hold good. Too high initial camber of leaf springs and reduced spring range for heavy loads constitute other objections which must be taken up.

With regard to the means for escaping excessive rebound, attention may be called to two devices which can be used for limiting rebound with close reference to the position from which the spring action starts when a jolt is received, this position varying with the load, of course. The first device is patented by Loomis and assigned to the Packard Motor Car Company. The principle is shown in Figs. 1 and 2. (In another form of it, which is equivalent in principle, the appearance is improved by having the sluggish element operated by rotation around the free pivotal joint, 6, of the arms instead of by dashpot). Plate 17 is supposed to be secured to arm 4 and is thinnest at the middle where it is loosely grasped between friction linings 16 of arm 5 and plate 15, these being held in elastic mutual relations by pins 19 and coil springs 18, as shown separately in Fig. 2. The shape of plate 17 is determined by the rate at which it is desired that the friction of the device shall be increased when arm 5 is moved toward arm 4, by deflection of vehicle spring 3, or away from it, by rebound beyond the position of equilibrium represented in Fig. 1.

Arm 4 is pivoted to vehicle frame 1, and arm 5 to a bracket secured, as shown, to piston 24 in dashpot 22, the latter secured to spring pad 11 of axle 2 by clip 12. The dashpot is filled with a very thick fluid, such as graphite grease, and a small aperture 25 in piston 24 admits of a very slow relative movement between the piston and the dashpot.

When a shock is received on the road, arm 5 will be actuated from piston 24 as if the latter were securely attached to the axle, the duration of the shock being too short to get the dashpot into action. The device will therefore work in accordance with the plan followed in the shaping of plate 17. This would not be the case after changing the load of the vehicle, except for the compensating effect of the dashpot feature. If the load were increased, arm 5 would be moved toward arm 4 with the vehicle at rest, and, on receipt of a shock the friction acting against deflection would be greater than for a lighter load, while the friction restraining the rebound would be reduced. With the dashpot in action, an increase of load moves arm 5 toward arm 4, but the first few shocks afterward received move the piston, by means of the resistance encountered, down to the position which again brings arm 5 to grasp the thinnest portion of plate 17 when the vehicle is at rest, and the whole action of the device thereby becomes the same as it was before the load was increased.

If it is assumed that the thickness of the substance in the dashpot, the dimensions of aperture 25 and the shape of plate 17 are factors which can be brought into harmony with each other, it becomes evident that the device will have two effects which are of interest in this connection. First, the upper portion of plate 17 will act by reason of its shape as self-tensing auxiliary against shocks (but will not help the vehicle spring to sustain increased load, as a true self-tensing spring does), and, as the friction on the return of arm 5 to neutral practically equals the friction operating against deflection, the force of the rebound will not be as great as that which would be experienced with the vehicle spring unassisted and subject to a larger deflection from any given shock. Secondly, the lower portion of plate 17 can evidently be shaped so as to limit the rebound, below the neutral position, with any desired gradation or abruptness. The device is therefore an example, in conjunction with an ordinary vehicle spring, of an arrangement producing a self-tensing effect by means of friction, having automatic adjustment to load changes and involving no increase of rebound but, on the contrary, any desired checking of the rebound. Plate 17 can be shaped so as to leave the vehicle spring almost free of restraint for all small shocks, for which purpose the enlargements 21 on pins 19, Fig. 2, serve to space arm 5 and plate 15 apart. The principal theoretical shortcoming in comparison with the North system of adjustment by hand lies in the reduced range of action with heavy loads which the arrangement has in common with the use of ordinary springs alone if these are made flexible enough for light loads; and this shortcoming applies only to pleasure cars and omnibuses where the range of action is limited by a certain scant maximum distance between frame or body parts and axle parts.



Figs. 1 and 2—Packard company's patented shock absorber with compensation for variations of the vehicle load

Probably there are practical difficulties in the construction, such as in making the automatic adjustment operate reliably, in making friction elements conform to the best shape of plate 17, and in the method of checking the rebound by a friction which at first diminishes as the spring returns toward the neutral position, but the patent was applied for in 1908 and does not in these features represent the best that may be done to-day.

Another Rebound Check for Varying Loads

The other device showing that self-tensing springs may be combined with complete checking of the rebound irrespective of the load carried was designed by the writer for use with any type of spring suspension and is illustrated in Fig. 3, giving two sectional views. It can be operated with glycerine, oil or grease of any preferred consistency, this feature affecting only the adjustment and the size of the vent in the free piston 7, but as the degree of consistency or fluidity should not be affected much by the temperature of the atmosphere, a thin oil with or without graphite admixture is probably best. The base 1 is secured to the vehicle frame and the wing piston 2 is keyed to the annular central boss of the outer cover plate 3, which is connected by the usual jointed arm to the vehicle axle, so as to be actuated when the vehicle springs are actuated. The interior cover plate 4 (with holes for pins 10, 13 and 14) is closely fitted into a recess in the outstanding flange of base 1 and a corrugated copper ring 5 protects against leakage at the joint between the two cover plates. Stop 6 limits the downward movement of free piston 7. Nut 8 with washer holds the outer cover plate in alignment and may be secured by locknut arrangement. The one-way valve flap 9 on pin 10 in conjunction with plug 11 constitute the adjustment by which the whole rebound stroke can be moderated at any desired rate. Hollow plug 12 normally contains only air and provides for irregularities in the expansion or contraction of materials and fluid.

Damping Rebound Stroke Only

Deflection of the vehicle spring turns wing piston 2 downward, and the fluid driven before it raises free piston 7 a corresponding angle, the vent being so small as to have no appreciable effect in the case of a rapid spring movement. The fluid in the upper part of its circular path opens the one-way valve 9, passing practically unhindered. When the rebound stroke begins and wing piston 2 starts back, valve 9 closes and fluid is forced through space above it, which can be restricted more or less by adjustment of plug 11. The rebound stroke is thus retarded from its beginning as much as desired. Meantime the free piston 7 is being driven back toward stop 6 and reaches it at the same moment as wing-piston 2 reaches its starting position. Any further rebound movement of wing piston and vehicle spring must take place by forcing the fluid through the vent in free piston 7 and along its surfaces of contact in the device. The more the rebound is restricted from its start by the one-way valve 9 and plug 11, the less abrupt is the checking caused by free piston 7 and stop 6.

The action for load variations, which is the feature of interest for comparing the North system of spring adjustment with automatic self-tensing springs, is as simple as possible. If the load of the vehicle is increased, wing-piston 2 takes a new and lower neutral position, and free piston 7 is raised momentarily, but at once begins to gravitate back to the stop, the fluid passing slowly through the vent. Thereafter the action of the device is the same as it was with the lighter load, that is, spring rebound is again checked from its beginning, at a rate determined by the adjustment (which is constant for a given vehicle) and is finally checked at the moment when the vehicle spring reaches the position of equilibrium with its static load.

Similarly, if the load is reduced, the wing piston rises slowly to a new initial position, forcing the fluid through the vent in the free piston which remains at rest against stop 6. The action for shocks is thereafter again the same as before. The free piston is made sufficiently heavy to make its gravitation—producing the automatic adjustment to increased load—certain and definite, with the size of vent and the kind of fluid substance selected.

These two devices suffice to show that there are no great mechanical difficulties in removing North's principal objection to self-tensing springs; namely, that their strong rebound produces discomfort. The object of using self-tensing springs, being mainly to take equally good care of light and of heavy loads, which is also the object of the North cantilever spring with adjustable fulcrum, a simple device which takes care of the rebound in any desired degree independently of what the load is, becomes the first important element in favor of self-tensing springs for variable loads.

Camber and Spring Range

But other objections remain to be considered. It has been seen that, if the equivalent of self-tensing properties for shocks are produced by a friction device combined with ordinary springs, the deflection of the springs under loads will be strictly in proportion to their flexibility, and they must be either too stiff for light loads, or their original camber must be greater than desirable and the range of spring action will be reduced too much for the maximum load in the case of pleasure cars and omnibuses, in which the possible range is limited by the conventional vehicle design; and this objection will hold good even if the friction device operates with equal correctness for light and heavy loads. Also, the objection relating to the strong original camber of the spring leaves, holds good even for motor trucks having ample spring range as well as for pleasure cars.

With a true self-tensing spring that is load-supporting at all stages, these objections lose some of their force, as it always carries its load as high as an ordinary spring of the tension which would be chosen for a normal load corresponding to that momentarily carried by the self-tensing spring. But as a self-tensing spring should be considerably more flexible in its light-load range than an ordinary spring can be (being calculated for normal or maximum loads), the original camber of its leaves would necessarily be strong in order to have it come normal for light load, if it were not possible and practicable to make special provisions to avoid this objectionable feature.

Cross Springs for Minimum Load

Such a provision, and one of the most plausible schemes in this connection, is to use for the static support of the minimum load either an elliptic spring crosswise of the vehicle between axle and frame—as may be most suitable for trucks—or a semi-elliptic (perhaps two quarter-elliptics instead) secured at its middle to a frame transverse and at its ends shackled to the axle or to the rear of the brake beam, and to have this cross spring highly flexible. Evidently coil springs or air springs could be used similarly to hold the minimum load at the proper height—the height giving the needed spring range—and could be made self-tensing for all or part of their work, but this possibility lies farther afield than the use of light-load leaf springs.

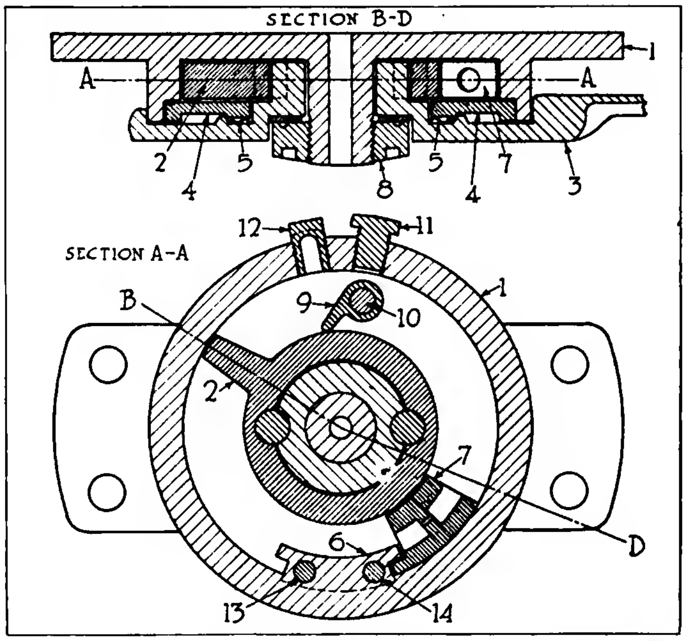


Fig. 3—Device for damping and checking rebound stroke correctly with any vehicle load

Self-tensing cantilever springs at the sides of the vehicle, used in conjunction with such highly flexible cross-springs for the static minimum load, could then be made straight, short and thin-leaved without getting bulky, having only to handle the difference between minimum and maximum loads plus their share of the jolts, and the frame support would be better distributed than with cantilever springs alone, while the lateral stability would also be better secured.

For pleasure cars a sufficient range of loads could no doubt be suitably sprung on this plan by having the cantilever springs alone self-tensing, while for trucks it might be better to arrange also the cross-spring on the self-tensing plan or to incorporate progressive friction in the rebound check or shock absorber, as in the Loomis device. Or, for pleasure cars, the cross-springs could be self-tensing and the cantilever springs normal.

One-Sided Loads

Comparing again with the North system, it is noted that the latter fails to compensate for one-sided load variations, which are especially important in omnibuses, while the plan mentioned differentiates properly between the heavy and the light side of the vehicle.

It should perhaps also be noted that, with the rebound check preventing all spring action below static equilibrium, the stability could not suffer, even when driving with a light load supported on the highly flexible cross-springs alone.

To finish the comparison with the North system (or, more broadly, with the plan of adjusting vehicle springs to a load variation by advance operation of an adjustment device) it should be shown in detail how a cantilever spring may be arranged to act on the self-tensing plan, and how other types of spring may be so arranged, but the purpose is here only to show that, in general, the self-tensing plan seems better worth developing than the plan of operative adjustment.

It seems incontestable, however, that the North system after all retains one advantage: With reference to pleasure cars, it makes a simpler provision for sufficient range of spring action at all adjustments than any which it has so far been shown can be incorporated in the self-tensing system, if the latter shall give an equally ample deflection for a given shock at maximum load. But a number of possibilities remain for overcoming also this superiority. A step in this direction would be taken, for example, if a shock absorber (with rebound check) could be devised in which the friction or other form of resistance, would be increased by an increase of the vehicle load but would remain constant during a deflection caused by a jolt.

In the whole subject, the use of dampers and rebound checks which are self-adjusting to load variations, and the use of separate minimum load springs of high flexibility, seem to the writer to be the leading ideas, which in the end should make self-tensing springs wholly practicable.

Paragraphs on Current Topics

By **Marius C. Krarup**

Motto: Radical Thought, Conservative Action

"Those who think that speed is the great cause of street accidents might do worse than consider the possibility of establishing their case by facts instead of relying upon vague enunciations," writes Francis M. Hugo, Secretary of New York State, and recommends "a critical scrutiny of the evidence given and verdicts returned at each of the hundreds of coroner's inquests held on victims last year." Such a scrutiny "ought to show how far the accidents were reasonably attributable to the speed at which the vehicles concerned were traveling." It might also show certain insufficiencies in the average coroner's inquest which would react upon the reasoning and leave us in the same uncertainty as before.

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Motor of Copenhagen writes that the radical Jacobsen design, which was described and illustrated recently in this journal, is now being built into a Benz racing car in Germany, and that the inventor is also negotiating with the Mercedes branch of the German Daimler company.

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The American Automobile Association, better known as A. A. A., plans to have a national Good Roads Convention held every year at Washington under the direction of the Federal government, and more particularly under the auspices of the United States Office of Public Roads and Rural Engineering in the Department of Agriculture. In this manner somebody may eventually rise to tell the world how the Good Road is built which shall finally convince taxpayers that it is worth paying for, and therefore worth building and maintaining on a large scale.

□□□□

"No machine made by man could penetrate into the roadless mountains or follow the troopers over their almost impassable trails," sings an editor in dithyrambic enthusiasm over the army mule. Give two inventors and a dozen engineers financial *carte blanche* and a modest reward at the goal, and the impossible machine will be produced in six months and will not only penetrate but will pull a good many troopers with it and shelter them against bullets from ambush besides.

□□□□

The *Motor World* of Melbourne, Australia (issue of April 28, 1916, being Vol. II, No. 12), gives over a few practical pages to "Woman and the Car," almost entirely devoid of millinery and dress goods display. "Chauffing" as a vocation for women is proclaimed, in accordance with recent British example, as patriotic and in line with improved national efficiency—the work being done well enough by the women and the men released for more exacting occupations. From all sides American women are being crowded, by example of their sisters abroad, into the motor and automobile field.

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One of the smouldering questions in aviation—ready to burst into flame at any moment—is: "Are two motors safer than one?" Quite knotty, too, with weight and distribution of weight duly considered. We vote for one, at least until aeroplanes get very much bigger. But this recalls an interesting old theory. According to it, when aeroplanes become as big as a cloud it should be possible to keep them floating with scarcely any use of power, on the principle that they cannot fall without moving such quantities of air under them that the same, when forced to escape at the edges, would reach a speed so high as to set up resistance greater than needed for sustentation. This weird explanation of the heavy floating cloud must soon be due to come under discussion, as it unfolds several surprises applicable to aeroplanes (and to large flocks of birds) when looked into.

Library Service for Aid in Research

Referring to the article on this subject in last week's issue, W. P. Cutter, librarian and secretary of the Library Board of the United Engineering Society, 29 West Thirty-ninth Street, New York City, imparts the information "that just such a service"—as outlined in the article—"is offered here."

A circular inclosed with the letter explains this service and records requests for information from 239 localities in the United States during one year. During that period requests have also been received from 58 localities in 17 foreign countries. "Our chief difficulty is in publicity for this service," writes Mr. Cutter in conclusion.

A contribution to the desired publicity is hereby freely tendered; so much more readily as the writer has often made use of the excellent facilities of the United Engineering Society's library and yet has never been made aware that any special organization, such as the Library Service Bureau, to which Mr. Cutter refers, was, and is, in operation.

The circular explaining this service shows that its purposes are indeed similar to those which prompted the article last week. The methods adopted, on the other hand, differ materially from those suggested. Those interested can probably obtain the circular by writing for it.

Possibly next to a national library for preserving the originals of interesting illustrations—which, unlike words, suffer in reproduction—the nationalizing of library facilities for research would seem to be the most interesting subject connected with libraries in which the automobile industry and its engineers are concerned, and it may be entitled to be viewed from many angles.—M. C. K.

Boillot—Chevalier of the Legion

Dramatic Death of the Speed King of Europe

GEORGES BOILLOT

PARIS, June 3—About 6 o'clock on the morning of Saturday, May 20, Flight - Sub - Lieutenant Georges Boillot reported for duty to the officer in command of squadron No. 49, in the neighborhood of Verdun, and a few minutes later went aloft aboard his single-seater Nieuport 100 m.p.h. scout machine. On his uniform Boillot bore the red ribbon indicating that he was a Chevalier of the Legion d'Honneur, a decoration which had been awarded him a few days before in recognition of his bravery in aerial encounters. But he was not perfectly satisfied. Speed King of Europe, he was only one of hundreds of aviators, and far from best known. Opportunities had not presented themselves of showing that he could be as brilliant in the air as he had proved in many a fierce competition on the road.

As a scout pilot, Boillot's task was to keep away enemy machines, thus allowing the French observation planes, with a speed of only 60 m.p.h. and slow in their movements, to carry on their work of photographing and observing the effect of artillery fire without molestation. Away to the northeast beyond the outer-forts of Verdun, where French and Germans had been struggling day and night for 3 months, Boillot dimly observed the outlines of three enemy machines. The numbers increased to five—Albatross biplanes each with a couple of men aboard, and each armed with two machine guns. The Frenchman was alone with a single machine gun, at a height of 9000 ft., with only one feature in his favor: his Nieuport was faster and quicker on its controls than the German aeroplanes.

A Daring Attack

Most men would have dived for home or given the enemy an exhibition of speed until reinforcements had come up from below. Boillot's only idea was to attack. He had been waiting for such an opportunity for weeks. What really happened 9000 ft. above the battlefield on that beautiful May morning cannot be told, for the leading actor in the drama is no more. Speeding out to meet the invaders, Boillot tackled the leading machine before the others could come to its support, and sent it crashing down to the French lines. A few seconds later the observers saw the four remaining machines deploy for a converging attack on the swift French biplane. The machine guns got into action; their smoke was visible, but no sound could have been heard even had there been no artillery bombardment at the time. Suddenly Boillot's machine staggered, then dived, then capsized. A human form was seen to fall clear of it: the pilot was dropping earthwards a distance of nearly 2 miles. As nearly as could be observed, the aviator fell into a forest surrounded by bog land to the northeast of Verdun, not far from Douaumont fort; the wrecked biplane came to rest in the branches of some trees.

Immediately two automobile drivers volunteered to go in search of the dead man's body. One of the cars failed to return: it was hit by a shell and its occupants perished. The other came back a couple of hours later with the almost unrecognizable remains of the man who had gone forth that morning rejoicing in life and confident in his power to overcome all difficulties. The medical examination showed that Boillot had received a bullet in the head and another through the heart; it was thus only a corpse which had been thrown into space as the aeroplane capsized. The following morning a simple military funeral took place at the village of Vadelaincourt, 4 miles to the south of Verdun. There were present only officers and men from the aviation corps. No civilians entered that rapidly filling cemetery; not even the dead man's wife, father, mother, and brother had been allowed to penetrate that death stricken zone. As the burial party moved out of the graveyard shells began to fall around the place.

There are men who have won as many automobile races as Georges Boillot, but not one who managed to bring himself so prominently before the public or to secure such an incontestable right to the title of Speed King. Boillot's beginnings were modest. Born in Paris 30 years ago of parents of moderate means, he first worked in the dry goods trade, but had an ambition to become a professional cyclist. He figured as an amateur, and ran in a few amateur bicycle races, but had to recognize that he had not the time or the means to train for the profession. He entered the Peugeot factory as a mechanic and was later transferred to the drawing office of the main establishment at Audincourt.

Soon after completing his compulsory military service, Georges Boillot joined the Lion Peugeot racing team, winning fame at Dieppe and Boulogne. In 1911 the Peugeot company decided to run in the big car races and Boillot became head of the team. Goux was his lieutenant, Paul Zuccarelli was called in, and technical matters were in the hands of Ernest Henry, a young Swiss engineer who knew everything about high-efficiency motors but little about chassis.

His Rise to Fame

This new team set to work building cars for the French Grand Prix of 1912. Boillot won that 2-day race at Dieppe, defeating, among others, Louis Wagner and David Bruce-Brown. Working in the same way, Boillot's team won first and second places in the 1913 Grand Prix. By this time Boillot was recognized as the best driver in Europe and the racing Peugeots were the most-copied cars in the world Mercedes team-work beat him in the 1914 race, his car going out with a broken valve toward the end of the race.

Boillot visited America only once, for the Indianapolis 500-mile race in 1914.

Preparedness and Motor Trucks—Part II

Special Military Vehicles Such as Automobile Searchlights, Kitchens, Ambulances and Repair Shops—Use of Motor Buses as Transports

By Donald McLeod Lay

PRACTICALLY all special army vehicles have twin pneumatic tires on the rear with a housing around them brought as low as possible compatible with clearance. In some cases band tires are fitted on the front wheels without protection, the wheels being either cast steel or steel disks. Other special machines are motor work shops, aeroplane tenders and trailers.

Use of Disk Wheels by Italians

A distinctive feature of Italian construction is the use of disk wheels for trucks up to 2-ton load. These are detachable by unscrewing five or six nuts and are easy and cheap to construct, consisting merely of a stamped steel disk riveted and welded to a steel rim.

The trucks most frequently used by the Italian army are 4-tonners, while the smallest are 1-ton trucks on pneumatic tires generally with twin tires on the rear wheels. The Italian army employs a much greater proportion of pneumatic trucks than any other European army due to the adaptation of touring car chassis to truck work instead of having special truck designs. This arrangement is not most economical because all Italian trucks are driven too fast and tire upkeep is enormous.

At the end of the first 7 weeks of the war the motor transport service had settled down to business, and the weaklings and unsuitable types which were pressed into service too hurriedly had been abandoned and replaced by new trucks from the English factories. Classification of the trucks had also been made so that it was no longer necessary for 5 m.p.h. machines to keep pace with 12 m.p.h. vehicles.

Originally, the plan was to make use of motor trucks for carrying supplies from the railhead to a point a couple of miles back of the firing line from which point distribution was made to the men by horse-drawn wagons. Before October, 1914, this plan had been altered, the trucks going right up to the firing line and delivering direct to the men in the trenches. This system exposed the trucks to fire and caused several to be lost, but the time gained was considered sufficient justification for its continuance.

A motor convoy under fire is in less danger than a number of horse-drawn wagons, and although the trucks are far from bullet-proof, it is surprisingly difficult to put them out of business, many of those at the front being speckled all over with shrapnel shot without having their running qualities affected in the least. Compared with the horse, the modern motor is a very small target, and unless a bullet strikes the cylinders or goes through the radiator the vehicle is not likely to be incapacitated. Automobile captures were rare during the early part of the war, the vehicles being wrecked when it was necessary to abandon them.

Ambulance removing wounded French soldiers from the front

Comparing the mobility of troops and supplies where automobiles and motor trucks are used instead of railroad trains, it was stated in November, 1914, that "it takes little to disorganize a railroad, while it is practically impossible to disorganize automobile service."

By the end of October, 1914, it was reported that 3000 American-built motor trucks had been bought for war purposes by the belligerent powers, the bulk of these being fitted with wagon bodies having sides and tail board hinged to swing downward, the sides being provided with chains to hold them in a horizontal position and to make loading and unloading easy. Usually these bodies were supplied with a tarpaulin top supported by a series of removable semi-circular metal bows fitting into brackets at the sides of the body, the whole top looking somewhat like a prairie schooner. Some of the trucks carried bodies of the Russian design in which the platform is not horizontal, the floor bowing down in the center so that it has an arc shape instead of being flat. This is done in order that the loads carried press toward the center, thus avoiding any tendency to slip off at the side.

A Difference of Opinion

All French purchases of American trucks were for 2 and 3-ton models, the orders for 4 and 5-ton trucks coming from English army authorities, showing the difference of opinion as to the value of the two types. Owing to the deteriorated roads, W. F. Bradley pointed out, in February, 1915, that the 3-ton load could be handled with greater advantage.

After the English impressed trucks were sent into France they were painted gray to cover the advertising matter which usually decorated them, and more attention was paid to the protection of the drivers, a high, curved dash surmounted by a leather apron on both front and sides, entirely covering the steering wheel, so that with the substantial wood roof extension the men were well protected from the weather.

French Buses Superior

The Paris and London motor buses were used extensively early in the war for transporting troops, the Paris buses carrying forty men apiece. The London buses were found to over-heat when put to heavy work while the vehicles were incapable of hauling others of equal load and weight. Springs broke frequently, and in fact the English bus chassis proved inferior to the French, which was designed with war service as a possibility. It was merely a case of over specialization.

Motor Ambulances Are Efficient

The motor ambulance most generally used early in the war was a 20-hp. touring car chassis fitted with a large capacity canvas body having mica windows. The body was of sufficient size to carry four stretchers in two tiers, leaving a space down the center for the ambulance attendant. These ambulances would go as close to the firing line as possible, load up with wounded brought in by stretcher men and carry them to the rail head or general headquarters, where they were attended in temporary hospitals before being carried to the rear by trains and finally distributed to the hospitals by more automobile ambulances. The great defect in the organization at that time was the inadequacy of the motor system for removing men from the hospitals just behind the firing line, wounded men frequently having to spend 15 to 20 hr. lying on straw in freight trains when touring cars could have brought them back in 3 to 4 hr.

Heating the Ambulances

The Ford ambulances used by the American ambulance corps in France did excellent service. These consisted of the standard Ford chassis fitted with an ambulance body of wood and canvas capable of receiving a couple of army type stretchers or to carry four wounded men sitting, thus making with the driver and attendant a maximum load of six. For heating these in cold weather a section of stove pipe, bound with asbestos and with the ends closed, was fitted around the exhaust pipe, a lead carrying the heat to a grating in the floor of the car.

Automobile Searchlights Employed

Automobile searchlights form an important branch of the French army, the electric searchlights being mounted on large touring car chassis, the current being generated by dynamo driven from the automobile engine. Six vehicles formed a working section, including a workshop and general stores truck capable of making repairs in the field. These machines were all painted grayish green, to render them inconspicuous. Some of the outfits were arranged so that the searchlight could be carried some distance from the automobile, one having a light steel telescopic tower permitting the light to be raised to a height of 40 ft.

Another way in which motor trucks were utilized was as traveling kitchens, being fitted with a stove and the cook preparing meals while on the road, thus saving time and increasing the comfort of the men.

Handling of Repair Work

After four months of war the repair department was shipping all kinds of vehicles, French, English, German, etc., to a big repair depot 100 miles from the front, where the uninjured parts of the vehicles were utilized in building composite machines if it was impossible to repair them. At this depot there were work shops but no machine tools, most of the truck repairs being undertaken by the car and truck factories.

Wreckage of motor trucks and cars at a repair depot

Mobile repair shops consisting of two or three trucks completely equipped with machine tools, etc., were found to operate most effectively 25 miles from the front, it generally being possible to convert buildings, at various points, into repair shops, the equipment being readily shifted from point to point.

Types of Mobile Workshops

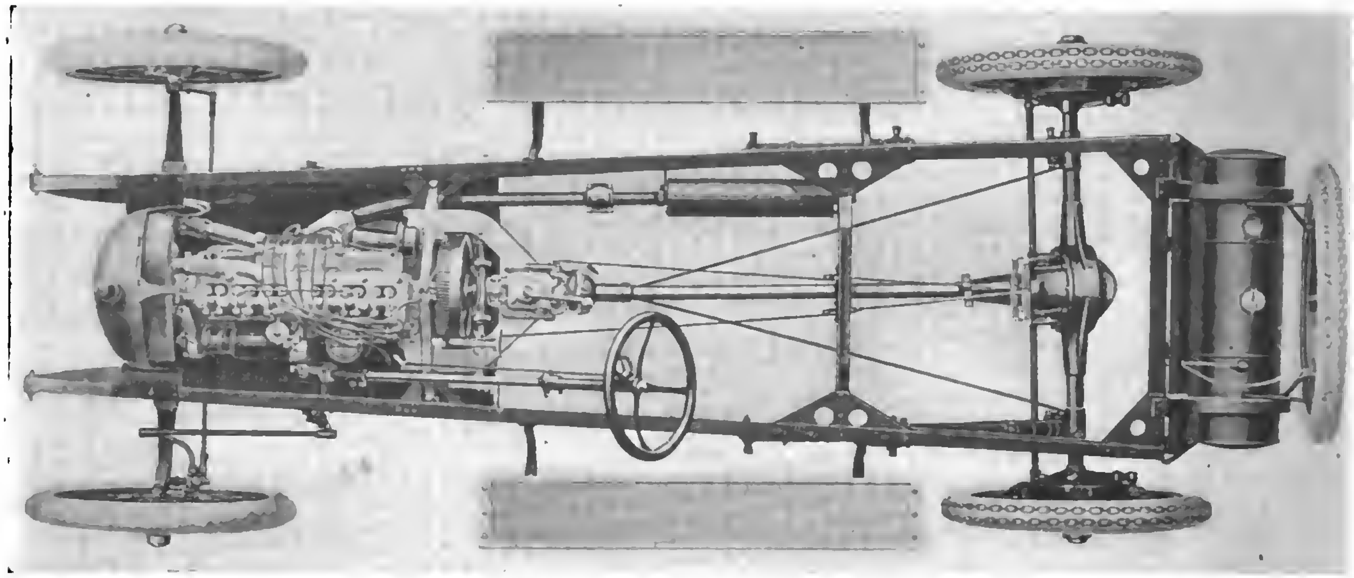
Each division of the British army motor service included three or four motor workshops kept in the open air garage at the depot town. These shops consisted of a heavily built high-wheeled van with sides opening outward on hinges so as to increase the floor space. The roof was made to open, being covered by a waterproof canvas blind on rollers which served to make the whole vehicle waterproof when closed up and also being capable of spreading out as a sunshade. These trucks were drawn by steam tractors and were completely fitted with machine tools, lathe, forge, drills, saws, etc., and obtaining its power from a single-cylinder motor on the ground under the workshop with a belt through the floor.

French Workshops Smaller

The French workshop was smaller than the English, being an automobile chassis with a workshop body, the motor serving both to drive the vehicle and to drive the machinery.

About 50 per cent of the truck casualties were caused by trucks bumping into the machine ahead when operating in convoy formation. Radiator protections must be very strong and fitted with powerful coil springs, the ordinary type of bumper being insufficient. Radiators on armored cars are especially vulnerable points and should be protected from bullets, collisions, etc., without impairing their cooling abilities. Of course, other motor vehicles are likely to be similarly injured and at least some protection should be afforded the radiators, especially if the machines are used anywhere near the firing line.

Left—Buick with a powerful searchlight for aircraft work. Right— Ambulance corps sheltered from aeroplanes in clump of trees



The Grant six chassis for 1917. Note that the valve rocker cover plate has been eliminated, as the car owner frequently failed to remove it to oil the valve mechanism. A Wagner electric system and a Stromberg carbureter are fitted for the coming season

Better Bodies Feature 1917 Grant

Fitting of Wagner Two-Unit Electric System and Stromberg Carbureter, Dropping of Valve Rocker Cover Plate and Quieter Operation Other New Developments

AMONG the first to make announcements of new cars for the coming season is the Grant Motor Car Corp., now located at Findlay, Ohio, but which is shortly to move to Cleveland. This concern has lifted the veil from what is undoubtedly the best-looking vehicle yet produced under the Grant name. It is model K, and is entering the moderate-priced six-cylinder field for the 1917 selling year.

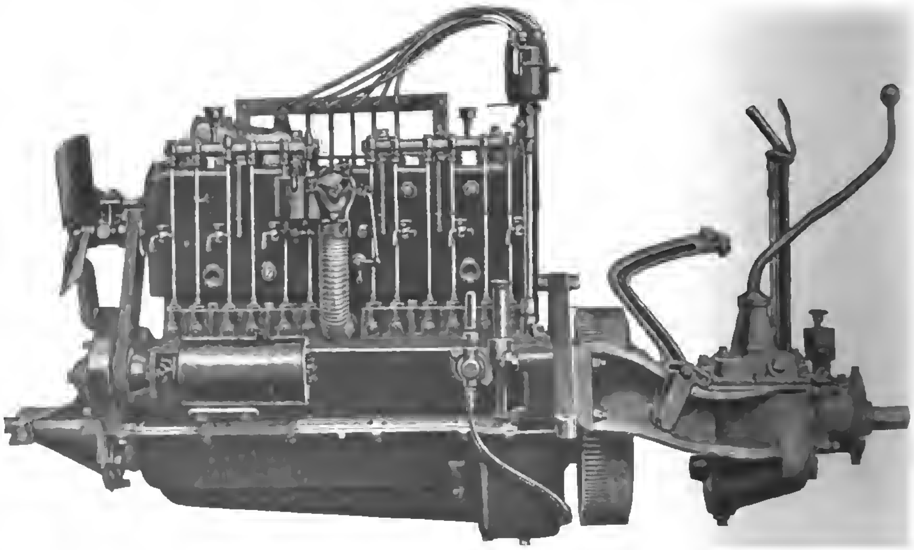
Although the most noticeable change over the previous Grant six is in the body lines, there are a number of other improvements that help to make it a better car. A Wagner two-unit starting and lighting system replaces the single-unit system formerly used, and likewise Remy ignition is fitted instead of the make employed for 1916. Stromberg carburetion is also given a place along with a change in the fuel system from the cowl tank to a reservoir at the rear from which the gasoline is drawn by Stewart vacuum feed. Larger brakes, minor changes in the instrument board arrangement, a larger steering wheel and a standard design of I-beam front axle are also changes of note.

Noise Is Minimized

The matter of silence has also been carefully looked into, and the Grant engineering department has gone over the entire chassis with the idea of making it quieter than its predecessor. This greater silence of operation has been brought about in the power plant, in the running gear and in the springs.

Practically no change has been made in the 3 by 4¼ overhead valve, block-cast engine with the exception of those minor differences due to the fitting of a separate starting motor and separate generator, and the use of a different carbureter. One unusual change is in the elimination of the cover plate that previously was fitted to the top of the cylinder block to house the rockers and valve stems. There is a good reason for this. It was found that in the hands of the average owner, the valve parts did not get the proper lubrication due to the fact that it was necessary to remove this cover plate to get at them. Although this was not a difficult thing to do at all, it was more trouble than some wanted to take, hence they neglected to lubricate the parts in question. So in order to make it as easy as possible to take care of the rockers and their bearings, it was decided to do away with the cover, and large and convenient oil cups are provided to take care of the proper lubrication of the rocker shafts, of which there are two.

The new Stromberg carbureter connects directly to the



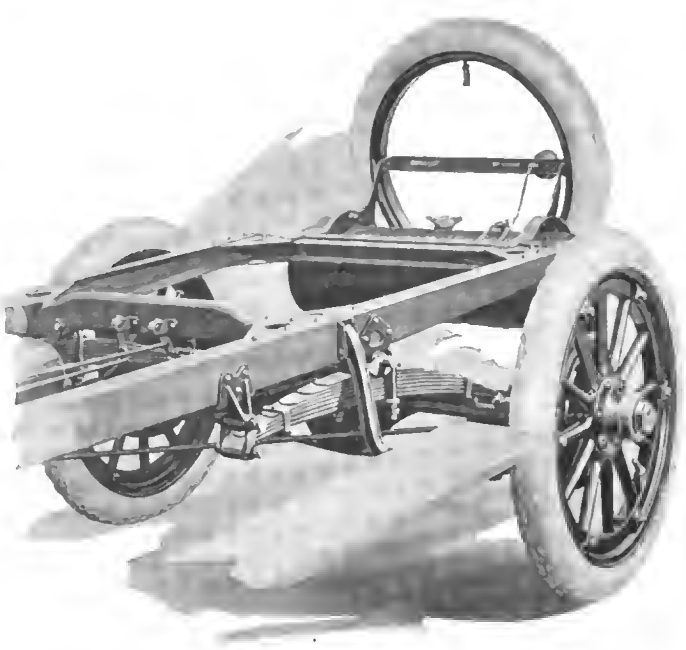
Intake side of Grant six for 1917, showing high carbureter mounting and ignition distributer. Note generator drive and hot-air connection for carbureter cylinder head, with the distribution of gas to the several cylinders done within the casting itself. In the previous design, there were two inlet connections in the head unit, and a double-branch manifold connected externally from these to the carbureter. Now there is no external manifold whatever so far as the inlet of gas is concerned, and the new attachment permits of the carbureter being placed higher on the engine so that it is more readily accessible, to say nothing of being conducive to better carburetion because the gas has less distance to travel. This higher mounting is of course made possible, in a large measure, due to the removing of the gasoline tank from the cowl and placing it at the rear of the chassis. It was necessary to have a good head on the gasoline when it was fed by gravity in the previous model.

Although the make of ignition apparatus is changed to Remy, the method of drive and the location of the distributer are not changed. Driven off the end of the camshaft, the vertical distributer shaft occupies the left rear side, and the distributer is high enough to make it easy to reach, at the same time affording plenty of room over the top of the valve rockers to allow the wires to be run without interference to the plugs on the right side of the head, a supporting bracket being fitted which carries each ignition lead well out of the way of the valve parts.

Starting Motor Is Separate

Because the starting motor is a separate unit, it is mounted at the right rear side of the engine and the driving connection is made through the Bendix centrifugal-action device to teeth cut in the rim of the flywheel. The separate generator occupies the opposite side from its location on the 1916 engine, being mounted so as to be driven by an extension of the fan-driving shaft on the left, a leather universal coupling allowing for any slight variation in alignment and making a noiseless connection.

Reviewing some of the salient features of the motor, for the benefit of those who are not familiar with the Grant power plant construction, it should be mentioned that the unit is suspended in the frame at three points, the front end resting freely on the front cross member, and the rear being hung from a forged cross member just back of the cylinder block. The main cylinder casting and the upper part of the crankcase are one piece, this making a rigid and compact unit that carries the crankshaft and insures alignment of the cylinders and the shaft. The head casting, which carries the valves and their operating mechanism, is bolted to the main unit, and it is therefore a simple process to reach the cylinder walls and the pistons for inspection, cleaning, etc., when occasion demands.

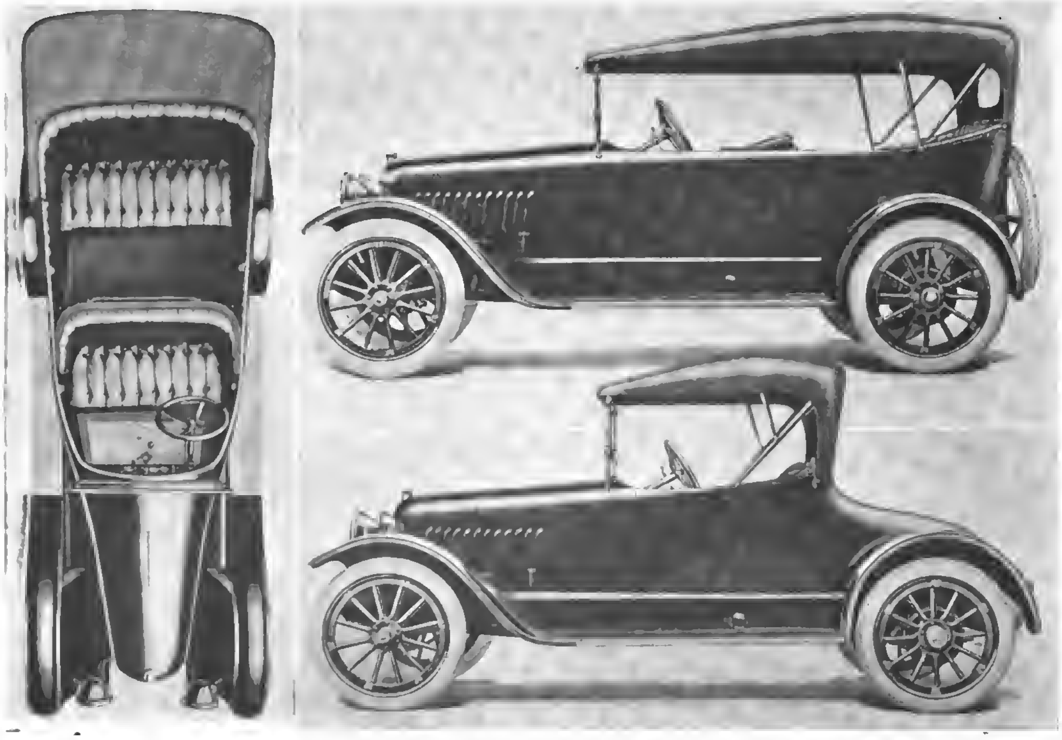


Rear construction of Grant six chassis, showing cantilever springs, gasoline tank mounting and tire carrier

Internally, standard practice has dictated the design throughout. There are three bearings for the crankshaft, these being of the ample diameter of 1 9/16 in., with the lengths 2 19/32, 2 and 3 in., from front to rear respectively. Pistons are made of cast iron and as light as is consistent, each carrying three rings. Three bearings are also provided for the camshaft, which has a diameter of ⅞ in.—ample for an engine of this size —and the cams are so shaped that quiet action is one of the first considerations. One nice feature of the valve assembly is the provision for removal of the tappets and their bushings from the top of the crankcase outside. The tappet assembly for three cylinders is made a unit so far as the mounting is concerned, and by the removal of six holding bolts this can be lifted out bodily.

Timing Gears Quiet

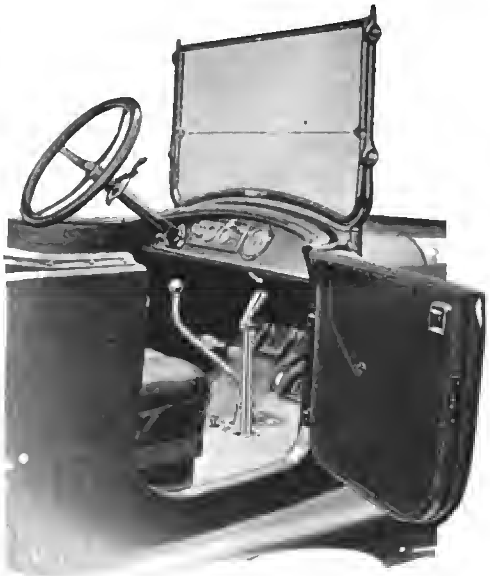
Timing gears are helically cut, the center gear being steel and the others cast iron, so that they run silently together.



Grant touring car and roadster for 1917, showing the new body lines. These models sell for $825 and there is also a cabriolet which lists at $1,050

Driven off the rear end of the camshaft is a plunger oil pump that draws the lubricant from the motor base after it has been strained, and delivers it through a dash sight feed and thence to the front gear case and to the rear of the engine. From this point it overflows into the successive connecting-rod troughs and eventually runs back into the reservoir at the bottom. An oil level indicator, which is neatly formed as a part of the oil pump case, tells the quantity in the reservoir. This is on the left side.

Thermo-syphon cooling is still advantageously adhered to in this car, the radiator being assisted by a pressed-steel six-bladed fan which is driven by a belt, as already mentioned, there being the customary adjustment at the fan mounting for taking up any slack that may develop in the leather. Grant is still using the characteristic rounded-front radiator, which is of a special tubular form, as in previous models.



Driver's compartment of the 1917 Grant, showing the wide door and the arrangement of the control levers. Note the simplified instrument board

The method of attaching the gearset to the rear of the motor by means of two drop-forged arms has not been changed. This mounting leaves the flywheel open, and is a factor for reducing weight to the minimum. The gear assembly is a compact unit having the usual three speeds ahead. To give an idea of its ruggedness, and to make the unit as compact as possible, the countershaft gears are cut integral with their shaft, the forging being blanked out as a single piece. The gears have ⅝-in. face and are of the stub-tooth shape, and in mounting their shafts a double-row ball bearing carries the front end of the mainshaft, a single ball bearing the rear end.

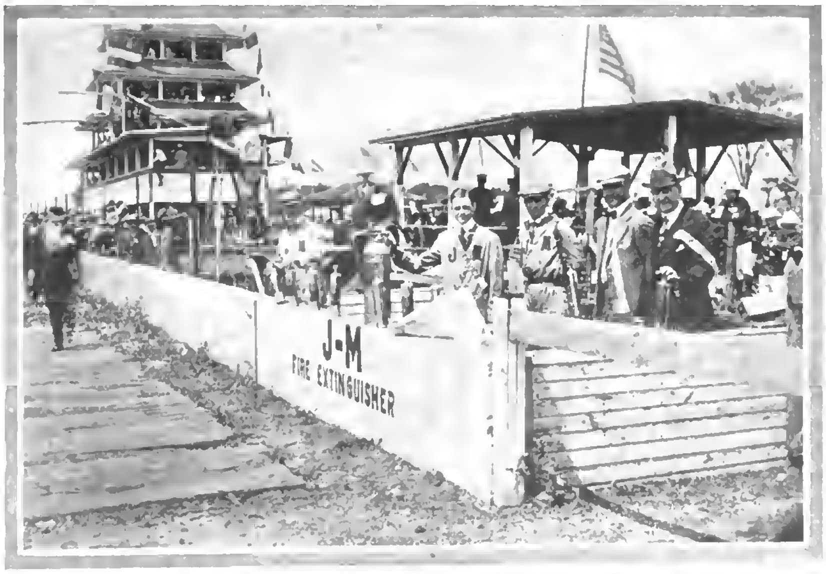
Grant maintains the form of final drive in which the power first goes through a cone clutch, the gearset, then a universal and eventually through an inclosed propeller shaft. The torsion tube inclosing the latter is light and strong to carry the drive and torque and presents a most compact appearance with the rear end swaged out to meet the axle housing. The axle is floating, with means for gear adjustment on removal of the rear inspection plate, this applying also to the driving pinion. A gear ratio of 4½ to 1 is used.

Although the diameter of the brakes has been considerably enlarged, from 10½ to 12 in., there is no other change of importance in the braking system. The equalizer bars are carried at the rear axle on the brake operating rods that are attached forward of the axle tubes. By bringing the equalizers all the way back, side brake operating rods are eliminated, only one control rod from each brake control running back from the supporting cross member.

In connection with the running gear, the previously used front axle, which, though it was of I-beam section, was fitted with some specially-designed steering knuckle mountings and features, is replaced by a standard form with strong and stout steering connections throughout. Nothing has been changed in the rear cantilever spring suspension. These members are 38 in. long by 2 in. wide and give free action due to the trunnioning of the center directly under the frame member and the shackling of the front end, with flexible mounting to the axle tube as well. No change has been made in the 112-in. wheelbase, nor in the tire size, which is 32 by 3½, with non-skids on the rear.

Besides the roadster and touring body types, Grant is offering a cabriolet model as well. The prices are $825 for the two open models and $1,050 for the cabriolet.

J-M Fire Extinguishers at Indianapolis Race



Headquarters of the J-M fire extinguisher brigade at the Indianapolis International Sweepstakes May 30. There were fifty-four J-M men distributed through the grandstands and pits and around the track

HIGH speeds and the hot weather which has come to be considered characteristic of Memorial Day, and the almost invariable accompaniment of the annual International Sweepstakes race on the Indianapolis speedway, constitute very favorable conditions for outbreaks of fire upon either the overheated cars or the track itself. The accompanying illustration shows the headquarters occupied by the extinguisher brigade of the H. W. Johns-Manville Co., New York City, at the recent Hoosier classic which was won by Resta in the Peugeot.

The Johns-Manville company had fifty-four men on the grounds during the running of the race, distributed through the grandstand and the pits and stationed at various points around the track armed with J-M extinguishers. Both the accidents which occurred took place near the J-M service station and, although the men were not called upon to use their extinguishers, they rendered aid to the injured drivers and their mechanicians until the arrival of medical authorities.

The History of the Pneumatic Tire—6

Efforts To Preserve Cushioning Effect While Protecting the Rubber—The Carmont Clincher Tire—Other Interesting Patents — First Pneumatic Tires for Bicycles

The History of the American Automobile Industry—33

By David Beecroft

THE wired method of construction in which the round rubber cord or tire was held in place by a sheet steel jacket, which jacket had ears that extended radially alongside the felloe and were provided with slots and pins by which they were held to the felloe but permitted movement as the rubber under the jacket compressed was one of many attempts to get the cushion effect but protect the rubber from the effect of the road. Inventors who seek this supposed advantage do not know that rubber is quite long-lived; sometimes more so than steel, when exposed to gritty service. The steel being unyielding is scratched or chipped by every contact with sharp stones, whereas the rubber simply yields, and if not loaded beyond its strength comes back to its original shape without losing any material.

The Carmont Patent

The Carmont tire, patented in June, 1887, was a clincher type, solid tire. It had a very wide base and was fitted into a rim much wider than the tire so that it could not roll out or turn over easily. In its center, at the base portion, was a V-shaped groove intended to permit the rubber to yield, the inventor seeming to have known what many experimenters at that time did not, that rubber is practically incompressible. Many later forms embodied this same idea, but the movement of the rubber within the rim often damaged it and eventually caused the tire to come off.

The year 1888 showed a number of patents which afterward became prominent in the pneumatic tire industry. The first of these, to Thomas B. Jeffery, late of the Thomas B. Jeffery Co., in May, was held in a clincher rim by little studs or projections of some harder material, such as metal rivets, which, engaging the overhanging edges of the rim, held the tire in place. In June, a half dozen or more patents were issued to A. W. Thomas and were strictly of the pneumatic variety. Their general principle involved the casing separate from the tube, which casing was held to the rim in some mechanical manner, such as by clamps. Two more patents were issued to Thomas in 1889. These Thomas patents were taken up by George R. Bidwell a couple of years later and the first real manufacturing of pneumatic tires in the United States was begun. Bidwell combined with the Thomas patents a license from the English Dunlop people which had been given to A. Featherstone of Chicago, and believed that he controlled the tire business in America. A factory was established at Sixty-sixth Street, near Columbus Avenue, New York City, and orders were placed with the New Jersey Car Spring & Rubber Co. of Jersey City, N. J., as well as with the B. F. Goodrich Co. of Akron, Ohio. These orders, given in March or April, 1891, were the beginning of the now enormous business of the Goodrich company.

Dubois Solid Tires

In 1888 the Dubois Mfg. Co., of Philadelphia, secured patents on solid rubber tires, one form being D-shaped, held in place by a flat band or wire placed in a hole near the base of the tire. The other was simply a rubber cushion of practically rectangular shape set into a flanged rim and having a groove in its outer surface. Into this groove a steel rim of T section was forced and held in place by the groove. This device was practically a copy of the Dietz device of 1835, excepting for the groove in the rubber and the stem on the metal for holding the two parts together. This stem undoubtedly stiffened the metal very materially and probably rendered the supposed cushioning action less evident. The form retained by the flat band proved more practical and was frequently seen in use in later years.

Other Cushion Types

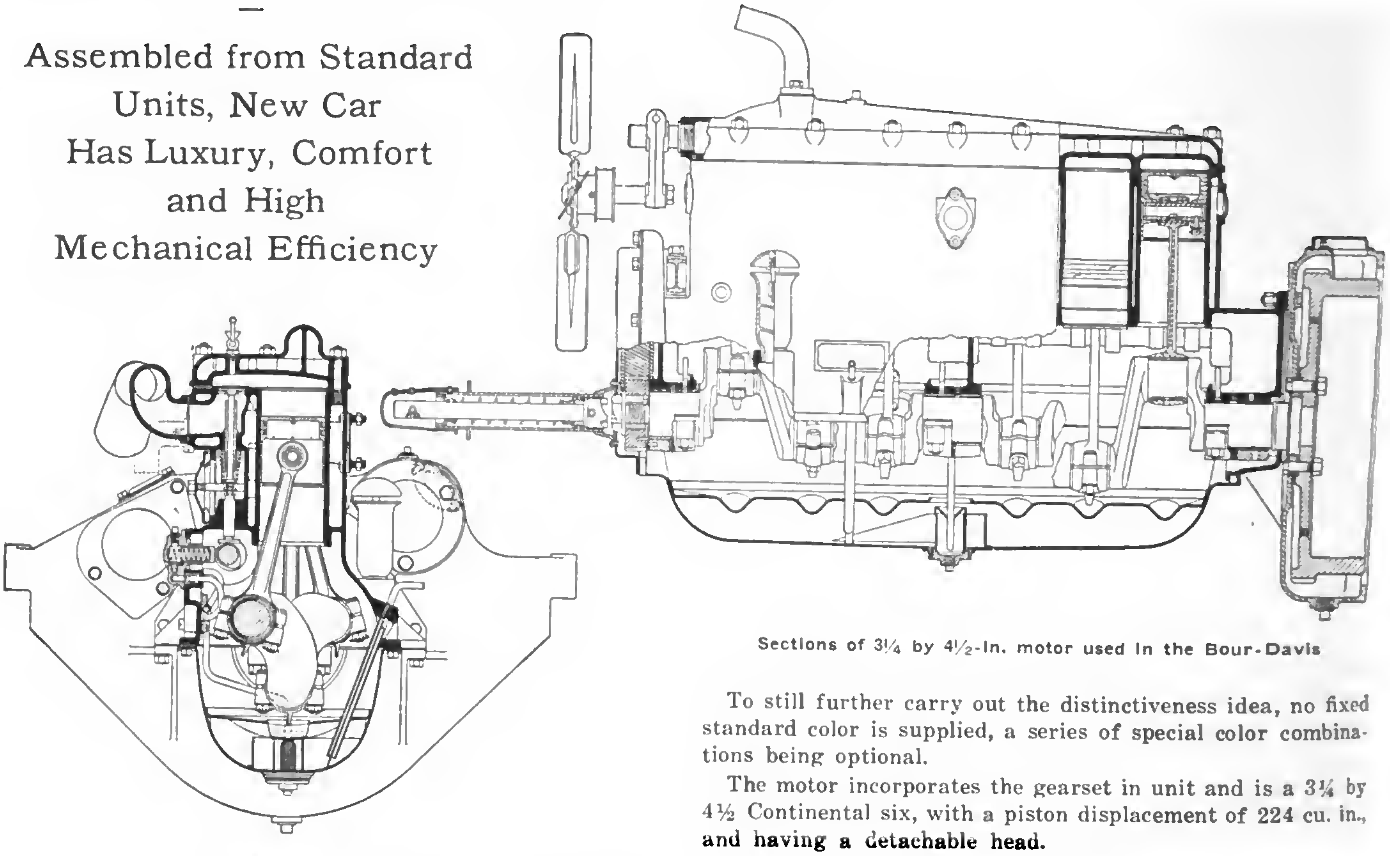
In 1889 we find a cushion tire having a thin sheet of metal in its base and adapted to be forced into a hooked or clincher rim. This was followed by a number of tires in which the crosswise stiffness of the base was expected to hold the tire beads in their places under the hooks of the rim after they were once placed there and until the central portion of the base should be lifted or pushed upward, which permitted the tire to be removed.

Pneumatic Bicycle Tires

In 1889 the first pneumatic-tired bicycles reached this country from England and their introduction was the first use of the air tire in America. This shipment was three New Rapids bicycles from the St. Georges' Engineering Co. to Samuel T. Clark, of Baltimore, Md.

Bour-Davis Six a Distinctive Design

Assembled from Standard Units, New Car Has Luxury, Comfort and High Mechanical Efficiency



Sections of 3¼ by 4½-In. motor used in the Bour-Davis

DESIGNED to meet the requirements of that class of buyers which demands luxury of appointments, finish and detail in a car, along with distinctiveness and individuality, in addition to efficient mechanical construction, the Bour-Davis, which is the product of the Bour-Davis Motor Car Co., one of Detroit's newcomers within the past year, is now formally placed before the public. The thought of the builders in producing the car was to fill the gap in the price class for the luxury type of car between the low-priced type and the high-priced vehicles. The price has been set at $1,250 for the touring car and $1,500 for the inclosed type, the only other form of body offered on the chassis for the present.

The car is a roomy vehicle, made up of standard parts. The motor is a Continental; the gearset is produced by the Detroit Gear & Machine Co.; Borg & Beck make the clutch; Remy supplies the ignition; Stromberg the carbureter, and Ward-Leonard builds the lighting and starting system. Some unusual equipment features are a roomy luggage trunk at the rear, Motometer for determining the water temperature, rear-vision mirror, windshield cleaner, in addition to the generally accepted requisites of the car of to-day.

Bour-Davis touring car which sells for $1,250

To still further carry out the distinctiveness idea, no fixed standard color is supplied, a series of special color combinations being optional.

The motor incorporates the gearset in unit and is a 3¼ by 4½ Continental six, with a piston displacement of 224 cu. in., and having a detachable head.

Crankshaft and camshaft are well mounted to insure minimum of vibration, and each has three bearings. The crankshaft bearings are bronze-backed and babbitt-lined, and their ample proportions are indicated by the dimensions: 2 9/32 by 2½ in., 2¼ by 2⅞ in., and 2 7/32 by 2 15/16 in., these being the front, center and rear respectively, and the first figure in each case representing the diameter. One of the essential features of efficient motor operation is a substantial camshaft that cannot be distorted, and in this motor the point has been well considered, for the dimensions of the bearings are quite large. The diameters are 1⅞, 1 13/16 and 1 11/16, and the lengths 2½, 2⅛ and 2 11/16 in., front to rear respectively. The cams have wide faces of ⅜ in., and the shaft is driven by helical gears.

To promote smooth running with a minimum of vibration, the connecting-rod and piston assemblies are all weighed and the six that enter into the construction of any one engine are of the same weight. The rod runs in bushings at both ends, that at the piston end being of bronze and at the shaft end of die-cast babbitt.

A cam-operated oil pump feeds the lubricant to the bearings and to troughs, from which it is splashed by the rod ends to the various other bearing surfaces within the engine. This is the conventional force-feed and splash combination with which Continental has been very successful. The oil capacity of the pressed steel oil pan that forms the bottom of the motor is 5 qt., the amount held at any time being indicated by a dial.

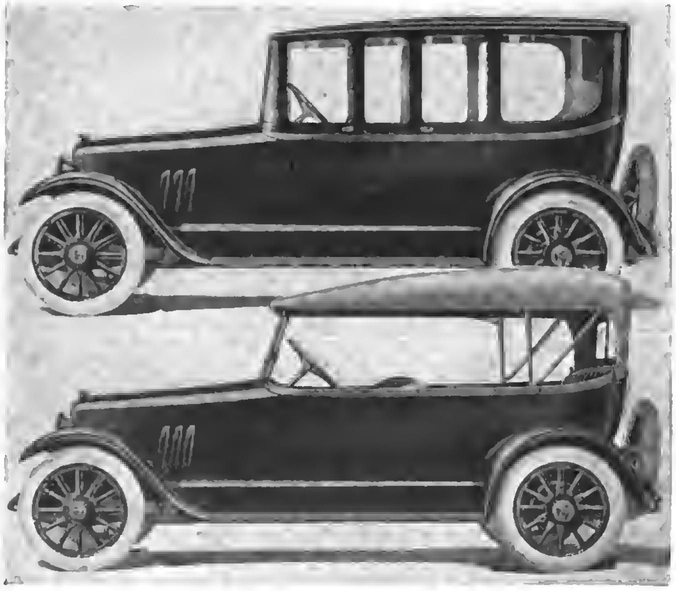
On the right of the engine and forward is the centrifugal water pump which is driven from the timing gears by a shaft. Between this unit and the cylinder block and the radiator the piping is therefore short, with obvious advantage. The water outlet is formed in the head casting and is also forward so that there is only a short pipe connection to the radiator. There is a belt-driven fan at the front, the belt tension being adjustable.

Ignition, starting and lighting units are separate. That is, a two-unit Ward Leonard equipment is provided for furnishing the lights and starting, while a Remy high-tension coil and distributer are used for ignition. The starting motor drives through teeth in the flywheel, meshing and demeshing of the starter pinion and the flywheel teeth being accomplished by the Bendix automatic device. It is only necessary to press the starting button, when the revolving of the motor armature automatically throws the pinion into mesh with the gear, and the operation is reversed when the engine starts under its own power. The generator is driven by the front gears, and connects to a 6-volt, 80-amp.-hr. battery.

In the gasoline system there is combined a Stromberg horizontal-outlet carbureter with a Stewart vacuum feed tank mounted on the front of the dash. The gasoline supply tank is carried at the rear of the chassis, and a very commendable feature of its mounting is the three-point suspension employed so that it does not have to take the strains resulting from any frame weaving, as would be the case were it rigidly mounted.

Back of the engine, the drive passes through a 10-in. disk clutch and the compact unit gearset, in which gears and shafting are of chrome-nickel steel, and the shaft mountings are annular ball and Hyatt roller bearings, there being provision for taking up wear. The spool type of countershaft with its stationary spindle assures smooth and noiseless action and prevents oil leakage. The speedometer gear is driven by the transmission shaft.

In the rear axle, which is of the three-quarter floating construction, nickel-steel spiral bevel gears are used to promote silence and smoothness of operation. Artillery wood wheels are standard equipment, and they carry 32 by 4 tires on demountable rims.



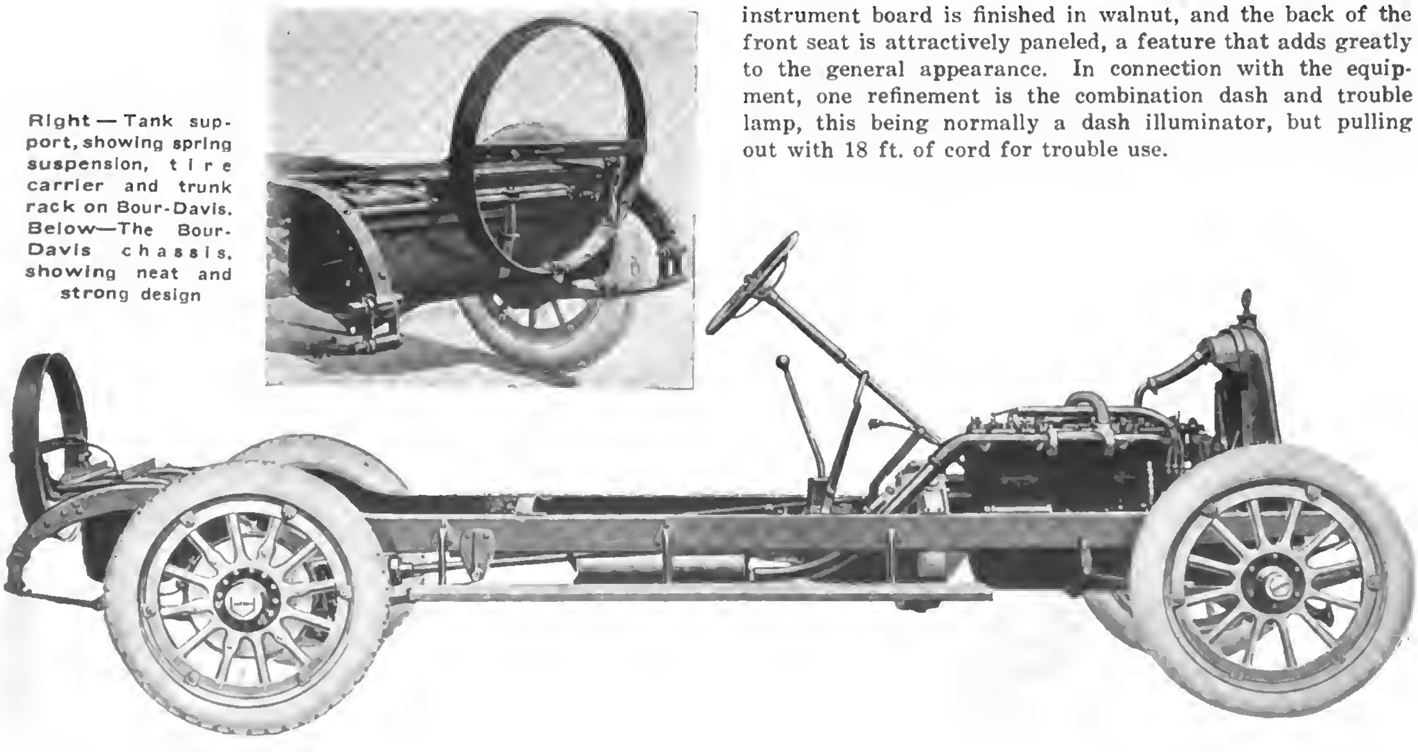
Above—Bour-Davis closed car which sells for $1,500. Below—Touring car model with the top up

Springs, both front and rear, are semi-elliptic and self-lubricating. The front pair is 37½ in. long, and holds the front end of the car in castor fashion, thus counteracting the road shocks. The rear ends of the frame rails are bent down to hold the rear ends of the springs, which are 52 in. long and underslung from the axle.

A tapered frame has been utilized, having a front width of 29⅛ in. and widening to an extreme rear width of 4½ in.

The wheelbase is 118 in. and there is plenty of leg room for comfort. The front seat is 14 in. high, 16½ in. deep and 42 in. wide, and the rear 14½ by 18 by 47 in. The angle that has been given the seats and the shaping is such that they are remarkably comfortable, the designers having this idea of comfort especially in mind when building the body.

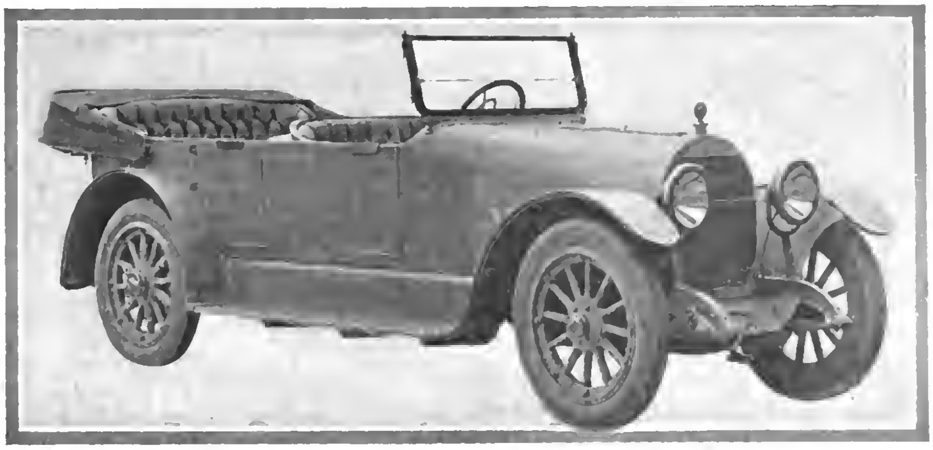
Very excellent coach work has been given the body. The instrument board is finished in walnut, and the back of the front seat is attractively paneled, a feature that adds greatly to the general appearance. In connection with the equipment, one refinement is the combination dash and trouble lamp, this being normally a dash illuminator, but pulling out with 18 ft. of cord for trouble use.



Right—Tank support, showing spring suspension, tire carrier and trunk rack on Bour-Davis. Below—The Bour-Davis chassis, showing neat and strong design

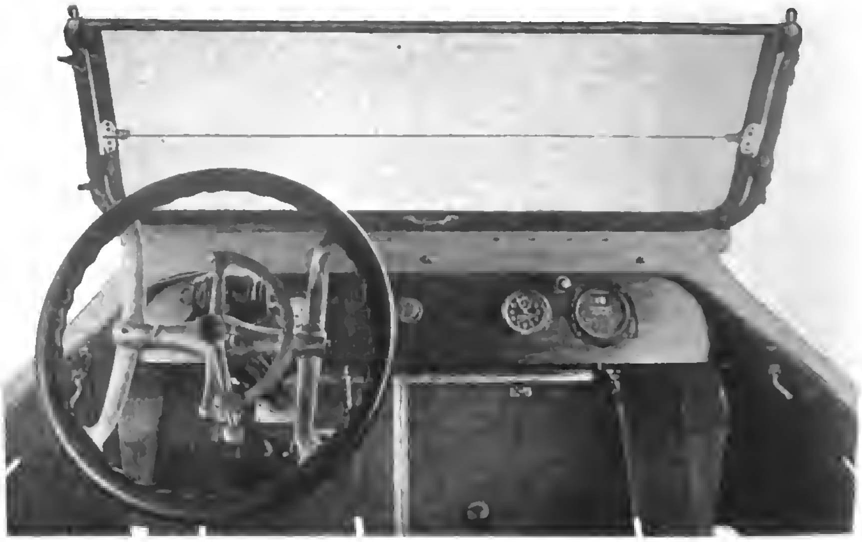
1917 McFarla Chassis—

Built 4 in. Nearer the Gro Wheelbase Is 4 in. Longe More Powerful and Live



The 1917 McFarlan selling at $3,200

MANY improvements distingush the new series X McFarlan, manufactured by the McFarlan Motor Co., Connersville, Ind., the company concentrating on this chassis for 1917 and discontinuing the model T chassis. The new car is striking in appearance, having a very low-hung effect, while the body is roomier than the previous model, being 4 in. longer and 4 in. lower with the top of the body panel only 48 in. from the ground. There are a number of refinements in the chassis also. A six-cylinder, 4½ by 6-in. motor is used similar in design to that employed on McFarlan cars for 6 years. Owing to the improvements embodied in the new car as well as to the increased cost of materials, all open models are now $3,200, instead of $2,990, or $210 higher.



Driver's compartment. Note the tilting wheel and control box on the column

A Teetor power plant is used, and this has several refinements, giving a higher-powered and livelier motor for the same displacement. This has been accomplished by reducing the combustion chamber volume, thus increasing the compression 10 lb., or from 60 to 70 lb., and by providing a new cam action which gives a quicker inlet opening; also the tappets are lighter. The valves are inclined and enter the cylinder at an angle.

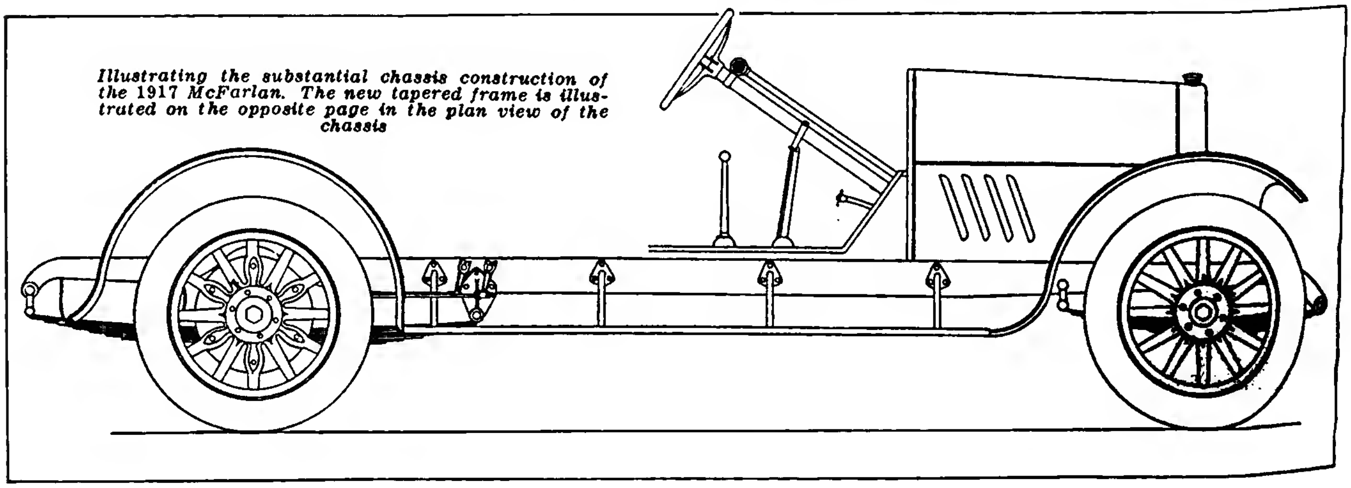
While the bore and stroke remain the same, the connecting-rods are now 12½ in. instead of 10 in.

The spark plugs are now in the centers of the cylinders, designed to act in conjunction with the higher compression in producing more efficient combustion. Another change in the cylinder block is that the cooling water enters at two places below the exhaust valves instead of one. The water pump is now on the right side instead of the left. The exhaust manifold is now a separate casting.

A three plate dry clutch has replaced the cone, requiring a pedal pressure of only 6 lb.

The Brown-Lipe gearbox is still used, but in place of the annular ball bearings it is equipped with Timken bearings throughout. The propeller shaft is now hollow and the universals are Spicers, with one between clutch and gearbox.

Both front and rear axles are Timken. The front axle carries a bearing in the knuckle and the rear axle operates through a splined shaft. On the rear system a change of



Illustrating the substantial chassis construction of the 1917 McFarlan. The new tapered frame is illustrated on the opposite page in the plan view of the chassis

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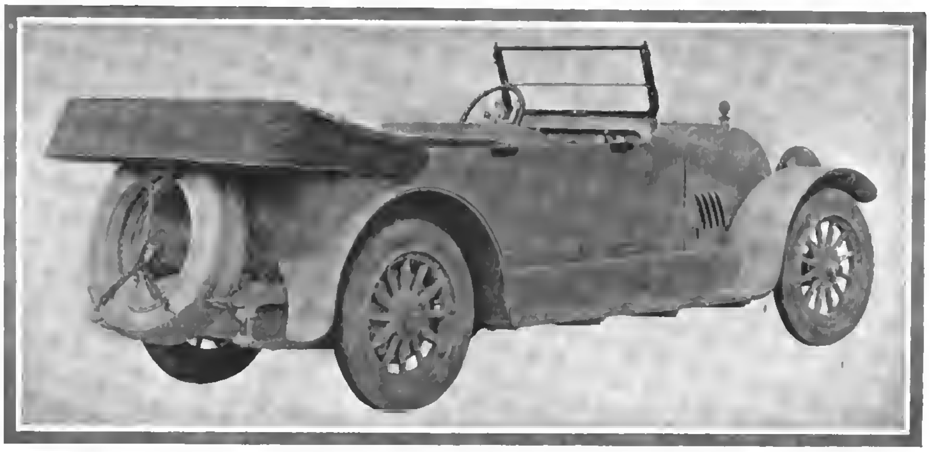
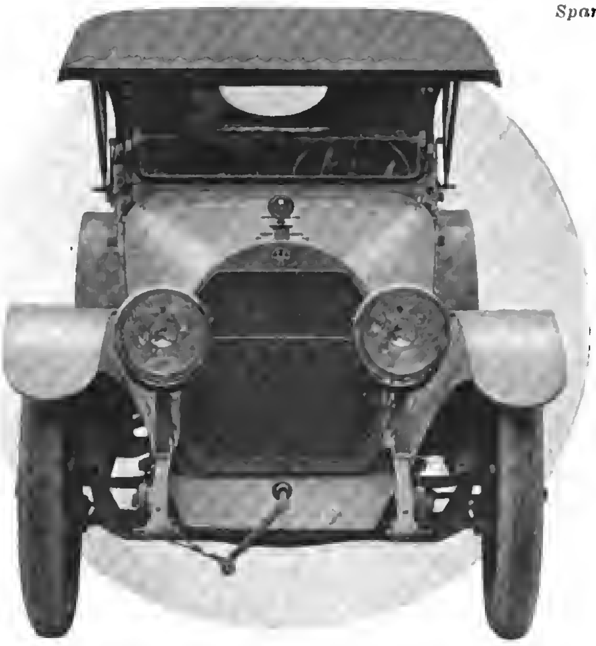


Spare tires are compactly mounted and the mudguard blends into the body



The 1917 McFarlan is built 4 in. lower than its predecessor

importance is in the brakes, which are 17 by 2½ in., instead of 16 by 2½.

The new frame is drawn in at the front in bottle-neck fashion to give a short turning radius. It tapers back to a width of 40 in., and there is a kickup over the rear axle.

The suspension of the car has been changed front and rear. In the front the springs are semi-elliptic, 40 in. in length. The rear has been changed from a 56-in. cantilever to a 62-in. underslung semi-elliptic. The new rear springs take both thrust and torque, giving a full Hotchkiss drive. Bronze bushings have been placed throughout the car at all wearing points. In spite of the changes, the car weighs 300 lb. less than for 1916. Also, the wheelbase is now 136 in., as against 132 in. Aluminum pistons are continued.

Curved cheek counterbalancing is used on the 2⅛-in.-diameter crankshaft, which is supported on four main bearings. The dimensions of these are 4¼ in. long by 2⅛ in. diameter at the ends, and 1⅞ in. long by 2⅝ in. diameter at the center.

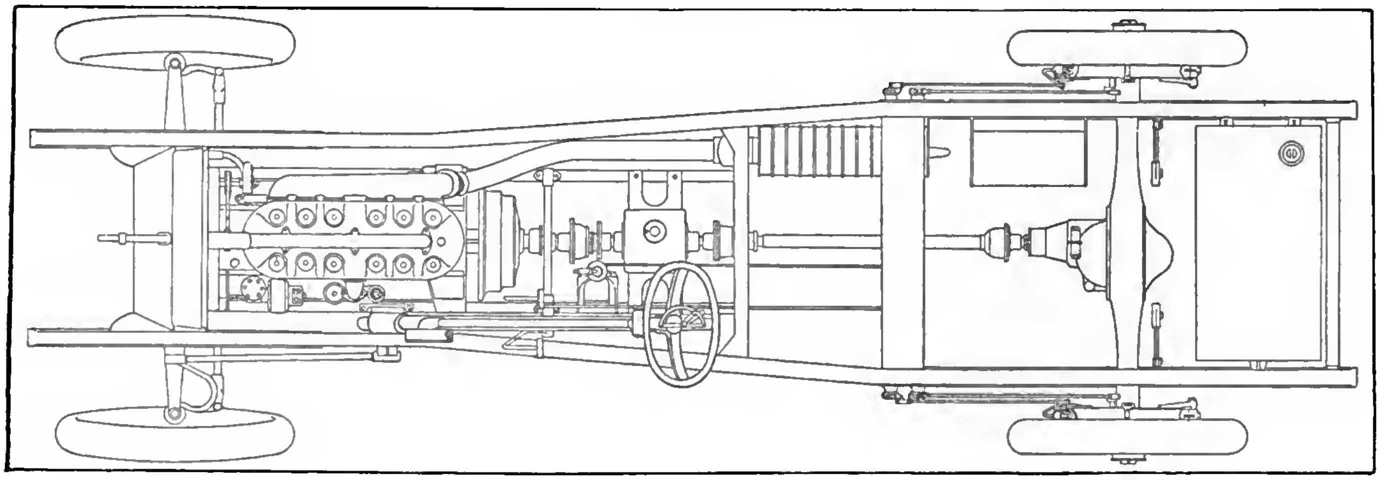
Lubrication is by combined force feed and splash. The oil is fed to the main bearings under a pressure which varies from 5 to 30 lb. under different engine speeds. The connecting-rods and cylinders are taken care of by the Teetor patented system, in which the splash level is variable and controlled by gravity.

The electrical system is centralized in a control box on the steering column, and all wiring is in the chassis, so it is only necessary to pull out two connectors when changing bodies. The steering wheel tilts and is equipped with an electric warming device for winter driving.

Electrically the entire car is Westinghouse. The generator and ignition unit is mounted on the left side of the engine and the starting motor is on the rear at the right side.

The body is of the true double cowl, streamline design, with the exception that the front backs are raised slightly out of this cowl to allow a higher and heavier upholstering than has formerly been used. The same scheme has been followed out in the rear seat; the raise, however, being completely hidden by the back curtain and back stays which are carried around the corner of the body.

The auxiliary seats fold into a cabinet and are hidden by flexible wooden curtains.



ACCESSORIES

Cozy Camp Trailer

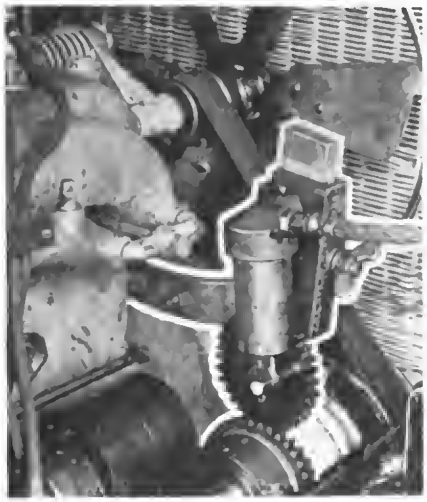
THIS combination trailer and camp outfit, as may be seen from the accompanying illustrations, is of neat design and strong construction while the equipment is very complete. The trailer is fitted with selected second growth hickory and solid rubber tires, the axle being 1¼ in. diameter of high grade specially tested steel with ball bearing spindles. Springs are of platform style with hard wood cross sills providing support for the body, which has high side and end panels strongly braced with wrought iron. It contains the built-in removable refrigerator and removable drawers for carrying accessories. The tent is of heavy, closely woven waterproof duck with screened skylights for ventilation and light. The equipment comprises two double spring beds for large bed mattresses, table, cook stove and the refrigerator already mentioned, the maker reserving the right to alter the specifications in the matter of improvements. The maker provides a swivel hitch for attaching to cars on which it is possible to reshape the rear irons to suit. When this is not practicable, an axle hitch is furnished at the same price, the entire outfit including the trailer, the equipment specified and a rigid weatherproof canopy deck selling for $165 f.o.b. Indianapolis, $25 with order, balance on receipt of shipment.—Cozy Camp & Auto Trailer Co., Indianapolis, Ind.

Adams-Williams Convertible Top

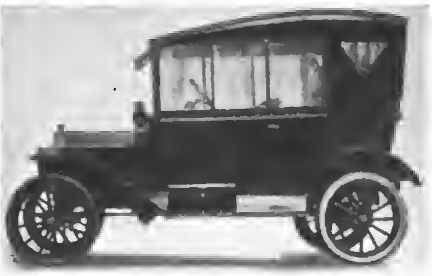
This top consists of a set of glass sides which cover over the open space usually closed by the side curtains. It may be put up or taken down in 3 minutes it is said, and from the inside of the car. It is made for all cars. Prices, $60 and up.—Adams-Williams Mfg. Co., New York City.

Alben Jack and Crane

While this device resembles a portable crane with a bifurcated base and ball-bearing caster wheels, it differs in that the boom or arm to which the chain is attached moves upward bodily, the upright part sliding in a hollow column and being actuated by a hand-crank, through gearing. The gearing gives two speeds, one for heavy loads and the other for light loads and quick lowering. Another feature is a jack arrangement, consisting of a pair of arms hinged to the sliding upright, so that they can be inserted under the load and the load raised by turning the crank. The arms can be swung to any angle and can be moved back out of the way when not needed. Minimum boom height, 6 ft. 4 in.; maximum, 9 ft. 3 in.; length of jack arms, 26 in.; weight of complete machine, 300 lb. It sells for $85.—Alben Co., Milwaukee, Wis.



Juleco power pump for Maxwells



Adams-Williams top for Fords

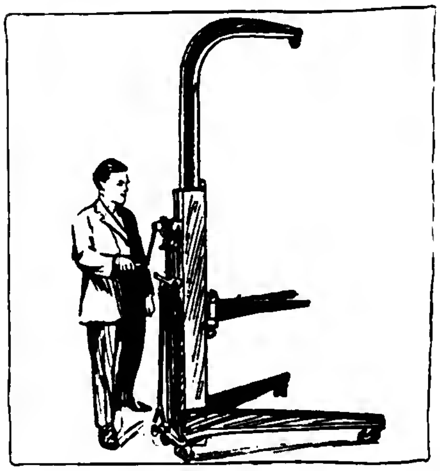
The Cozy Camp outfit open

Juleco Pump for Maxwells

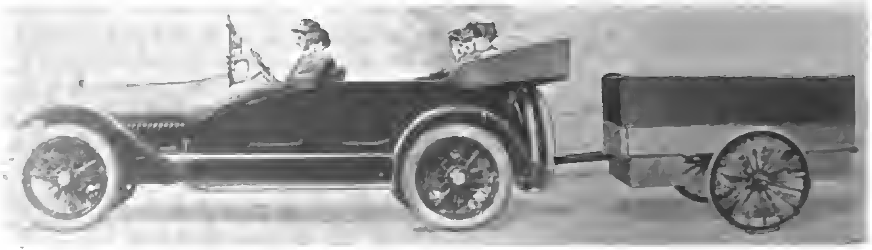
This pump has been brought out to supplement the Juleco line for Ford and Metz cars. The new design for Maxwells is similar to the Ford type and its efficiency is said to be practically the same. It is quickly attached without drilling or mutilating the car or engine in any way, being conveniently located behind the fan on the forward end of the motor as shown in the accompanying illustration, slides in and out of mesh very easily. Some of the features are: Pumps tires in 2 to 3 min. at 425 r.p.m.; has a Wear-Better plunger; requires little attention, only a few drops of oil on the bearings occasionally; satisfactory operation and all parts are guaranteed. Price, $6.—Judd & Leland Mfg. Co., Clifton Springs, N. Y.

Potstada Shear

This bench shear for cutting metal will work steel plate ⅛ in. thick. The shear is of forged steel and the handles and stand of malleable iron. The stand has a lug for gripping in the vise. There are but seven parts in the tool and all are numbered for easy identification in case of breakage. Price, $7.50.—C. Groos, Racine, Wis.



Alben combined lifting jack and crane



The Cozy Camp trailer outfit packed and attached to the car

The AUTOMOBILE

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Military Transport

THE establishment of the military transport committee of the S. A. E. makes America the first country to tackle the problem of arranging for emergency in this regard along really rational lines. The German methods of preparation were good, but they are possible only in a country not blessed with a democratic form of government. The British subsidy scheme was a good conception, but it was developed without proper reference to the opinions of the men in the industry who would have made the best advisers. The almost complete uselessness of the scheme when it was put to the test in August, 1914, provides a lesson that American engineers and the American army have not been slow to realize.

Just exactly what will be the duties of the new S. A. E. committee is impossible to tell as yet, but in the main its purpose is to form a connecting link between the army authorities who are experts on the requirements and the industry which is expert in the design and construction of trucks.

The effect of the work to be done may not be noticeable for some time to come, but after several years it cannot help but raise the efficiency of preparedness from the transportation angle. Transportation is a chain which binds together the army and the suppliers, neither is any good without the other, and in that great chain the S. A. E. committee is one of the most important links.

The Best Yet

THE trip which the S. A. E. started on Monday last is unquestionably the best organized as well as the most largely attended excursion in the history of the Society. Its program of papers and discussions has never been approached for variety or for average excellence, and the subjects chosen have never been more closely in accord with the vital topics of the day.

One of the most striking things is the fact that the breadth of outlook indicated by the papers program is so entirely representative of the increasing breadth of the responsibility of the automobile industry. To-day the word "automobile" is coming to be regarded more in its true sense. Not only passenger cars, but trucks, tractors, aeroplanes and even motor boats are automobiles in the dictionary definition; they are self-propelling machines. There is no fundamental difference between the tractor and the aeroplanes, and a great fund of common knowledge is necessary in designing either one of them. This the S. A. E. has realized, just as the engineers themselves have realized it, and the trend of present events shows clearly that the past work of the society is being appreciated by both extremes of the profession.

Small Output

DESPITE the enormously increased productions of the past few years, and despite the tendency to group factories together so that the aggregate output is immense, it is still easy enough to obtain capital for a very different sort of car making. There are a good many firms now in existence making small quantities of very high grade cars, selling them at a very high price and with a big profit per car, but there are not so many small firms making a medium price vehicle.

The man who wants a really distinctive car of good, sound construction and whose limit of price is about $2,000 has not a great many machines from which to choose. He can get a wide range of models around $1,250, but is often willing to pay an extra few hundred to get something that is *not* produced in large quantities. Mechanically an excellent chassis can be assembled from the best parts for under $1,000 and it is then possible to make the retail price anything from $1,200 or $1,300 upward, according to the degree of finish on the body and the quality of the accessories. Lasting good finish is still not cheap, and first grade accessories command a price commensurate with their durability and good appearance. For the first class body and the highest grade of fittings many people are willing to pay; and they will pay, too, for a car which they can recognize as theirs from a distance of a couple of blocks.

To suit this class of consumer only a limited number of cars can be built, for a large output defeats the purpose of the maker. Thus, however large the major concerns in the industry may become, there is always sure to be room for a number of small factories producing medium price cars.

N. A. C. C. Approves Service and Repair Parts Policies—Defines Standard Truck

Puts Service Standards on Fair and Definite Basis with All Purchasers of Passenger and Commercial Vehicles —Policies Are Outcome of Service Managers' Convention

NEW YORK CITY, June 13—The National Automobile Chamber of Commerce has approved a form of standard service policy to be put into effect between the members and the purchasers of their cars, and has also approved a standard repair parts policy to become operative between the manufacturers and their distributors and dealers.

These two policies are the outcome of the service managers' convention held in Detroit last year, and embody the results of careful study and recommendations made by the service managers' associations of Indiana and Michigan, organized last year, and of the two special committees appointed by the N. A. C. C., of which Percy Owen (Liberty) and E. T. Klee (Stutz) were the chairmen.

The service policy is as follows:

N. A. C. C. STANDARD SERVICE POLICY

The Blank Motor Car Co., through its dealers, aims to give all purchasers of Blank cars uniformly fair, courteous and businesslike treatment and to assist them in every reasonable way to keep their cars in good running condition.

The principles of this policy are:

First—To fulfill the obligations assumed under the manufacturer's warranty.

Second—To furnish repair parts as promptly as possible at our current prices.

Third—To maintain facilities for making repairs, adjustments and do general overhauling in a prompt and competent manner at reasonable charges.

Fourth—To make inspections and adjustments, not necessitated by neglect or abuse, free of charge for 1 month following delivery of a new car to purchaser, and thereafter at our regular prices.

Fifth—To furnish printed instructions in the operation and care of our cars.

Sixth—Service to be rendered does not include furnishing repair parts or labor without charge, except as provided in the warranty and in the following specific clauses of this Service Policy.

Replacement of Defective Parts

(a) Within 90 days after delivery of a new car to purchaser the Blank company will furnish, free of charge at the factory, duplicate parts to replace any parts as covered by our warranty that are returned to the factory with shipping charges prepaid and which are determined by the company to have been defective in material or workmanship, or it will put such parts in condition as good as new without charge.

(b) Within 90 days after delivery of a new car to the purchaser the dealer will install, free of labor charges, any parts that the factory furnishes or repairs free of cost to replace any parts determined by the factory to be defective, the purchaser to assume cost of replacement parts and installation of same pending factory decision.

(c) The party returning the parts will be notified promptly of the decision of the factory regarding allowance of a claim for replacement or repair of parts returned.

Inspection and Adjustment

(d) Cars brought to service stations maintained by factory, branch or dealer will be inspected and all necessary adjustments will be made as in paragraphs (e) and (f) without charge during the first month after delivery of a new car to purchaser, provided the car has not been tampered with or injured by accident or neglect. After the first month adjustments will be made at the regular charges of the service station.

(e) Inspection includes examination and report of the condition of the car.

(f) Adjustment includes only such adjustments as inspection has found necessary to put the car in good operating condition.

(g) Every dealer is expected to give the same inspection and adjustment service on the cars made by this company without regard to the territory in which they were bought.

Repairs, Replacements, Etc.

(h) All work not included in inspection and necessary adjustment during the first month, or installation of replacements under the warranty, will be charged for at regular rates.

(i) When any charge work is to be done and the cost can be estimated in advance, the owner, upon request, will be advised of the amount of charges before the work is begun.

(j) When it is necessary, for the convenience of the owner, to render service at a distance from the service station, the time spent by employees going to and from the job will be charged for at the regular rates of the station, together with all proper expenses of making the trip, cost of shipping parts, if any, and other necessary incidental expense.

Overtime Work

(k) Any overtime, holiday or Sunday work done upon the request of the owner will be charged for at the regular overtime rate.

Instructions in Care and Operation

(l) Instructions in printed form regarding the care and operation of the car and its accessories, and proper method of ordering and returning parts, will be given the purchaser upon the delivery of the car.

(m) Personal instruction will be given in accordance with the agreement between dealer and customer at the time of purchase.

General

(n) For service and replacements on engine starters, batteries, magnetos, generators, lamps, carbureters, tires, rims or other trade accessories that are not made by the manufacturer of the car, application may be made direct to the nearest service station maintained by the maker of such accessory. Dealers will be provided with a list giving names and addresses of the manufacturers of said accessories.

(o) No promise of service, free repair work, inspection or adjustment, except as herein specified, given or made by the dealer, shall be binding on the manufacturer of the car.

(p) To help the dealer carry out the intent of this Service Policy, the owner is requested to furnish all information necessary to the prompt and proper filling of orders and issuing of credits and to observe the requirements regarding return of parts with claims for replacement.

(Signed) THE BLANK MOTOR CAR CO.

N. A. C. C. STANDARD REPAIR PARTS POLICY

The purpose of this policy is to place the relations between the Blank Motor Car Co. and its dealers on a definite, fair, uniform and businesslike basis.

1. STOCK OF PARTS—The dealer will be required to maintain a minimum stock of both "current" and "service" parts as specified by manufacturers, to be paid for by the dealer on or before the 20th day of month following delivery.

2. CENSORING OF ORDERS—To prevent the overstocking of inactive parts by the dealer or the purchasing of an excessive stock of any parts, the right is reserved by the manufacturer to reduce in quantity the number of pieces of any part or parts ordered by the dealer.

3. INVENTORIES—The dealer will be required to furnish an inventory of current and service parts upon request. The manufacturer reserves the right to send an auditor to verify inventories and reduce or increase stock as he sees fit in accordance with clause No. I.

4. SHIPMENTS TO DEALERS' TERRITORY—So far as possible, the dealer will be required to see that all orders for parts from his territory are placed through him.

5. DISCOUNTS—Discounts to garages or repairshops will be at the discretion of the manufacturer.

6.—DESIGNATION OF PARTS STOCKS—Stocks of parts shall be designated as follows:

(a) **Current Parts**—All parts used in cars of models being produced by the factory.

(b) **Service Parts**—All parts for models no longer being produced by the factory and which have not been superseded by other parts that are interchangeable with them.

(c) **Obsolete Parts**—Parts that have been superseded by other parts that are interchangeable with them.

7. RETURN OF PARTS—

(a) **Defective**—Parts claimed defective under the 90-day warranty must be returned to the factory, with shipping charges prepaid, within 30 days from time defect claimed manifests itself.

(b) Obsolete parts shall be returned only as ordered by manufacturer.

(c) Surplus parts may be returned only by individual arrangement with the manufacturer.

All parts shipped to the manufacturer by dealer shall have transportation charges prepaid and be properly tagged.

8. NOTIFICATION OF OWNER—The manufacturer reserves the right to communicate direct with owners concerning replacement and disposition of parts returned.

9. DISPOSITION OF RETURNED PARTS—The manufacturer reserves the right to dispose, within 30 days, of parts returned without assuming liability unless covered by shipping instructions or adjustment is accepted.

10. PARTS PURCHASED OR MADE OUTSIDE OF TERRITORY—The manufacturer will refuse to consider claims for or accept for adjustment any parts not supplied by him.

(Signed) THE BLANK MOTOR CAR CO.

Definitions of standard truck chassis have been approved by the National Automobile Chamber of Commerce.

The object of these definitions, suggested by Windsor T. White, chairman of the commercial vehicle committee, is to indicate what minimum parts, finish and equipment constitute the standard chassis for gasoline and electric commercial vehicles. The definitions are expected to simplify the compilation of catalog specifications, etc. They read as follows:

WHAT A GASOLINE TRUCK CHASSIS IS

A standard chassis of a commercial vehicle to be propelled by an internal combustion engine shall consist of an assembly of all essential parts of a truck chassis with protective housings, ready for operation on the road, including set of tires attached to wheels; driver's seat with padding or cushion on all chassis rated at 1-ton capacity or more; front wheel fenders; runningboard or mounting step; tool campartment; priming coat of lead on all parts to be painted; pair of front lights and one tail lamp; license brackets; warning signal, jack and a set of tools commonly used for making adjustments and minor repairs on the road.

WHAT AN ELECTRIC TRUCK CHASSIS IS

A standard chassis of a commercial vehicle to be propelled by electricity shall consist of a running gear, motor, battery cradle or box, driving and control mechanism and wiring, with all essential parts, fittings and protective housings thereof, assembled complete ready for operation on the road with the exception of a battery; a priming coat of lead on all parts to be painted; set of tires attached to wheels; pair of front lights and one tail lamp, with necessary wiring installed; license brackets; charging plug and cable; odometer; warning signal, and set of tools commonly used for making adjustments and minor repairs on the road.

Skinner Joins Liberty

DETROIT, MICH., June 9—G. S. Skinner has joined the sales division of the Liberty Motor Car Co. Mr. Skinner has been connected during the past few years with the Canadian distributors of the Hudson company.

Brunning and Benedict Join Oakes

INDIANAPOLIS, IND., June 8—W. H. Brunning and H. M. Benedict have joined the engineering department of the Oakes Co., this city.

French Import Ban in Effect

Barring of American Automobiles, Bodies and Chassis Affects Dealers

PARIS, June 3—On the ground that shipping was required for articles of greater national importance, the French Government has prohibited the importation of automobiles, automobile bodies and automobile chassis. Other articles barred in the same decree comprise such uxuries as pictures, photographs, jewel- y, cameras, etc. Within 48 hr. of the aw being passed, the decree had been igned putting prohibition into force. his rapid action came as a surprise to me dealers who were ill prepared for . It was obvious, however, after Eng- nd's action in imposing first a 33 1/3 r cent duty then prohibition that rance would not be long in following it. Careful observers were aware, too, at the French automobile industry was ing its best to influence the govern- nt toward prohibition of automobile ports.

st Close Agencies

All the agents affected are handling erican cars, the makes of cars being rd, Overland, Buick, Dodge, Maxwell, vrolet and Saxon. These were the y ones doing active business in nce. Generally sufficient stocks are l to keep business going for a couple nonths. After that the agencies may vell close, for they will have nothing e to sell. Although the law is in e, an attempt is being made by deal- to get it repealed. It is pointed out the demand for cars comes from ons who need automobiles in their ess. This is shown by the fact that on as French cars are requisitioned the military American cars are ht in place of them. These pur- s would not be made at the present if the cars were not really neces- By shutting out American cars at e when the home factories are un- to supply, dealers will be ruined eir business connections lost. Thus rench manufacturers are doing elves harm, for they are destroying sses which are essential to their rity in normal times.

s very doubtful if the protest t prohibition will produce any im- e result. The influential leading acturers are enraged at the pos- of America getting hold of the market, and will bring very pressure to bear against any at- at repeal. It is obvious too, that this protective measure becomes ssary at the end of the war, they will not be satisfied to return to their old tariff rate, but will ask for a substantial increase.

Much of the opposition is directed against Ford; yet it is significant that Ford is now building a big factory in England and in the future will supply the Continental market from that source. Thus any preferential tariff among the Allied powers will necessarily admit Ford into the French market on the same terms as cars of entirely English origin. Some members of the industry are inclined to look upon the Ford as a missionary car which will extend the motoring movement. The majority, however, look upon it as a direct competitor.

White Domestic Orders Gain 45 Per Cent in 4 Months

CLEVELAND, OHIO, June 9—Domestic orders of the White Motor Co., this city, have gained 45 per cent during the first four months of 1916. It is reported that 4000 White trucks are being used by the Russian army and that further orders from that country are expected. At the French army's headquarters, 1000 White trucks are held for emergency service, so that not less than 5000 White trucks are in use by the Allied army.

As of Dec. 31, the company's buildings, machinery and current assets amounted to $12,537,275, and total liabilities other than capital stock amounted to $2,013,120, leaving a balance of $10,524,155 in net tangible assets, which is equivalent to 66 per cent on the capital stock.

The net profits for 1915 were $8,700,000, equal to 54.3 per cent on the $18,000,000 stock, and the output was 8100 cars.

The company recently received an order for 800 trucks from the French government, and it is stated that negotiations are now pending for the purchase of 500 more from that company.

465 Packards Shipped to Allies

NEW YORK CITY, June 14—The first trainload of ten will arrive in the freight yards of the Pennsylvania Railroad this week loaded with one of the largest shipments of trucks ever made in this country. The entire shipment consists of 465 Packard trucks, valued at $2,000,000, purchased by Gaston, Williams & Wigmore, for immediate shipment to Russia, England and France. As only two trucks can be loaded to a car, the shipment will consist of 233 specially built freight cars.

Evans with United Truck

GRAND RAPIDS, MICH., June 13—E. C. Evans, formerly with the Packard Motor Car Co., Detroit, has been appointed production manager of the United Motor Truck Co.

Monster Merger Is Abandoned

Complications Arise Causing Entire Plan of $250,000,000 Combine to Be Dropped

NEW YORK CITY, June 14—Quite unexpectedly comes official announcement from John N. Willys, that owing to the failure of the parties concerned in the $250,000,000 merger to come to a definite agreement, the plan has been abandoned. Rumors have up to this time been coming from Wall Street of a hitch in negotiations, but details were not available.

During the latter part of last week an official statement from Mr. Willys had it that a new corporation was to be organized by him and associates in the Willys-Overland Co., which would acquire their holdings of the stock of that company and the entire capital stock of the Auto-Lite Co. The new corporation was to be controlled by Mr. Willys. Among the properties under consideration were those of the Hudson, Chalmers and Fisk companies.

These companies will continue to act independently. It is understood that there were legal difficulties which it was feared might lead to serious complications.

It is stated that the bankers sought to impose certain obligations which the manufacturers refused to adopt and *vice versa*.

In well informed circles attention was drawn to the fact that since the first announcement of the proposed formation of the new concern there has been no definite statement issued as to the capitalization or the basis of stock exchange on which the different companies reported were to be taken over. In spite of this fact an underwriting syndicate composed of William Salomon & Co., J. S. Bache & Co., Dominick & Dominick and Laird & Co. of Wilmington, Del., had been formed.

Corcoran Mfg. Co. Formed

CINCINNATI, OHIO, June 12—Corcoran interests are represented in a new company to manufacture fenders, hoods and radiators for automobiles. Three of the five Corcoran brothers, who were in the recent merger of the Corcoran Lamp Co., the Victor Lamp Co. and the Victor Auto Parts Co., into the Corcoran-Victor Co., are represented in the new concern. They are John J., E. B. and William J. The first-named is president, E. B. Corcoran is vice-president, and William J. is treasurer. W. R. Hughes, formerly sales-manager of the Victor Auto Parts Co., is secretary and sales manager of the new company.

The company expects to be turning out 500 sets of fenders on or about July 1.

Lower Gasoline Prices Predicted

Federal Trade Commission Told of Coming Overproduction at 2-Day Hearing

WASHINGTON, D. C., June 13—Predictions of lower gasoline prices in the near future were made at the hearing before the Federal Trade Commission to-day, because of the recent discovery of oil fields, which, it was contended, will cause overproduction. T. J. James, secretary of the Assn. of Refiners of Kansas and Oklahoma, responsible for this statement, also exonerated the Standard Oil Co. from the charge of putting up the price, and said the upward tendency was wholly natural under the conditions of the oil market. At the time of the rise in price, he said, the Standard Oil Co. held probably 51 per cent of the production properties, but now he thought that the independents held about that proportion of the crude output.

At yesterday's meeting it was charged that the big companies originally started the increase in the price of gasoline through manipulation and through speculating in crude petroleum. It was also brought out, in answer to the preceding charges, that the big companies bought up crude petroleum not for speculation but because experts predicted a famine and the companies were seeking merely to protect themselves.

To Make P. D. Q. Spark Plug

DETROIT, MICH., June 10.—The Wolverine Spark Plug Co., a newly incorporated concern, with a capital of $100,000, has located at 45 Fort Street, East, in the Boydell Building. New equipment is now being installed to manufacture in large quantities a new spark plug called the P. D. Q.

The officers and directors of the company include C. H. Braselton, president; A. Kugeman, vice-president, and P. S. Linton, secretary and treasurer; also F. R. Pence and William Bohleber.

Ludwig Opel Killed at Verdun

NEW YORK CITY, June 9—According to advices from Copenhagen the well-known German automobile manufacturer, Ludwig Opel, was killed at Verdun in May.

3,000,000 Edmunds & Jones Lamps for 1916 Season

DETROIT, MICH., June 8—The Edmunds & Jones Corp., this city, will produce 3,000,000 lamps in the current year and arrangements are being made to handle an output of 4,000,000 lamps in 1917. The output in 1915 was 1,467,119 lamps, in 1914 it was 661,430 and in 1913, 442,646.

The company has $500,000 in cash and gross sales this year are expected to exceed $4,000,000, and net after preferred dividends, of about $15 a share on the 40,000 shares of common stock.

The Detroit plant is now turning out 20,000 lamps daily compared with 16,000 in 1915.

An addition will be made to its Chicago Electric Mfg. Co. plant which will double its output.

Hancock Represents Dort in Antipodes

FLINT, MICH., June 8.—R. J. Hancock, proprietor of the Colonial Trading Co., Melbourne, Australia, has been appointed direct factory representative of the Dort Motor Car Co. in Australia and New Zealand.

Batchelder Joins Dort Sales

FLINT, MICH., June 8.—C. F. Batchelder, for many years sales manager of the John Deere Plow Co., St. Louis, Mo., has become assistant general sales manager of the Dort Motor Car Co., this city.

Smith Is Argo Sales Director

JACKSON, MICH., June 8—W. L. Smith of the Smith Motor Sales Co., Washington, D. C., has been appointed director of sales for the Argo Motor Co., Inc. Mr. Smith has been the Argo distributor in the East and South since the first car was put on the market.

Hilts Joins Puritan Machine

DETROIT, MICH., June 12.—The Puritan Machine Co., Detroit, has appointed M. R. Hilts as assistant to Frank M. Eldridge, advertising manager, appointment to take place immediately. Mr. Hilts was formerly connected with the advertising department of the Oakland Motor Car Co., and of the Paige-Detroit Motor Co.

Morehead Heads N. Y. Goodrich Branch

NEW YORK CITY, June 9.—H. J. Morehead has been appointed manager of the local branch of the B. F. Goodrich Co. Mr. Morehead entered the service of this company in 1905 at its Detroit branch as a salesman. In 1908 he succeeded H. C. Miller as manager there.

Durst Is Delco Publicity Mgr.

DAYTON, OHIO, June 10.—J. E. Durst has succeeded W. O. Waldsmith as publicity manager of the Dayton Engineering Laboratories Co., this city.

Mr. Waldsmith will be general agent for the Delco-Light, the new farm lighting plant. His territory includes the Eastern half of Missouri and about fifteen counties in Illinois.

Gasoline at 11 Cents a Gal.

Rittman Process Enables Production at That Price with Use of Oil Residue

NEW YORK CITY, June 12.—Gasoline may be produced for about 11 cents per gal. by the Rittman process when fuel oil sells for about $1.40 per barrel, the average current price. This oil is the residue from the crude, after the gasoline and kerosene have been subtracted from it. Its price varies throughout the country, averaging at the present time $1.20 to $1.30 in Chicago, and $1.50 to $1.60 in New York. At $1.20 the price is 10 cents and at $1.60, 12 cents. With oil at 50 cents per barrel the cost would drop to 7.8 and with oil at $2.10, the price would be 13.9 cents. These figures are for a $20,000 plant which would have a monthly capacity of about 5000 barrels. Seventeen per cent of the fuel oil becomes gasoline, 10 per cent is lost in the process, and 73 per cent remains fuel oil and may be sold at the same figure at which it was purchased.

COST OF FUEL OIL 50 CENTS PER BBL.

Expense		
5000 bbl. fuel oil at 50c. per bbl.		$2,500
Production cost—		
Labor for 1 month	$560	
Fuel (1050 M feet at 15c.)	160	
Electricity	100	
Repairs	100	
Interest and depreciation, 6 per cent each	200	
Refining cost, 20c. per bbl.	1,000	
Production cost	$2,120	2,120
		$4,620
Credit		
3650 bbl. residuum at 50c. (fuel oil)		1,825

Net Cost

Net cost 850 bbl. (35,700 gal.) gasoline.$2,795
Cost of gasoline per gallon, 7.8 cents.

COST OF FUEL OIL $1 PER BBL.

Expense	
5000 bbl. oil at $1	$5,000
Production cost	2,120
Total cost	$7,120
Credit	
3650 bbl. residuum at $1 (fuel oil)	$3,650

Net Cost

Net cost 850 bbl. (35,700 gal.) gasoline. $3.470
Cost of gasoline per gallon, 9.74 cents.

COST OF FUEL OIL $1.47 PER BBL.

Expense	
5000 bbl. oil at $1.47	$7,350
Production cost	2,120
Total cost	$9,470
Credit	
3650 bbl. residuum at $1.47 (fuel oil)	$5,365

Net Cost

Net cost 850 bbl. (35,700 gal.) gasoline. $4,105
Cost of gasoline per gallon, 11.5 cents.

COST OF FUEL OIL $2.10 PER BBL.

Expense	
5000 bbl. oil at $2.10	$10,500
Production cost	2,120
Total cost	$12,620
Credit	
3650 bbl. residuum at $2.10 (fuel oil)	$7,665

Net Cost

Net cost 850 bbl. (35,700 gal.) gasoline. $4,955
Cost of gasoline per gallon, 13.9 cents.

Houk To Increase Production

Completes New Sheet Metal Stamping Plant—Large Scale Operations Start Sept. 1

BUFFALO, N. Y., June 12.—With the addition of a new sheet metal stamping plant and the installation of Bliss presses, the Houk Mfg. Co., this city, will be on a larger scale of production by Sept. 1. This addition will provide a production of 5000 hub shells per day besides its own production of 50,000 spokes per day.

A contract has been placed with the Standard company of Torrington, Conn., for a minimum of 1,000,000 spokes per month beginning Sept. 1. Arrangements have been made in Detroit and Chicago for factories to assemble a minimum of 1000 wire wheels per day.

Ford Tractor Plants in Foreign Countries

DETROIT, MICH., June 10—Gaston Plaintiff, New York manager of the Ford Motor Co., sailed last week on the Scandinavian-American liner Frederick VIII for a general tour of investigation of all countries of Europe. Mr. Plaintiff will lay the lines for an investment of many millions of dollars, perhaps eventually $25,000,000 in manufacturing plants for the Ford tractor.

General charge of the European tractor business is to be vested in Mr. Plaintiff, who will ultimately establish permanent headquarters in one of the foreign capitals. R. S. Neely accompanied Mr. Plaintiff.

The first purchase of land will be in Norway, Sweden or Denmark to supply those three countries. Thereafter Holland, England, France, Germany and Russia will be visited.

The latter country will be toured extensively.

Essex Motor Truck Co. Formed

NEW YORK CITY, June 8.—J. T. Rainier and P. N. Lineberger, who have been associated in the automobile business in this city since 1901 as Eastern distributors for passenger cars and commercial vehicles, have organized the Essex Motor Truck Co., with a capital of $600,000.

The company will produce only one model, a 1000-lb. truck, the chassis of which will retail for about $750. It will be composed of standard units, including Timken worm drive in the rear axle, a Light 3¼ by 4½-in. motor, rated at 16.9 hp.

Among the stockholders and directors are Gottfried Piel and William Piel of Piel Bros., brewers; C. W. Feigenspan, president of the Feigenspan Brewing Co. and of the Federal Trust Co., Newark, also Adolf Kuttroff and Carl Pickhardt, both of the Badische Co., importers of dyes and chemicals. The engineering and designing will be in charge of Carl Neracher, formerly chief engineer of the Willys-Overland and Garford companies.

The offices of the company are at present located at 299 Madison Avenue, this city, pending the completion of a factory in Long Island City.

Emerson Four at $395

NEW YORK CITY, June 9.—The Emerson Motors Co., recently incorporated with offices in this city at 1328 Broadway, announces a five-passenger four-cylinder car, selling at $395, f.o.b. New York.

The specifications include a 3¾ by 4-in. block motor, thermo-syphon cooling, selective three-speed gearbox in unit with the motor, multiple disk clutch, center control, rack and pinion steering gear on left, floating rear axle, forged I-beam front axle, 30 by 3-in. front tires and 31 by 3½-in. rear, pressed steel frame, semi-elliptic front springs, 110-in. wheelbase, steamline body, one-man top, 10-gal. gasoline tank, crowned fenders, two head lamps and one tail, electric horn and complete tool kit.

Lancaster Wiregrip Tire Litigation Brought to an End

LANCASTER, OHIO, June 8.—Announcement has been made by the Lancaster Tire & Rubber Co., Lancaster, Ohio, manufacturer of Wiregrip pneumatic tires, that patent litigation, which practically took the original wire tread tires, formerly manufactured in Hartford, Conn., off the market, has all been satisfactorily concluded. In the future these tires will be known and marketed as the Wiregrip, with headquarters at Lancaster, where they will be manufactured on a large scale.

The Wiregrip differs from other makes in that it has imbedded in its tread to a great depth four endless triangular coils of spring steel. A little wear develops hundreds of little steel prongs which serve the purpose of holding to the road with a vice-like grip, thus preventing skidding on wet or slippery streets.

Blair Resigns from S. K. F. to Form Own Company

HARTFORD, CONN., June 8.—F. R. Blair, formerly secretary, treasurer and sales manager of the S. K. F. Ball Bearing Co., has resigned and has become president of F. R. Blair & Co., with offices at 50 Church Street, New York City. It is understood that Mr. Blair is engaged in developing motor efficiency devices.

Motometer Secures New Plant

Boyce Organization Will Start Manufacturing in L. I. City Factory July 1

NEW YORK CITY, June 9—With standard equipment on forty makes of cars and with business increasing each day, the Motometer Co., this city, maker of the Boyce Motometer, a motor heat indicator, has been forced to find larger factory quarters. A large three-story plant in the center of the automobile district in Long Island City has been taken and manufacturing will be started in it about July 1.

The new plant will put the company on a larger scale of production, about triple the present, and the floor space will be increased five times the present, about 20,000 sq. ft.

The local plant will not be given up, operations in it being confined to light assembly work.

Bell Purchases Factory

YORK, PA., June 9.—The Bell Motor Car Co., which was organized in this city less than a year ago for the purpose of manufacturing automobiles, has increased its capitalization to $1,000,000.

It has just purchased a 15-acre factory site in East York at Rockburn Station, upon which it proposes to erect, between now and the first of next year, modern factory buildings.

This firm has been placing upon the market this season two models—a pleasure car and a light 1000-lb. commercial car.

As soon as the new factory buildings are completed this concern expects to be able to provide employment for 500 to 1000 men.

Lauterbach To Build Cars

NEW YORK CITY, June 13.—H. Lauterbach, manager of sales for the New York branch of the Chevrolet Motor Co., has resigned to enter the manufacturing field. With others he has purchased the plant of a manufacturer in the Central West and will market a passenger car and a light delivery vehicle to sell for about $700.

Gundrum Joins Bell

YORK, PA., June 9.—H. F. Gundrum of York, formerly connected with the traffic department of the Pullman Motor Car Co., has been made traffic manager of the Bell Motor Car Co. Prior to his going with the Pullman company he was the agent for the Western Maryland Railway Company in York.

April Exports Total $11,692,945

1790 Trucks, Value $5,294,801; 6242 Cars at $4,998,350— Parts at $1,399,794

WASHINGTON, D. C., June 10—American makers of trucks, pleasure cars and parts continue to expand in foreign fields, according to official figures compiled by the statistical bureau of the Department of Commerce. In April last the number of trucks exported was 1790, valued at $5,294,801, while the passenger car exports totaled 6242 machines, the value of which was $4,998,350. The exports of parts, not including engines and tires, were valued at $1,399,794. For the 9 months' period ended April, 1916, the exports reached these tremendous totals: Commercial cars, 18,135, valued at $48,898,380; passenger cars, 45,048, valued at $34,269,158; parts, not including engines and tires, $18,223,401.

Turning to the figures for last year it is found that during April a year ago 2267 commercial cars, valued at $5,240,481; 3078 passenger cars, valued at $2,804,741, and $1,807,567 in parts, not including engines and tires, were shipped abroad, while during the 9 months' period of 1915 the figures were: Commercial cars, 8580, valued at $23,977,968; passenger cars, 14,641, valued at $12,356,472; parts, $5,258,175.

While the warring nations of Europe, with the exception of Germany, continue as heavy buyers of American-built motor cars, it is interesting to note that countries like South America and the British possessions in Oceania are constantly growing in importance as markets for our cars.

In April last France imported 1056 cars, valued at $3,086,601, from this country, while in April a year ago the number was just one less, but the value was only $1,710,702. The exports to France during the 9 months' period increased from 3951 cars, valued at $10,035,842, in 1915, to 6203 cars, valued at $16,290,264, in 1916.

Russia's purchases of American cars in April last amounted to 178 machines, valued at $433,825, while during the 9 months' period of 1916 the number was 4774 and the value $14,868,354. Russia did not figure in the export returns last year, so there are no comparative figures available.

Germany did not import any American machines in April of this and last year, but during the 9 months of 1915 the returns show that twenty cars, valued at $20,164 were shipped there.

Seven hundred and thirteen cars, valued at $870,184, was the United Kingdom's contribution to American motor car makers in April last, which is a decline from last year's figures for the same period, which were 1455 cars valued at $1,925,280. However, during the 9 months' period the exports there rose from 7652 cars, valued at $10,840,309, in 1915, to 16,820 cars, valued at $22,959,602, in 1916.

There were seventy-three cars, valued at $55,452, shipped to Denmark in April last, while during the 9 months of this year the number was 597 and the value $411,708. No comparative figures for these periods of last year are available.

Italy's share in our automobile export trade in April last was only 4 cars, valued at $3,073, as against 23 cars, valued at $9,983, in April a year ago. During the 9 months' period the exports there increased from 88 cars, valued at $58,368, in 1915, to 256 cars, valued at $172,731, in 1916.

"Other Europe" imported 395 cars, valued at $922,988 in April last, as against 855 cars, valued at $2,535,169, in April a year ago, while the shipments for the 9 months' period fell from 2118 cars, valued at $6,129,392, in 1915, to 1745 cars, valued at $2,259,142, in 1916.

On this side of the Atlantic the figures show that Canada contributed largely to our export trade during the periods under consideration, the exports in April last totaling 2130 cars, valued at $1,371,108, as against 696 cars, valued at $611,797 in April a year ago. During the 9 months' period the exports to the Dominion increased from 2768 cars, valued at $3,165,739 cars, in 1915, to 7433 cars, valued at $5,156,373, in 1916.

Large Demand from South America

A striking feature of the automobile export trade is the constantly increasing demand for American cars in South American countries. Formerly the department grouped all the automobile exports to South America under one head and last year's returns show that 98 cars, valued at $60,437 were shipped there in April, while during the 9 months' period the number was 906 cars, and the value $494,488. In April last Argentina alone imported 505 cars from this country, the value of which was $245,984, while during the 9 months of this year the shipments amounted to 3497 cars, valued at $1,630,943. Chile bought 125 cars from us in April last, the value being $86,814, while during the 9 months' period the number was 704 cars, and the value $464,555. Only 20 cars, valued at $12,318 were shipped to Brazil in April last, but during the 9 months of this year the number reached 204 cars, valued at $127,247. Venezuela's contribution was 47 cars, valued at $24,718, in April, and 416 cars, valued at $264,470, during the 9 months of this year, while all other South American countries purchased 40 cars, valued at $21,419, in April, and 453 cars, valued at $256,288 during the 9 months' period.

Exports of Automobiles, Trucks and Parts for April and 10 Previous Months

	April				10 Months Ending April			
	1915		1916		1915		1916	
	Number	Value	Number	Value	Number	Value	Number	Value
Passenger cars	3,078	$2,804,741	6,242	$4,998,350	14,641	$12,356,472	45,048	$34,269,158
Commercial cars	2,267	5,240,481	1,790	5,294,801	8,580	23,977,968	18,135	48,898,380
Parts, not including engines and tires	.....	1,807,567	.....	1,399,794	......	5,924,175	......	18,223,401
	5,345	$9,852,789	8,032	$11,692,945	23,221	$42,258,615	63,183	$101,390,939
By Countries								
Denmark	.....	....	73	$55,452	......	....	597	$411,708
France	1,055	$1,710,702	1,056	3,086,601	3,951	$10,035,842	6,203	16,290,264
Germany	.....	....	.....	....	20	20,164	......	....
Italy	23	9,983	4	3,073	88	58,368	256	172,731
Russia	.....	....	178	433,825	......	....	4,774	14,868,354
United Kingdom	1,455	1,925,280	713	870,184	7,652	10,840,309	16,820	22,959,602
Other Europe	855	2,535,169	395	922,988	2,118	6,129,392	1,745	2,259,142
Canada	696	611,797	2,130	1,371,108	2,768	3,165,739	7,433	5,156,373
Mexico	6	4,025	47	43,897	64	63,660	338	328,318
West Indies and Bermuda	247	119,893	497	272,099	1,121	696,210	3,860	2,345,668
South America	98	60,437	.....	....	906	494,488	......	....
Argentina	.....	....	505	245,984	......	....	3,497	1,630,943
Brazil	.....	....	20	12,318	......	....	204	127,247
Chile	.....	....	125	63,814	......	....	704	464,555
Venezuela	.....	....	47	24,718	......	....	416	264,470
Other South America	.....	....	40	21,419	......	....	453	256,288
British East Indies	.....	....	341	268,987	......	....	2,467	1,875,183
British Oceania	307	270,230	1,319	948,367	2,471	2,059,033	6,109	5,000,813
Asia and other Oceania	394	560,845	181	280,498	1,340	2,119,888	4,178	5,461,385
Other countries	209	236,861	361	1,332,498	722	651,347	3,129	3,294,494
	5,345	$8,045,222	8,032	$10,257,830	23,221	$36,334,440	63,183	$83,167,538

Resta and De Palma Matched

To Meet June 18 on Chicago Speedway in Three Heats—$5,000 Prize Offered

CHICAGO, ILL., June 13—Resta in his Peugeot and De Palma in his Mercedes, first and second in Sunday's 300-mile race on the Chicago speedway, have agreed to a match race to take place on the local track Sunday, June 18. They will race to determine which driver and which car is supreme, as the claim has been current that Resta's winning was a matter of luck and that De Palma's Mercedes is a faster car. Arrangements call for a series of three heats, one of 10 miles, one of 24 miles and a third of 50 miles, the two best out of three declares the winner. A prize of $5,000 has been offered by the speedway management, and A. A. A. sanction is already filed.

Neither of the drivers wishes it to be understood that this is a challenge race. De Palma wants to show his friends who have claimed that his traditional hoodoo lost the race that their assumptions are justified, and Resta's plans are to give proof that the race was won because he drove his blue Peugeot faster than any other pilot and could have done even more. According to the statements of both drivers the agreement was reached when the ten prize winners appeared yesterday at the speedway office for their checks.

250-Mile Speedway Race for Arizona

PHOENIX, ARIZ., June 10—A 250-mile automobile race over a three-mile speedway will be the principal event of the Arizona State Fair. It will be staged on the afternoon of Saturday, Nov. 18, the last day of the fair.

This plan, originated by Secretary Tom Shaughnessy, has been approved by the fair commission, which has set aside $7,500 for prizes. Steps have been taken to secure a sanction from the A. A. A., the idea of holding outlaw races having been dropped.

1917 Velie Six-Cylinder Cloverleaf Roadster Added to Line

MOLINE, ILL., June 9.—The Velie Motor Vehicle Co., this city, has announced for 1917 its model 22, a cloverleaf roadster, seating four, at $1,065. The chassis remains the same as the 1916 model, the only changes being in the body. A 40-hp. Continental motor is used. Other features include: multiple dry disk clutch, automatic ignition, Hotchkiss drive, special gears in rear axle, 50-in. underslung rear springs, Stewart vacuum feed, two-unit Remy electric system, deep tufted upholstery, double bulb headlights, 15-gal. gasoline tank with gage, one-man top, 32¼-in. tires, with non-skids in the rear.

The top furnished is made to fold down closely around the outside of the backs of the rear seat, and the dust cover, when in position, is closed over the two rear seats, making them invisible. This arrangement gives the car the appearance of a two-passenger roadster with an ordinary top cover on.

This roadster has unusually large space for luggage aside from the space in rear and under the seats. There is a compartment back of the front seats with doors opening from the inside; these doors are padded on the top and act as a rest for the arms of those sitting in the rear seats.

Two Wheelbases for 1917 Chalmers

DETROIT, MICH., June 12.—For 1917 the 3400 r.p.m. Chalmers will be made in two wheelbase lengths, 115 and 122 in., the latter being for seven-passenger bodies—the touring model will sell for $1,280. The wheelbase of the five-passenger will remain at 115 and the price at $1,050 for the open model; roadster and cabriolet models will be made as heretofore. On the larger chassis will be mounted three closed body designs, a touring sedan, limousine and town car. All three seat seven.

Vanderbeck Leaves Timken Bearing

DETROIT, MICH., June 8—H. Vanderbeck, chief engineer of the Timken Roller Bearing Co., Canton, Ohio, will sever his connection with this company in the near future. His successor has not yet been selected.

Allen Enlarges Bucyrus Plant

FOSTORIA, OHIO, June 9. — The Allen Motor Co. has broken ground for an addition to its motor and transmission plant in Bucyrus. The addition will double the size of the plant.

Reynolds with Paige-Detroit

DETROIT, MICH., June 9—F. H. Reynolds, Jr., has joined the Paige-Detriot Motor Car Co., this city, in the capacity of special representative. Reynolds comes from the Champion Ignition Co., Flint, Mich.

Ask Receiver for Lauth-Juergens

FREMONT, OHIO, June 9—A receiver for the Lauth-Juergens Motor Car Co., is asked in a suit filed recently to obtain judgment of $526.74 for labor and material. Recently stockholders of the company voted to transfer the company to the H. G. Burford Co.

Studebaker Convention Closes

Demand for Cars Expected to Last Throughout Year—8000 Cars a Month

DETROIT, MICH., June 10. — That the present unprecedented demand for automobiles will continue throughout the year instead of showing the customary slack during the summer and fall months was the message brought by Studebaker branch managers who attended the semi-annual branch managers' convention of the Studebaker Corp. in Detroit June 6-9. The predictions made by the branch managers were based on a study of conditions in their territories. Heads of the Studebaker branches in all parts of the country were present at the sessions during the week, as were also the assistant branch managers, district managers and retail sales managers.

Orders now on hand, the nation's prosperity and the fast swelling ranks of people who recognize the motor car as a utility and in many cases a necessity rather than an expensive luxury — these were given as the chief reasons for the prospect of a continuing demand of even larger proportion than ever before known.

According to J. G. Heaslet, vice-president, in charge of engineering and production, factory additions and enlargements of facilities will soon make possible a normal output of 8000 cars a month and a forced output of 10,000. July 1, despite the materials situation, it was announced, will show shipments for the preceding 12 months of more than 65,000 cars, which is approximately double the best previous year.

L. J. Ollier, vice-president and director of sales, who presided at the various sessions at the convention, announced that the Studebaker dealer organization has grown in 2 years from 2000 to 6500.

The opening day was occupied with group conferences with the sales officials, followed by tours through several of the plants, where an opportunity was afforded to see the additions that have been made since the last convention in December.

In addition to Messrs Erskine, Ollier and Heaslet, talks were made by C. C. Hanch, treasurer; C. D. Fleming, assistant treasurer; H. E. Dalton, general auditor; R. T. Hodgkins, general sales manager; G. L. Willman and W. T. Bush, assistant general sales managers; H. T. Myers, commercial car sales manager; H. A. Biggs, advertising counsel; Max Hagelstine, service manager; C. L. Hemphill, secretary of the Commercial Investment Trust Co. of New York, and Walter Robbins, vice-president of the Wagner Electric Co. of St. Louis.

Clifton Heads N. A. C. C. for 1917

Shipments for Year Amount to 237,523 Carloads—Eleven New Members

NEW YORK CITY, June 9—Charles Clifton, treasurer of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., was re-elected president of the National Automobile Chamber of Commerce, Inc., at the annual meeting held here yesterday, which was characterized by a record attendance of members of the chamber. The other officers were all re-elected, as follows: First vice-president, W. C. Leland, vice-president and manager of the Cadillac Motor Car Co., Detroit; second vice-presidents, Hugh Chalmers, (gasoline passenger car division), president Chalmers Motor Co., Detroit; Windsor T. White (commercial vehicle division), president of the White Co., Cleveland, and H. H. Rice (electric vehicle division), president of the Waverley Co.; secretary, R. D. Chapin, president of the Hudson Motor Car Co., Detroit; treasurer, George Pope, receiver Pope Mfg. Co., and general manager, Alfred Reeves.

The directors elected were J. N. Willys, president of the Willys-Overland Co., Toledo, Ohio; C. C. Hanch, treasurer of the Studebaker Corp.; H. H. Rice, Waverley, and J. Walter Drake, president of the Hupp Motor Car Co., Detroit.

Oppose Tavenner Bill

The automobile makers placed themselves on record as opposed to the Tavenner bill now before Congress, which has for its purpose the prohibition of the use of time studies and premium or bonus payments in connection with work of the government. The makers feel that such a bill or any similar measure is dangerous class legislation which would prevent efficient methods in private manufacturing industries and be directly opposed to the interests of the whole population of the country and to the working men themselves, by placing a premium on inefficiency besides reducing the production capacity of manufacturing plants.

There are now ninety-seven companies holding membership in the N. A. C. C., eleven of which were admitted since last June, including the Argo Motor Co.; Consolidated Car Co.; Denby Motor Truck Co.; Dort Motor Car Co.; Empire Automobile Co.; Grant Motor Car Corp.; International Harvester Corp.; Lewis Spring & Axle Co.; Milburn Wagon Co.; Monroe Motor Co.; and the Mutual Motors Co.

Shipments Gain

Substantial gains in automobile shipments for the month of May were reported by the Traffic Committee, as stated in THE AUTOMOBILE for June 8, the figures showing that more than 24,000 carloads were as against 15,392 carloads for the month of May last year. The shipping conditions have become more normal and makers are no longer obliged to use flat cars in shipping automobiles.

During the year the shipment of 237,523 carloads of automobiles was made and 9523 notices were sent to the railroads in advance of the arrival of shipments, so as to insure prompt return of freight cars to manufacturing territory.

The commercial vehicle convention decided that no truck show was necessary at this time. They decided against any change in the standardization of frame widths at this time.

For the protection of buyers of trucks, a standard definition for motor truck chassis, both gasoline and electric, was decided upon and the convention, together with the annual meeting, approved a form of service policy which is expected to supply even better service to the truck owner.

Now O-So-Ezy Products Co.

DETROIT, MICH., June 10.—The O-So-Ezy Mop Co. has changed its name to O-So-Ezy Products Co.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.58	.58	.58	.58	.58	.58	...
Antimony, lb.	.23½	.22¾	.21½	.21½	.21½	.21½	—.02
Beams & Channels, 100 lb.	2.77	2.77	2.67	2.67	2.67	2.67	—.10
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.28	.28	.28	.28	.28	.28	...
Copper, Lake, lb.	.28	.28	.28	.28	.28	.28	...
Cottonseed Oil, bbl.	10.85	11.02	10.85	10.75	10.75	10.80	—.05
Fish Oil, Menhaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb.	6.95	6.95	6.90	6.85	6.85	6.80	—.15
Linseed Oil, gal.	.68	.68	.68	.65	.65	.66	—.02
Open-Hearth Steel, ton	42.00	42.00	42.00	42.00	42.00	42.00	...
Petroleum, bbl., Kans., crude, gal.	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pa., crude, gal.	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	1.05	1.05	1.05	1.05	1.05	1.05	...
Rubber, Fine Up-River, Para, lb.	.66	.66	.65	.65	.64	.64	—.02
Rubber, Ceylon, First Latex, lb.	.70	.70	.70	.70	.70	.64	—.06
Sulphuric Acid, 60 Baume, 100 lb.	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	44.50	44.50	45.25	44.50	44.50	44.25	—.25
Tire Scrap, lb	.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	...

Hanlon Patent Invalid

Injunction Against N. A. C. C. Members on Use of Windshield to Be Lifted

CINCINNATI, OHIO, June 9—The United States circuit court of appeals for the sixth circuit has declared the Hanlon windshield patent invalid and will later lift the injunction against the National Automobile Chamber of Commerce members, after certain technical formalities have been observed. Until that time, the members will continue to respect the injunction.

The case in question is particularly important in that many manufacturers are using the Hanlon idea of windshield, which is a double glass with the outer or forward glass divided and the top adjustable so that it can be inclined forward to serve as a rain vizor if necessary.

The decisions just handed down involve the cases of Rauch & Lang Carriage Co., against William B. Hanlon and J. R. Wardrop and the Anderson Electric Car Co., and the National Automobile Chamber of Commerce, Inc., against William B. Hanlon and James R. Wardrop and the Anderson Electric Car Co.

These cases are separate appeals from the decision of the United States district court, northern district of Ohio, eastern division, in which the court held the Hanlon reissue patent No. 13,653, Dec. 2, 1913, valid and infringed and ordered an injunction against the Rauch & Lang Carriage Co. and the National Automobile Chamber of Commerce and its members.

The N. A. C. C. took a separate appeal in which it denied the legality of including the chamber and its members in the injunction. The decisions of the circuit court of appeals in reversing the lower court will cause the dissolution of the injunction against the chamber and its members and also the Rauch & Lang Carriage Co.

Market Prices Steady

NEW YORK CITY, June 13—Automobile material prices were steady last week. Those changes that occurred were drops caused by dull markets. Lead, which was weak and dull, dropped 15 points to $6.80 per 100 lb., and tin, which was in a similar condition, was 25 cents lower, closing yesterday at $44.25 per 100 lb. Copper remained unchanged at 28 cents a pound, with a quiet market.

Crude rubber was steady though lower in price. Fine up-river Para declined to 64 cents a pound, at a loss of 2 cents.

Yesterday Ceylon grade was more active with quotations at 64 cents a pound. The domestic demand is quiet. The arrivals in London last week were light, but the landings have proved a slow process due to inadequate labor, while the unsold stocks in London have reached dimensions such as have not been seen for a few years past. Meanwhile reserve stocks in manufacturers' hands are being used up to a large extent.

In regard to the gasoline situation, it is noted that the supply is catching up with the demand. Last month there was a cut of 1 cent a gallon in the price of gasoline from Texas. It was reported that some easiness was being felt in certain outlying New York districts, while this week it was stated that the price of gasoline in Minneapolis was quoted down 1 cent a gallon by independent dealers and half that amount by the Standard Oil. It is the consensus of opinion among oil men, however, that the gasoline market will be firm from now on and prices may go higher by the end of summer. In regard to the Texas decline of 1 cent a gallon, it is stated that the cut resulted from sharp competition among the four leading marketing interests.

Dividends Declared

Saxon Motor Car Corp., initial dividend of 1½ per cent, payable July 1, to holders of record June 20.

Electric Storage Battery Co., quarterly of 1 per cent on common and preferred, payable July 1.

Gray & Davis, quarterly of 1¾ per cent on preferred, payable July 1.

F. S. Fealy, of Motor Parts, Dies

PHILADELPHIA, PA., June 10—F. S. Fealy, president of the Motor Parts Co., was drowned on June 4 in the Delaware River. He is survived by his widow.

Security Prices React

Chevrolet, General Motors, United Motors and Overland Quotations Drop

NEW YORK CITY, June 13.—Though automobile securities made substantial gains yesterday, they did not fully recover from the general decline during the latter part of last week. Those stocks which have been features on the Exchange and the Curb were considerably lower on Saturday. General Motors dropped 73 points to 475; Chevrolet was 2 points lower; Goodrich 119 points lower and Willys-Overland 6 points under the previous week's quotations.

Violent changes in United Motors and other automobile issues featured speculation in the unlisted securities on Saturday. United Motors, for example, after selling at 80¼, broke to 71¾, only, however, to advance during the afternoon to 79¾. Perlman Rim, White Motors and Motor Products also recorded wide fluctuations pro and con. Shares of the new Durant-Willys motor combine under the name of the American Motor Co., were dealt in at prices ranging from 60 to 65. The name given this stock is only temporary and only for trading purposes. This stock was dealt on a basis of when, as and if named, a new trading basis.

In regard to the drop in United Motors Corp. issues, it is stated that this has been due to an announcement to be made in a week or so by the syndicate managers, releasing all members of the syndicate who withdrew their stock from their agreement not to dispose of it before Sept. 1.

The selling recently of United States Rubber common stock is believed to have been by interests who bought it some time ago in the hope that dividends would be resumed this summer. According to information, such action will not be taken until after the funding of the company's 6 per cent bonds and other short-term obligations is accomplished in 1918.

Chalmers common was very active with a 40-point advance as was Saxon and Chandler with 3½ and 30-point rises.

Lubricating Oil Price Advanced

CHICAGO, ILL., June 9—The Standard Oil Co. of Indiana has advanced prices of lubricating oils 2 to 5 cents a gallon in steel barrels, making Chicago wholesale basis ranging from 18 to 32 cents per gallon.

Prices in New York City and the surrounding territory remain unchanged. Polarine is selling wholesale at 30 cents a gallon in barrel lots and 28 cents in 5-barrel lots.

Prodium Is Republic's Newest

YOUNGSTOWN, OHIO, June 12.—The Republic Rubber Co. is now marketing tires constructed of a new rubber compound styled Prodium. The compound is black and is exceedingly tough. Both plain tread and non-skid are being supplied by Republic dealers and branches throughout the country.

Goodyear Plant in Toronto

TORONTO, ONT., June 8—The Goodyear Tire & Rubber Co., Ltd., is building a plant here, to be exclusively for the manufacture of pneumatic tires. The amount invested, which includes equipment costs, is between $1,250,000 and $1,500,000.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	68	70	..
Chalmers Motor Co., com	95	97	240	255	+40
Chalmers Motor Co., pfd	91	94	100	105	+1
Chandler Motor Car Co	..	..	117	120	+30
Chevrolet Motor Co	..	..	260	262	—2
Electric Storage Battery Co	51	53	62	65	—2
Firestone Tire & Rubber Co., com	484	488	860	..	+20
Firestone Tire & Rubber Co., pfd	111	..	113	114	..
General Motors Co., com	152	154	475	594	—73
General Motors Co., pfd	100	101	113	114	—2
B. F. Goodrich Co., com	46½	48	78	78½	—119
B. F. Goodrich Co., pfd	101	103	115¼	116¼	+10
Goodyear Tire & Rubber Co., com	244	248	230	250	+33
Goodyear Tire & Rubber Co., pfd	105¼	106	105	107	—¼
International Motor Co., com	14½	15½	10	14	..
International Motor Co., pfd	37	39	20	25	—1
Kelly-Springfield Tire Co., com	129	132	74½	74½	+¼
Kelly-Springfield Tire Co., 1st pfd	83	85	96	98	..
Maxwell Motor Co., com	46	47	85½	86	—¼
Maxwell Motor Co., 1st pfd	86	87½	88½	89½	—¾
Maxwell Motor Co., 2d pfd	38	40	57½	58½	+½
Packard Motor Car Co., com	102	104	250	265	+10
Packard Motor Car Co., pfd	96¼	..†	101	104	..
Paige-Detroit Motor Car Co. (new)	..	..	50	57	—6
Peerless Motor & Truck Corp	..	..	27	27½	+2
Perlman Rim Corp.	..	..	140	145	—9
*Reo Motor Truck Co	15	15½	37	38	..
*Reo Motor Car Co	33	33½	43½	44½	—1
Saxon Motor Car Co	..	..	84½	85½	+3½
Stewart-Warner Speed. Corp., com	68	69	102	103	+16
Stewart-Warner Speed. Corp., pfd	103	105	109	110	+1
Studebaker Corp., com	75	77	142	143	+½
Studebaker Corp., pfd.	99	100½	107	110½	+1
United Motors Corp.	..	..	78¼	78½	—10¼
U. S. Rubber Co., com	65	66	56⅛	56⅛	+⅜
U. S. Rubber Co., 1st pfd	106	108	109⅝	109⅝	+⅛
White Motor Co. (new)	..	..	59¼	59½	+1⅝
Willys-Overland Co., com	131	132	304	307	—6
Willys-Overland Co., pfd	101½	103	112¼	112½	+1¼

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Auto Body Co.	..	..	35½	..	+1
Chalmers Motor Co., com	91	95	..	238	..
Chalmers Motor Co., pfd	94½	97½	101	107	+5
Continental Motor Co., com	180	200	41¾	42¾	+4½
Continental Motor Co., pfd	84½	86	9½	10⅛	+¼
Ford Motor Co. of Canada	950	..	..	400	..
General Motors Co., com	150	154	470	550	..
General Motors Co., pfd	100	101	115	118	..
Maxwell Motor Co., com	45	47	85½	88	+1½
Maxwell Motor Co., 1st pfd	85	88	87	90	—1
Maxwell Motor Co., 2d pfd	38¼	40¼	56½	60	+½
Packard Motor Car Co., com	..	104	256	259	+16
Packard Motor Car Co., pfd	96¼	99	101	104	..
Paige-Detroit Motor Car Co	..	..	..	56	..
*W. K. Prudden Co	19½	21	41	45	+1
*Reo Motor Car Co	..	32¾	44	44¾	—½
*Reo Motor Truck Co	14⅜	15⅛	36¾	37¾	..
Studebaker Corp., com	75½	77½	140½	143½	+1½
Studebaker Corp., pfd	..	101	110	..	..
C. M. Hall Lamp Co	..	..	33	37	..

INACTIVE STOCKS

*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	200	..	..	350	..
Regal Motor Car Co., pfd	..	25	17	..	..

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*Par value $10; all others $100.

†Ex-dividend.

A Study of Modern High-Speed Engines

Abstract of Paper Read Before S. A. E. by A. P. Brush

(*Continued from page* 1074)

cially in high-speed engines. In the first place, the centrifugal effect of the crankpin and crank-cheek mass is increased by that portion of the lower end of the connecting-rod immediately surrounding the crankpin. In addition, the intermediate portion of the connecting-rod supplements the centrifugal effects of the crank-cheeks, the crankpin and lower end of the rod to distort the crankshaft; and further, the upper end of the connecting-rod and the reciprocating mass of the piston and piston-pin throughout certain portions of each rotation of the crankshaft also supplement these centrifugal effects toward distortion of the crankshaft. All of these tendencies combined can be lessened by the selection of proper centrifugal forces due to the added counterbalancing masses.

In order to secure the minimum tendency to distort the crankshaft, the counterbalancing mass must be greater than that necessary properly to counterbalance or neutralize the centrifugal effects of the crank-cheeks and crankpins. This is merely another way of saying that a crankshaft that alone is in the nearest triple balance possible will not have the minimum tendency to distort in service; and that a crankshaft properly counterbalanced, so as to have the minimum tendency to distort in service, will show a marked tendency to distort when run at high speed without the connecting-rods and pistons attached.

Correct Counterbalancing Masses

I shall close my discussion of crankshaft counterbalancing with a brief consideration of what are correct counterbalancing masses to permit the least tendency to displace the axis of any crankshaft under service conditions. As I have already indicated, when a method of determining these values for a single-throw crankshaft is worked out, the correct application of counterbalance to a crankshaft of any number of throws involves nothing but simple and obvious mechanical and mathematical merging of those crank-cheeks and counterbalances that, due to the omission of center-line bearings, lie in the same planes of rotation. Fig. 15 represents an end view of a single-throw crankshaft, in which A is the axis, P is the center of the crankpin, and R is the uniform radius, representing the uniform radial pull tending to displace the axis at any given rate of speed, and always acting in a plane passing through the axis A and the center of the pin P. If suitable masses whose centers of mass lie within the plane B are arranged as indicated in Fig. 4, R will be opposed by an exactly equal force acting in the opposite direction, and the value of R will become zero. Considering Fig. 16, which is identical with Fig. 15, except that the lower end of the connecting-rod immediately surrounding the crankpin has been indicated, we see that the value of R has been increased to some new value as R_1, and that the centrifugal force due to our counterbalancing masses must be increased correspondingly to eliminate all tendency to displace the axis.

In Fig. 17, representing the mechanical train, that is the piston and connecting-rod, attached to the crankpin, we find that the value of R_1 is increased and thrown into variable form, and that this variable form has two points of minimum value, as at R_2 and R_3, lying in the radial lines C and C' with radial values slightly greater than R', the lines C and C' making right angles with the center line of the connecting-rod when the center of the crankpin lies within C and C'. As the crank in its rotation approaches either of the two dead centers from the points R_2 and R_3, the resultant forces tending to displace A are increased, having (due to the finite length of the connecting-rod) a maximum value at the upper dead-center, as represented at R_4, and having still another value less than R_4, but greater than R_2 and R_3 at the lower dead-center, as indicated at R_5.

It now becomes evident that if through the addition of counterbalancing masses we are to secure the minimum tendency to displace the axis A, the centrifugal value of our counterbalancing masses must be greater than R_2 and R_3 and less than R_5. Since revolving counterbalancing masses attached to the crankshaft can have only a constant radial value for any given speed, it is at once seen that counterbalancing cannot entirely eliminate all tendencies in actual operation to displace the axis A due to the motion of the parts. There is, however, a counterbalancing value for every crank throw and for its mechanical train, which under service conditions will permit a minimum tendency to displace A.

In Fig. 18, A is the axis of the crankshaft, P is a plane of rotation about A, passing through the center line of the mechanical train and I is the intersection of A and P. At the point I the motion of parts sets up tendencies to displace A, and these tendencies can, as we have already seen, be reduced greatly by the selection of proper values of centrifugal force for counterbalancing masses indicated at M and M', whose resultant centrifugal effect due to their symmetrical arrangement on each side of the plane P lies within the plane P.

No matter how many throws or what the form of a crankshaft, there will be a point I for every throw, and the resultant tendency to displace A at each of these points will be identical, irrespective of the number of throws or their angular relation. It is entirely immaterial, so far as these effects are concerned, whether center-line bearings are interposed between the throws.

Author's Conclusion

If this were not already too long, it would be interesting to analyze further the forces occurring at I. However, the analysis as it stands is sufficiently complete for the practical purpose of computing the proper centrifugal values for counterbalancing masses for all conventional types of engines, in which only one piston and connecting-rod are attached to a single crankpin.

With V engines it is also true that the entire problem of correct counterbalancing is involved in the determining of correct counterbalancing values for a single crank throw.

I have not attempted to exhaust the subjects under discussion, and have omitted entirely several interesting phases of high-speed engine design, as, for example, the analysis of the valving train, various installations of electrical and other auxiliary equipment, carbureter location, and intake manifold sizes and forms as affected by increased engine speeds.

No Discussion on the Paper

There was no discussion of the paper by Mr. Brush, and the discussion of the other papers was rather brief, owing to lack of time. The paper by D. D. Ormsby on Differential Substitutes and that by Herbert Chase and A. Browne on Possibilities of the Constant Pressure Cycle, are reprinted in part on the following pages.

Substitutes for the Differential

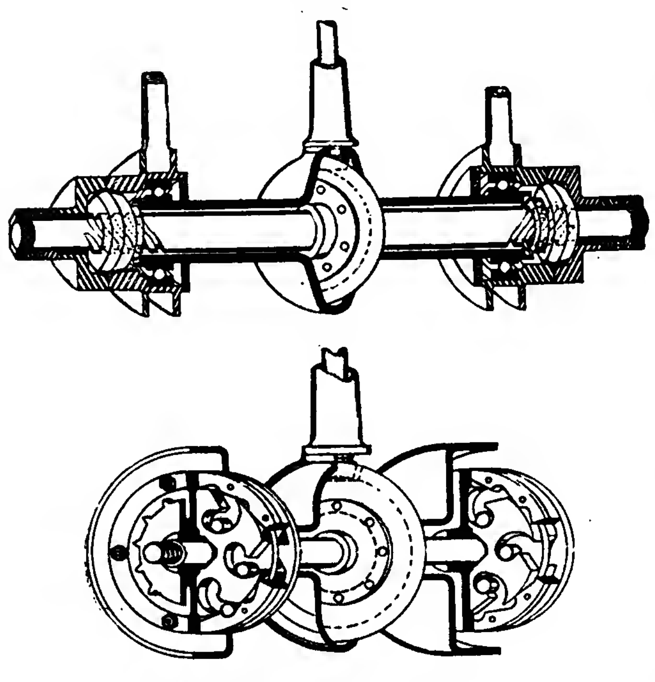
Divided Into Four Classes: Free-Wheel, Crank and Eccentric, Spiral Differential and Solid Axle Types—Advantages and Disadvantages of the Various Constructions

By D. D. Ormsby
Chief Engineer, Brown-Lipe-Chapin Co.

THE conventional differential rather than being inefficient is on the other hand too efficient in that it differentiates for all differences, whereas the automobile engineer wants it to take care only of the unequal velocities of the rear wheels. It becomes inefficient as a means of transmitting the power to the rear wheels if the wheels have unequal traction. It is to correct this defect of differentiating for unequal traction of the wheels that a great many intended substitutes for the present types of differential have been invented. I will describe a few of them briefly.

The substitutes can be divided into four classes: The free-wheel type, Figs. 1, 2 and 3; crank and eccentric, Fig. 4; spiral differential, Fig. 5; and the solid axle.

Fig. 1 shows the Hedgeland solid anti-skid automobile axle, of which little has been heard for some time. As the name indicates, this axle was constructed with a continuous or solid axle, having a thread cut on both ends. To these threaded ends were attached cone clutches having a double taper, so that when the power was applied to the axle these clutches were forced one way or the other by means of the thread on the shaft and they gripped a cup which was attached to the wheel, thus transmitting the power from the shaft to the wheels. When a car equipped with this device was making a turn or diverging from a straight course, so that the outer wheel was obliged to travel faster than the inner wheel, the outer wheel was automatically declutched and ran free on the axle around the clutch on the shaft. Fig. 1 is a sectional line drawing of this construction, and shows the mechanism clearly.



Above—Fig. 1—Hedgeland anti-skid axle. Below—Fig. 2—Free-wheel type of axle

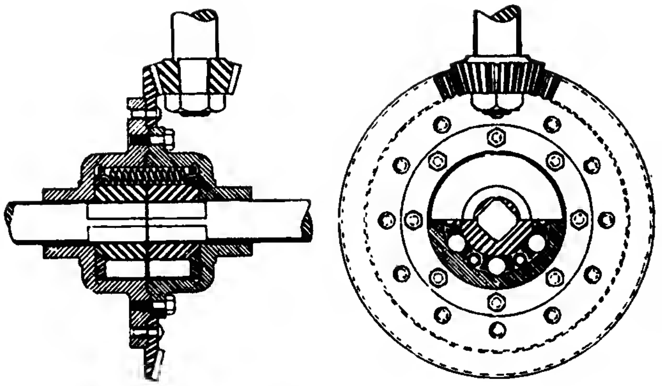
Fig. 2 represents a design similar to the one in Fig. 1, and the same principle is utilized, namely, having a loose wheel when the car is diverged from a straight line, so as to differentiate for the unequal velocity of the two rear wheels. Fig. 2 is a perspective view of a jackshaft equipped with this design. It is practically the same as the Hedgeland design, with the exception of the clutching mechanism, in that it employs a solid axle, to the center of which is fastened the bevel drive gear and on the ends of which the clutches are applied. In this case the clutches consist of two cams on each side, keyed or secured by some other means to the shaft; when driving forward or backward they force rollers out against a drum to which is attached the sprocket or rear wheel. By wedging these rollers against the drum the power is transmitted from the cam to the drum and thence to the rear wheels. Both wheels are gripped alike when the car is being propelled in a straight line but when the car diverges from a straight line, as in turning a corner, the outer wheel runs faster than the inner wheel, forcing the rollers back so that it is released from the cam and hence from the shaft, and allowed to rotate faster than the inner wheel.

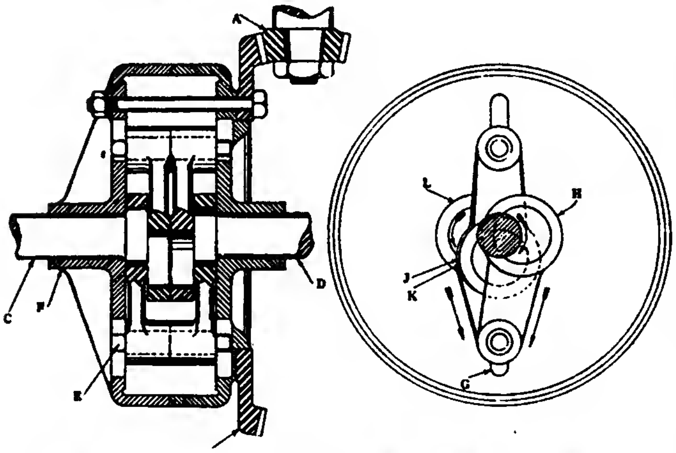
Another Substitute

The substitute shown in Fig. 3 is of similar design to the one shown in Fig. 2, in that cams and rollers are employed, but it is mounted in the conventional position instead of in the hubs of the wheels, and its action is the same, that is, when the car is being driven in a straight line both cams are clutched to the drum which drives both wheels at the same speed. When the car ceases to run in a straight line the outer wheel accelerates ahead of the inner wheel, declutching the cam attached to the shaft of the outer wheel.

Free-Wheel Differentiation

The action of the free-wheel type differential is such that it eliminates the inherent defect in the standard differential; that is, differentiating when the wheels have unequal traction. Yet there are some points in its action which are not entirely satisfactory. In the first place, with unequal size tires it drives more on the large tire, because the wheel with smaller tire has to rotate faster to make up for the distance traveled by the wheel having the larger tire. Secondly, in making a turn all the power is applied to the inner wheel and hence must be transmitted through one shaft. This throws an extra heavy load on the inner wheel, especially when making a turn on a steep hill. One other feature has, according to the experience of a car manufacturer, proved to be a serious defect. This is the shock of applying the brake when the car is not running in a straight line, for when making a turn the outer wheel, being free from the axle, is more sensitive to the brake than the wheel which is transmitting power. The outer wheel will be retarded





Above—Fig. 3—Cam and roller type of free-wheel mechanism.
Below—Fig. 4—Crank and eccentric type of differential

much more rapidly than the inner wheel. There is considerable shock when it slows down to a point slower than the inner wheel, and the differentiating mechanism is obliged to pick it up.

The Crank and Eccentric Type

The second type of differential substitute is shown in Fig. 4. For convenience I will call it the crank and eccentric type. I was unable to obtain the name of the inventor of this differential and believe it has not been tried out to any great extent. It is an interesting device composed of two axle shafts designated as *C* and *D* in the reproduction. At the ends of these shafts are turned two eccentrics, to which are attached four cranks, designated *H*, *K*, *J* and *L*; *H*, *K* being attached to the eccentrics on shaft *D* and *J*, *L* to the eccentrics on shaft *C*. These cranks carry bosses which are bored and through which are passed sliding pins *E* and *I*, upon which the cranks are centered and oscillate. The cranks *L* and *H* are attached to sliding pin *E* and *J* and *K* to sliding pin *I*. These pins are allowed to slide in slots in the case *F*, which is made in two halves bolted together. The action is as follows: The power applied to the bevel driving pinion *A* is transmitted to drive gear *B*, which is attached to and therefore rotates the case with the gear. When the car is traveling in a straight line, the sliding pins *E* and *I* rotate with the case, and the whole differential mechanism is rotated. When the car diverges from a straight line and the wheels have unequal velocities, the outer wheel speeding up oscillates the cranks by means of the eccentrics on the shaft, the cranks being allowed to oscillate around the center of the axis of the shafts and the eccentrics placed at such an angle in relation to each other that the required reverse direction of motion of the shafts is obtained. This allows the outer wheel to speed up and the inner wheel to become retarded, but because the angles of the eccentrics are so sharp, when one wheel loses traction it does not spin. I have never seen one of these differentials tried out and do not know how efficient it is, but it is ingenious and unique.

The Spiral Gear

The third type, which has received considerable attention, is the spiral gear. This differential is similar to the conventional type, except that its differentiating gears are made up of a train of spiral instead of bevel or spur gears. Its action is the same in principle as that of the bevel or spur gear types, but the spiral gears are placed in such a manner as render the differential train inefficient, so that it is impossible to spin one wheel without rotating the other. Fig. 5 is a perspective sectional view of the type. It seems that a design of this nature should be the ultimate solution of the present differential problem, for it is evident that both wheels should be connected to each other at all times by some means and that the power should be applied to both wheels under all conditions, which is accomplished in this design. This type is being used with marked success by one company in four-wheel drive trucks.

Differential Eliminated

The fourth "substitute" consists of the elimination of the differential altogether. The advantages of this construction are that it obviates the spinning of the wheels, insures a positive drive of the wheels under all conditions and makes possible a reduction in cost. The disadvantages are, however, in my opinion, too great to be overcome. Writers in the trade papers seem to advance the theory that the slippage is greater in making a short turn than in making a turn of larger radius through a given angle. In the solid type axle with the differential eliminated there must always occur, when the car is making a turn, slippage of the inner or outer wheel, or both wheels. It is hard to demonstrate exactly what happens. I have figured just how much slippage there is in making a turn of 90 deg. with a certain light touring car and a well-known runabout. I found by measuring the amount the front wheels can be turned in steering, that the touring car can be turned in a radius of 17.13 ft. (205.6 in.). This is the radius at which the inner wheel turns. The standard gage being 56 in. the outer wheels would turn in a radius of 261.6 in. The distance traveled by the outer wheel in a 90 deg. turn is 410.9 in. The inner wheel would travel 322.9 in.; a difference of 88 in. to be compensated for by the slippage of the wheels. The total circumference of the touring car 32-in. tire is 100.53 in. The amount of slippage di-

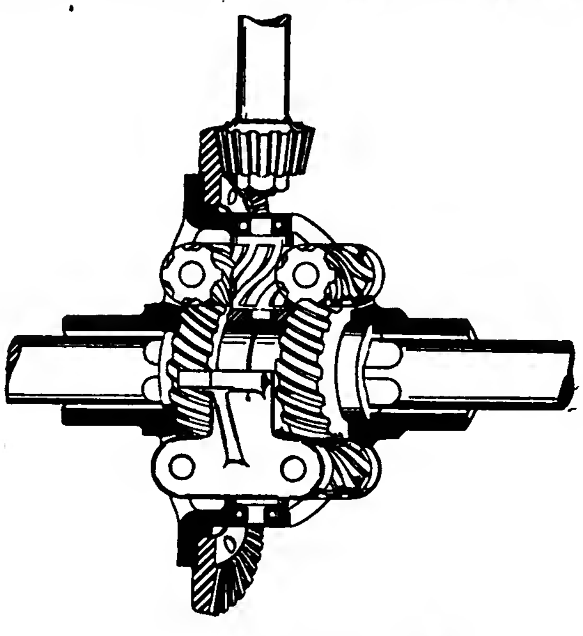


Fig. 5—Differential with spiral gears

vided by the circumference of the tire gives the proportion of revolution which the wheel has to slip in making a turn of 90 deg., and is 0.87.

The shortest radius at which the runabout examined can be turned is 13.9 ft. or 166.7 in. This is the radius at which the inner wheel turns. The outer wheel radius is 222.7 in. The distance the outer wheel travels in making a turn of 90 deg. with this radius is 350 in. The inner wheel travels 262 in. in making the same turn, the difference being 88 in., the same as with the touring car. I proved to my own satisfaction that the difference in travel between the inner and outer wheels in making a turn at a given angle depends upon the gage and not upon the radius of the turn. Taking the runabout tire diameter as 30 in., the circumference is 94.248 in. and the amount the wheel would have to slip 88 in. This divided by the circumference of the tire gives the part of the revolution that the wheel has to slip in making a turn of 90 deg., which is 0.93. No matter how great the radius, the amount of slippage through a given angle is always the same, for the difference in travel depends upon the gage and not upon the radius. Therefore with a solid axle no matter how slight the divergence from a straight line, an extra load, caused by the difference in travel of the two wheels, is always thrown upon the rear axle, wheels and tires. With a larger radius the slippage is not so noticeable, of course, as it occurs through a greater space.

S. A. E. On Record Summer Cruise

(*Continued from page* 1065)

material which had entered into a marvelous number of industries. When mixed with wood pulp and molded it is used for a great variety of purposes and can be molded to take any desired form. He told of how Mr. Hyatt started in search of a billiard ball which would be more resilient than ivory and as a possible result founded the Hyatt bearing company, the celluloid industry and finally kept on even after these two great by-products had been achieved until in conjunction with Dr. Bakel and Charles Burroughs he made the Bakelite ball which has a much greater elasticity than that of ivory. This was demonstrated on the scleroscope before the audience by Mr. Kettering.

A Study of Heat

The speaker then led his hearers into the mysteries of heat. The effects of heat are shown in the movements of the molecules of which a body is composed and hence the effect of a warm body upon a colder or *vice versa* is due to the collision of molecules moving at different relative velocities. Hot objects have rapidly moving molecules, cold ones have slower moving molecules. The effect of cooling a body is to slow up the molecules. Mr. Kettering demonstrated the condition of molecular cohesion in cold bodies by immersing several objects in liquid air. A rubber ball, a flower and a metal container were all shown to have their structural strength destroyed by the slowing of the molecules. A piece of mercury was frozen and cast in the shape of a hammer and Mr. Kettering drove several nails into a wood block with it, thus showing a strength increase caused by low temperature. Liquid air has a temperature of about 375 below zero.

Mr. Kettering then came to the subject of the earth's supply of energy. He gave as an illustration the bean, which is supplied with just enough energy to bring it through the crust of the earth, and he stated that the supply of petroleum was probably just enough to do the the same for the human race before it passed to other sources of power. The sun is the only source of energy, and until we can couple with it directly, we will not be perfect. As as illustration of the sun's power of pumping, he mentioned how the great lakes and the big rivers were kept perpetually full, entirely by solar energy.

62,000,000 Hp. in Automobile Engines

The enormous sources of water power which we have at our disposal were touched upon. He compared the 600,000,000 hp. available at present from water power to the 62,000,000 hp. generated by existing automobile engines, and stated that the ratio of supply to demand is greatly in our favor. We have available 25,000,000 hp. of animal energy. It takes 125,000,000 acres of land to feed these animals. Mr. Kettering said it would be a poor chemist that could not produce more horsepower than that from this huge area of ground. The speaker dwelt on the impractical suggestion of adding a few drops of material to water in order to produce energy by separating the hydrogen from the oxygen, as the amount of energy necessary in doing this is equivalent to that secured by combustion. It it were possible to change the air and have a greater percentage of oxygen we would be able to use fuels that are not now possible.

Radium and Its Possibilities

Mr. Kettering then spoke of radium as being one of the things about which we still know little and which might become very important. When this substance was first discovered scientists were puzzled by the fact that the air in a box containing radium was always warmer than the outside air. Eventually they found that the radium lost weight very slowly. Radium throws off particles of itself at an incredible velocity and it is the kinetic energy of these particles which causes the warming up of the surrounding container. The strength of a piece of steel is many thousands of pounds per square inch. If we could find means to let loose the energy which binds together the molecules of the steel we should have an inexhaustible source of power. As an example of this, the molecular forces holding together a grain of corn would provide over 2000 hp. for 24 hr. if we could find means for letting them loose.

The accuracy of measuring machines was touched upon and it was shown that with the interferometer it is possible to check within 1/1,000,000 part of an inch.

Mr. Kettering closed with a demonstration of the powers of the high frequency electrical current. He showed how a lamp could be lit through blocks of glass over 1 in. thick in spite of the fact that glass was supposed to be an excellent non-conductor. The frequency of the machine he used was 2,000,000 per second. In the meantime he had passed around samples of the various materials of which he had spoken, including several thousand dollars worth of radium.

Papers and Discussions

SS. NORONIC, Great Lakes, June 13 (*Special Telegram*)—To-day's proceedings opened with the reading of the paper on differential substitutes by D. D. Ormsby, Brown-Lipe-Chapin Co. The discussion was condensed somewhat to enable the morning's program to be covered. Secretary Clarkson first read a written communication from R. E. Wells, American Gear & Mfg. Co., supplementing Mr. Ormsby's arguments, and said that there seemed one difficulty in regard to the design of an ideal differential. What is wanted is a mechanism which will differentiate freely for corner turning and will not differentiate when traction differs in the two rear wheels through changes in the condition of the road surface. In other words, the differential substitute is required to distinguish between difference in traction due to road surface condition and difference in traction due to making a turn. The mechanism cannot be expected to do this.

Favors Free-Wheel Type

W. H. Diefendorf, New Process Gear Corporation, spoke in favor of the free-wheel type of mechanism, saying that 15,000 of these had gone into use during the past year. He said that the friction which is the feature of the spiral type differential must be objectionable, and as proof of its considerable magnitude he mentioned that a car with a differential of this sort exhibited a strong tendency to straighten out again after making a turn. With the free-wheel type, he said, no such action is observable.

Herbert Chase then read a letter from G. W. Smith, Thomas B. Jeffery Co. Mr. Smith gave it as his opinion that the ordinary rubber tire made a good differential as long as the radius of a turn was large enough to make the slip only from 2 to 4 per cent of the total distance traveled. The ideal would be a differential that would allow about 30 per cent but no more, which would cease to act as a differential when the difference exceeded this amount. This would prevent wheel-spinning and yet give perfect action on the sharpest turns.

A Year Without a Differential

A. Ludlow Clayden recited some experiences of his with a car of 90-in. wheelbase and 4-ft. tread, which he drove for a whole year without any differential. He said that on the whole the advantages and disadvantages were about evenly balanced. He didn't notice any increased tire wear, but there was grave risk of serious damage to a tire that became deflated if an instant stop was not made. He asked Mr. Ormsby what was the backlash in the spiral type differential and whether the internal friction provoked wear which increased this lost motion. The Hedgeland axle made experimentally years ago had a pronounced amount of backlash, and this caused a bump when the throttle was closed and the car commenced to drive the engine.

Ormsby made a short reply, at the request of President Huff, and said that the backlash in the spiral gear was about the same as in the normal type. He had driven a heavy car 12,000 miles with a spiral differential and could not observe any more lost motion at the end than at the beginning. He explained this by saying that the pinions in the spiral gear practically locked solid when any spinning tried to start.

Advocates Truck Formula

John Younger, chief engineer of the truck department, Pierce-Arrow company, submitted a written discussion on Professor Gallup's paper. This was read by K. W. Zimmerschied after he had read Professor Gallup's paper. Professor Gallup pointed out in his paper the fallacy of giving tests made under special condition as representative of stock car performance. He also dwelt on the advantage which would accrue from having a standard rating formula which would enable buyers to compare performance and price in making a choice.

Mr. Younger's communication dwelt on the desirability of a formula which would take into consideration something besides the mechanical measurements of the car. He particularly favored the sigma formula. This formula has been mentioned previously in THE AUTOMOBILE. It reads

$$\Sigma = \frac{0.0039\, d^2 \times S \times N \times G \times M}{D}$$

Where d equals bore, S equals stroke, N equals number of cylinders, G is gear ratio, M is gasoline consumption in miles per gallon, and D is the diameter of the wheels.

Mr. Younger gave some of the values of Σ, the highest being 4.7 under the most advantageous conditions.

British Railroads Use Motor Buses and Trucks

LONDON, June 8 — Nearly 500 motor vehicles were owned and operated last year by the principal steam railroads of the United Kingdom. The number was somewhat less than in 1914, owing to the requirements of the War Office, which requisitioned some of the vehicles for army purposes, taking, for example thirty-two of the London and North Western's fleet of fifty-two omnibuses. It is expected, however, that this year will show a considerable increase.

The British railroads collectively possessed 223 motor buses last year and more than 250 trucks and vans for hauling parcels, baggage and freight. The largest fleet were as follows:

Railroad	Buses	Trucks
Great Western	109	95
London and North Western	20	75
North Eastern	43	17
Midland	2	38
Great Northern of Scotland	36	..
London and South Western	2	27

The Midland doubled its fleet of trucks last year and the North Western increased its fleet 50 per cent.

These road vehicles are used principally as connecting links between the main lines and towns located some distance back from the railroads.

There is a big opportunity for similar use of motor vehicles by the railroads and interurban electric lines in the United States for serving communities too small to make the construction and operation of branch roads profitable.

United States Buys More F. W. D. Trucks

CLINTONVILLE, WIS., June 12—Another order for twenty-eight 3-ton transport trucks and five additional 600-gal. tank trucks has been placed with the Four Wheel Drive Auto Co., this city. An order was also given the Peerless company at the same time.

To Make Wheel for Fords

GRAND RAPIDS, MICH., June 8. — The Simplicity Demountable Wheel Co. has been organized by Frederick W. French and I. Bates and is operating at 412 Bond Avenue, N. W. The company manufactures regulation wheels for Ford automobiles.

Phelps Co. to Make Wire Wheels

COLUMBUS, OHIO, June 8.—The Phelps Manufacturing Co., incorporated several months ago with a capital of $100,000, has been organized by the election of H. C. Phelps, president; Dr. C. K. Wissinger, vice-president; T. W. Pickard, secretary, and L. M. Reif, treasurer. The concern took over the business of the F. & H. Wire Wheel Co., formerly of Columbus, but later of Springfield. The plant has been moved to Columbus and it is planned to manufacture 80 sets of wire wheels daily.

Pantasote Tops on Chalmers

DETROIT, MICH., June 10.—The Pantasote Co. has closed a large order for top material with the Chalmers Motor Co., and its product, Pantasote, will be standard top material on the new Chalmers model seven-22.

To Make Two-Speed Gears

COLUMBUS, OHIO, June 8.—The C. A. S. Products Co., incorporated recently with a capital of $100,000, is a reorganization of the Foster Gear Co., which holds patents on a two-speed gear. The company is preparing to manufacture the gears in large numbers. The rights to make the gears have been sold to several large automobile concerns, notably the Cadillac company. Incorporators are C. S. M. Krumm, C. D. Cutting, J. W. Graham, A. W. Tyler and Dorothy Loechler.

Constant Pressure Cycle Possibilities

Comparison of the Various Engine Cycles, Touching on the Advantages and Disadvantages of Each Type with Special Reference to the Constant Pressure Cycle

By Arthur B. Browne
Consulting Engineer
and Herbert Chase
Chief Engineer, Automobile Club of America

THE liberation of heat energy in a gas engine depends for its efficiency upon several conditions that may exist prior to ignition and during the combustion period. The efficiency is a maximum when the following conditions obtain:

(a) The density or compression of the charge is the greatest possible.

(b) The temperature prior to ignition is the highest possible.

(c) Oxygen is present in quantities just sufficient for complete combustion.

(d) The admixture of fuel with the necessary oxygen is perfect, that is, when the charge is absolutely homogeneous.

(e) Inert and diluting gases are absent.

Combustion may be divided into three main classes.

In *Class A* all the oxygen is furnished by the supporting atmosphere without admixture prior to combustion. An illustration of this is the luminous gas flame, in which gas issuing from an orifice finally comes in contact with the oxygen of the air and burns with a luminous flame of low thermal efficiency. It will be noted that Class A fulfills none of the conditions previously enumerated as making for efficiency because: (a) Both gas and air are at atmospheric pressure; (b) The temperature prior to ignition is low; (c) Much more oxygen is present adjacent to the combustion zone than is necessary and this excess is heated without useful purpose; and (d) There is no intimacy of the mixture, the gas molecules being forced to "seek" their proportions of oxygen before combustion can occur. Hence in the luminous gas burner the gas is caused to issue in a thin sheet, whereby its surface is made as great as possible in proportion to its volume.

In *Class B* part of the oxygen is mixed with the fuel, the remainder being furnished by the supporting atmosphere. This class is illustrated by the Bunsen burner and its thermal efficiency is, obviously, far greater than that of Class A. In this case the first three conditions are not complied with, the increased efficiency being clearly due to a partial compliance with condition (d.)

In *Class C* fuel and air are mixed in such proportions that there is just sufficient and no excess of oxygen, so that combustion ensues without regard to the gaseous medium in which it takes place. This is sometimes called "flameless" combustion, from the fact that the combustion is so rapid and so thorough that it takes place by concussive propagation between the molecules, in a very limited zone, almost a sheet, which is termed the "flame cap."

Class C, however, embraces combustion within the mass—a true molecular interchange confined to the sheet of flame cap only because at that point alone the rate of propagation between the molecules exactly balances the rate of flow.

In the case of flameless combustion there is no dilution of the unburned gases by the burned. The mixture of gas and air approaches the flame cap, complete and instantaneous combustion takes place and the products of combustion move away.

Comparison of Engine Cycles

Internal combustion engines may be classified as follows:

Class I.—Engines operating on constant volume cycle.

Class II.—Engines operating on constant temperature cycle.

Class III.—Engines operating on constant pressure cycle.

The Otto Cycle

To the first class belongs the Otto cycle, applied universally at the present time for internal-combustion automobile engines. Its chief advantages are its flexibility and adaptability to relatively lightweight and therefore to easily portable units. Its disadvantages are many and include the following:

(1) Poor thermal efficiency under the average condition of low compression pressure, which results from throttling of the charge and which (at maximum) must be relatively low to prevent self-ignition when a fuel rich in hydrogen (such as gasoline) is used.

(2) High explosion pressures occurring so suddenly as to deliver what practically amounts to a hammer blow on the piston head. To meet this condition the parts must be much stronger (and heavier) than they would otherwise need be to accommodate the relatively low mean effective pressure produced.

(3) Large clearance space required to admit of the low compression pressures necessary with rich and volatile petroleum fuels, which are practically the only fuels commercially available that will give reliable operation under varying load conditions. This clearance space is always filled with burnt gases, which dilute the incoming charge of unburnt gas.

(4) Impracticability (especially in light high-speed units) in cases where only heavy or relatively non-volatile fuels are available. This applies only to oil; that is, not to gas engines.

Combustion in the Otto cycle is superior by reason of its partial compliance with conditions (a, b, c and d) above. Combustion in this cycle clearly falls under Class C and would be highly efficient were it not for unavoidable losses and inherent limitations. But under condition (a) we find the density of the charge is limited by liability to pre-ignition, and under (b) the same limitation is placed on the pre-ignition temperature; as to (c) and (d) it is to be noted that the proportions and intimate admixture of the fuel and air depend on the efficiency of the carbureting device used. This is never perfect and is usually far from ideal. From condition (e) it is evident that the presence of burned gases in the charge not only serves to lessen the unit weight of charge taken in but entails a direct loss because of the heat delivered to these products of combustion.

The Constant Temperature Cycle

No engines practicable for motor vehicles have ever been developed using this cycle (Class II).

The Diesel Cycle

The Diesel cycle has several inherent advantages. High thermal efficiency, adaptability to use of heavy oils, variable cut-off (within certain limits) and high compression temperatures making ignition devices unnecessary, are foremost among these. Its disadvantages, on the other hand, are quite as numerous and in some cases insurmountable where small light-weight units are required. These disadvantages have to do largely with the high pressures encountered and include the following: (1) High compression and explosion pressures making necessary heavy and close-fitting parts, difficult to keep tight (engine may become inoperative if not tight); (2) Necessity for high pressure fuel injection pump, and separate air compressor; (3) Mechanical difficulties in regulating the minute quantities of fuel discharged by the pump to accommodate different loads; (4) Fuel admission line limited by the relatively small volume (entailed by the high compression necessary) to be heated by combustion; (5) Difficulties in starting with resultant complication; and (6) Low mechanical efficiency owing to close fitting parts (especially piston rings.)

The Semi-Diesel Cycle

The hot-bulb or so-called semi-Diesel engines possess most of the advantages of the Diesel type, although they are less efficient because of the lower compression pressure employed. They are limited as to power output per unit of weight on account of disadvantages similar to those of the Diesel cycle. This alone would preclude their adoption for motor vehicles.

The Constant Pressure Cycle

Let us now consider engines belonging to Class III. The advantages of this type are numerous and the disadvantages encountered in the past have had to do almost entirely with constructional difficulties. While the former have long been appreciated, not to say regarded as ideal, the latter have stood in the way of progress and have operated against the development of any commercially practicable* engine applying the principle of this cycle—this excluding, of course, engines operating on the Diesel or semi-Diesel cycles as not, strictly speaking, belonging to the constant pressure cycle class (see previous reference to Diesel cycle engines, under heading "Constant Temperature Cycle").

In order to have in mind exactly what is meant by the constant pressure cycle let us first consider the succession of events. A theoretical card for this cycle is shown in Fig. 1, in which AB represents adiabatic compression from atmospheric to maximum pressure; BC, addition of heat isopiestically; CD, adiabatic expansion from maximum pressure to atmospheric pressure; DA, cooling at atmospheric pressure. Note that heating is effected at constant pressure, and that this pressure is the maximum pressure of the cycle. There is no sudden rise in pressure at ignition as in the Otto cycle.

Advantages of the Constant Pressure Cycle

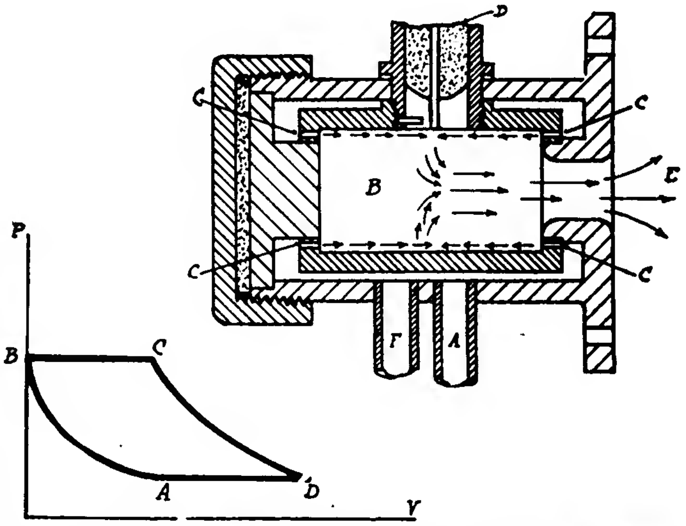
1—Inspection of the card given in Fig. 1 at once makes evident the two cardinal advantages of the cycle; (a) the large area indicating high mean effective pressure and (b) the low maximum pressure. In practice these are factors of utmost importance. They result in high and relatively uniform torque, large power output per unit of displacement and relatively low maximum bearing pressures and unit stresses on parts, with consequent light weight and length of life.

2—The possibility of varying the point of cut-off is practically the same as that in the ordinary steam engine. The variation can be made through such a wide range that the engine accommodates itself to most if not all variation in load. This fact is of utmost importance, since it operates to make the cycle practically as efficient at part load as it is at full load. No corresponding variation to meet changes in load is possible in the Otto cycle unless with "hit or miss" governing, which of course is not feasible for motor car engines. Variations in load are taken care of as a rule by throttling of the charge with consequent decrease in compression pressure. The thermal efficiency in any cycle falls rapidly with a decrease in compression pressure. In the automobile engine, for example, a maximum thermal efficiency of about 20 per cent is obtainable under full load conditions; the thermal efficiency can fall as low as 2 or 3 per cent under light load when the charge is throttled and the compression pressure correspondingly reduced. Since automobile engines run throttled during a large part of the time their thermal efficiency is necessarily low. Inspection of the card of the constant pressure cycle, Fig. 1, shows the feasibility of making the admission line BC so short (by means of an early cut-off) as to cause the expansion line CD to fall practically on the compression line AB. By this means it is probable that the lightest loads can be carried at the maximum pressure of the cycle with practically the same fuel efficiency as at full load. This being the case, throttling of the charge would take place only in starting.

Use of Low Grade Liquid Fuel

3—The importance of this factor in view of the constantly advancing price of highly refined petroleum distillates is readily apparent. The method by which low grade fuel can be utilized will be outlined later. But engines of this type can be made to run on quite as heavy an oil as can be utilized in any Diesel engine and with far better combustion conditions than are possible in the Diesel type. Self-contained constant pressure engines can therefore be expected to replace those of the constant volume type in the small size light weight class as rapidly as the Diesel engine has replaced the Otto cycle engine in the heavy weight class, where fuel cost is much in favor of the former. It is not at all unlikely that even the highly efficient Diesel engine will give place to the constant pressure type of engine when its advantages over the Diesel type are fully realized.

(To be continued)



Below—Fig. 1—Theoretical card for constant pressure cycle.
Above—Fig. 3—Representation of burner

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*Messrs. Carpenter and Diederichs state in their book on the Internal Combustion Engine that the Brayton oil engine was a thoroughly practical engine and saw wide application. This was true in its day but the engine has long since been abandoned, partly because of its inefficiency as compared to the modern Diesel types, but more especially because of cumbersome design and failure of its inventor to grasp certain important details of construction that will be treated of later.

Factory Miscellany

Body Plant in Dodgeville—Schroeder Bros., Milwaukee, Wis., are contemplating the establishment of an automobile body plant in Dodgeville, Wis.

Findeisen & Kropf to Add—The Findeisen & Kropf Mfg. Co., Chicago, Ill., will build a 25 by 110-ft. foundry at 2519 West Twenty-first Street, that city.

Warner to Add—The T. W. Warner Co., Muncie, Ind., maker of automobile parts, has had plans prepared for the erection of an addition to its plant, 85 by 125 ft., for which it contemplates the purchase of new machinery.

Fulton Tractor Plant in Anderson—The Fulton Tractor Mfg. Co. has taken over a plant in Anderson, Ind., which it will adapt for the manufacture of farm tractors and possibly automobiles. The company was recently organized with a capital of $300,000.

To Make Lamps in Knoxville—The Safety Automobile Light Co., Knoxville, Tenn., has been organized with $25,000 capital and contemplates building a plant to manufacture a special lamp for automobiles. J. G. Buchanan, A. M. Treadwell and others are the incorporators.

To Manufacture Fan—With orders from a number of large automobile companies, including one of 50,000 instruments from the Smith Form-A-Truck Co., the Pitter Fan Co. has started the manufacture of the Pitter automobile fan at 111 North State Street, Elgin, Ill. The company is specializing at present on a fan for Ford cars and trucks.

To Make Folding Berths—The Bradley Mfg. Co., Tacoma, Wash., R. L. Bradley, president, will establish a plant in Steilacoom, Wash., for the manufacture of a patented folding berth for automobiles. The enterprise is being backed by the Tacoma Commercial Club and Chamber of Commerce.

Davis to Add—The Davis Mfg. Co., Milwaukee, Wis., has increased its capital stock from $300,000 to $500,000 to accommodate its increasing business. The company recently took occupancy of its new plant at Fifty-sixth Avenue and Mitchell Street, West Allis, erected at a cost of more than $250,000.

Ford Plant in Duluth—The Ford Motor Co. will construct a plant at Duluth, Minn., at an estimated cost between $500,000 and $1,000,000.

This company recently took title to a parcel of land in Cleveland, Ohio, costing about $55,000. The property is 265 by 135 ft. in size. About half of it will be used for a two-story sales and service station.

It is also stated that the company is planning a factory for Des Moines, Iowa, on Grand Avenue.

Maxwell Starts New Castle Additions—Construction of the addition to the Maxwell plant in New Castle, Ind., has been begun. The new addition will take the shape of two large buildings, one to be used as a forge and hammer shop and the other to be used as a die shop. The forge and hammer shop will be in a large building, 550 by 80 ft., and will be constructed of concrete, brick and glass.

The building which is to contain the die shop will be erected between the new forge and hammer room and the main building of the plant. This building will be 220 by 90 ft. and of the same material as the other building.

Because of the call for additional power that the new addition will make, an addition to the present power plant is also under construction. The addition will be two stories in height and will be 54 by 45 ft.

Ill. Factory Items—F. G. Bain of Quincy, Ill., has purchased 4 acres of land near Bushnell, upon which he will construct a factory for the manufacture of automobile accessories. Bain has secured a number of patents upon various devices and will manufacture them upon a large scale. He will employ forty men at the outset. Originally Mr. Bain planned to purchase the plant of the Bushnell Tank Works and manufacture the latter's product in conjunction with his own inventions. He decided, however, to permit an option to lapse, preferring to keep the two lines separate.

The Barley Mfg. Co., Streator, has been given the central Illinois distribution for the Halladay car.

The Automobile Calendar

ASSOCIATIONS

June 12-16—S. A. E. Summer Trip on Great Lakes.
July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

June 17—Newark, N. J., Track Race, Olympia Park, Auto Racing Assn.
June 20—Galesburg, Ill., Track Race, 100 miles.
June 22-23—Chicago, Interclub Reliability Run, Chicago Automobile Club.
June 26 — Des Moines, Iowa, Speedway Race, Price Speedway Co.
June 28 — Des Moines, Iowa, Speedway Free - for - All, 300-Mile Race.
July—La Grande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300 - Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 4—Newark, N. J., Track Race, Olympic Park, Auto Racing Assn.
July 4—Visalia, Cal., Road Race, Tulare Co. Auto Club.
July 4—Spokane, Coeur d'Alene, Track Race, Reigel-Hiller Co.*
July 4—Benton Harbor, Mich., Track Race, F. E. Fitzsimmons.
July 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
July — Burlington, Iowa, 100-Mile Track Race, Tri-State Fair.
July 15—Portland, Ore., Track Race, Northwest Auto Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7 — Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Trade Happenings

Mountain Trade—The Adamson-Purinton Motor Co. is the name of a new concern at 1320 Broadway, Denver, which has secured the Dixie and Old Hickory truck agency for northern Colorado. Adamson is one of the proprietors of the South Denver Garage, 271 South Broadway.

The Colorado Motor Car Co., 1520 Broadway, Denver, Cole, Reo and Saxon distributor for Colorado and Wyoming, has opened a branch for used cars and service station in a new building at 801 Broadway.

The Chandler Motor Co. of Colorado, 1518 Broadway, Denver, Chandler distributor for Colorado and Wyoming and Stutz dealer for Denver and vicinity, is now in charge of G. W. Embrey, formerly of the Chandler factory. Embrey has been connected with this company from the time it started and held a service department position just before taking over the management of the Colorado branch.

The McQuay-Norris Mfg. Co.'s Denver branch, 528 First National Bank Building, handling piston rings and lyanite pistons, is now in charge of H. W. Sweeney. H. W. Knapp, whom he succeeded as local manager, has been transferred to the Kansas City branch.

De War Bros., new Denver agents for the Detroit Electric, have just completed a new building for salesroom and service station at 749-751 Broadway.

The Mid-West Rubber & Auto Co., 1606 Broadway, Denver, distributer of Pennsylvania Vacuum Cup tires for Colorado, Wyoming and New Mexico, has secured the Davis car distributing agency for these three States.

Trade News from Pa.—William Patten, of the Patten-Fleming Co., 1828 Market Street, Philadelphia, dealer in automobile accessories, has asked for a receiver for the business. Mr. Patten is withdrawing from the firm, but could come to no agreement with G. G. Fleming. The assets are $7,121 and the liabilities $5,677.

The Times Square Automobile Co., New York, has leased the entire first floor of the building at the southwest corner of Broad and Vine Streets, Philadelphia. The company, which has showrooms in a number of other cities, is having alterations made to the new one here.

The General Refractories Co., West Decatur, Pa., has awarded contracts for a one-story brick and steel factory building, 115 by 300 ft. The Johns-Manville Roofing Co. received the roofing contract.

The King Car Agency, 514 North Broad Street, Philadelphia, has taken additional quarters at Broad and Brandywine Streets.

The Industrial Bureau of the Philadelphia Chamber of Commerce is negotiating with several large manufacturers with a view to having them establish plants in this city. One of these is a group of New York and Detroit capitalists who are seeking a plant here to make kerosene for automobiles. The other is the Houk Wire Wheel Co. of Buffalo, which is also considering a branch factory here.

Ohio News Items—Papers have been filed by the Miller Rubber Co., Akron, for an increase of the authorized capital from $2,000,000 to $20,000,000. In filing the papers a fee of $18,000 was paid into the State treasury. The increase will be used for betterments and extensions.

J. M. MacDowall, formerly of Pittsburgh, has been made manager of the retail branch of the Ohio Electric Car Co., at 1220 Madison Avenue, Toledo.

The Willys-Overland Co. of Toledo has taken a lease on part of the former factory of the Columbus Buggy Co., on Dublin Avenue, Columbus, which will be used for the storing of cars for the present. Later, an assembling branch may be established.

Samuel Isaacs, formerly with the O. G. Roberts Co., Columbus, Overland agent, has taken a position with the Oscar Lear Motor Car Co., central Ohio agent for the Buick.

Gaston Goes to Lexington—H. W. Gaston, formerly assistant manager of the Eastern branches of the Reo Motor Car Co., has been appointed sales manager of the Lexington Motors New York Corp., with headquarters in the Circle Building. This corporation controls the Lexington output in New York, New Jersey, Connecticut and Rhode Island.

Ill. News—The Jennings Auto Sales Co., Springfield, has moved into a new building at the corner of Tenth and Adams Streets. A salesroom and all modern conveniences have been installed for the comfort of patrons. The rear will be devoted to a service station and the second story for storage purposes.

The Keyt-Erb Automobile Co., Rockford, has removed to the Countryman Building, corner of Main and Cedar Streets, due to the necessity for larger quarters, and the new plant will be utilized for a sales agency and repair department. The building will be devoted to a service station.

W. Y. Wayne, Decatur, has opened a paint shop for automobiles and motor vehicles of all kinds at 405 East Center Street. This is a new departure, as most of the vehicle paint shops have been taking care of cars as a side issue.

The Waite Tractor Co., Elgin, Ill., has taken over the entire manufacture of its tractor machine in the Kimball Street plant, Elgin. The machinery is now being installed in Elgin. Eight more men will be added to the Elgin plant by the change. Under the contracts in effect when the company located in Elgin the first of the year, part of the construction took place in Elgin and the remainder in Waukesha. By consolidating at Elgin better results are anticipated. About 250 tractors will be placed upon the market this year.

New England Trade Items—H. Strahan, S. A. S. Strahan and P. J. Dimond have formed the Crow-Elkhart Motor Co., Boston, Mass., with salesrooms at 1121 Commonwealth Avenue.

F. W. Paine and G. H. Russell have organized the Paterson Motor Car Co., Boston, for the Paterson six.

J. E. Cunningham, for 5 years with J. W. Maguire, Pierce-Arrow dealer at Boston, has resigned to become manager of the Republic Motor Truck Co., in that city.

The De Luxe Sales Co. has been organized at Boston, Mass., to build special bodies for Ford cars. H. H. Murphy is manager, and the salesrooms are at 1123 Commonwealth Avenue.

The B. F. Goodrich Co. has opened a new factory branch at Burlington, Vt., with L. E. Stone as manager.

The E. E. Wentworth Co., agent for the Overland in Maine, has outgrown its quarters at Portland and has moved into larger ones there.

C. R. Culver, who now has the Pierce-Arrow agency at Springfield, Mass., is planning to erect a new sales and service station at Hancock and State Streets. The Stoddard Motor Co., that handled the line for years, will take on another well-known make.

G. W. Geiger, formerly selling Kissel-Kars and Mitchells at Springfield, Mass., has resigned to join the Stearns-Knight agency there.

C. M. Stone, agent for the Davis line at Providence, R. I., has moved.

The AUTOMOBILE

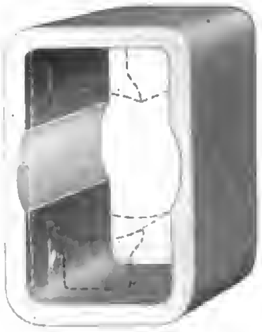
Vol. XXXIV
No. 25

NEW YORK, JUNE 22, 1916

Ten cents a copy
Three dollars a year

GRAY & DAVIS

STARTING
LIGHTING
IGNITION



QUALITY

STRENGTH

ACCURACY

As the Light House, *founded on a rock*, throws its distant beam in calm or storm, so Gray & Davis starting and lighting units, *built fundamentally right*, give uninterrupted service.

QUALITY. The frames are formed from flat bars of soft high grade dynamo steel. The ends are electrically welded together.

STRENGTH. The commutator end bracket is formed into channel section of tough steel for *added* strength. The frame and brackets are then fashioned into one piece by electric welding, thus permitting dis-assembling of units without disturbing bearing alignment.

ACCURACY. The units are so designed that all work operations are easily made accurate. The frames, bored in one operation, bring field poles and bearings into absolutely true alignment and give perfect magnetic balance which affords smooth, continuous operation.

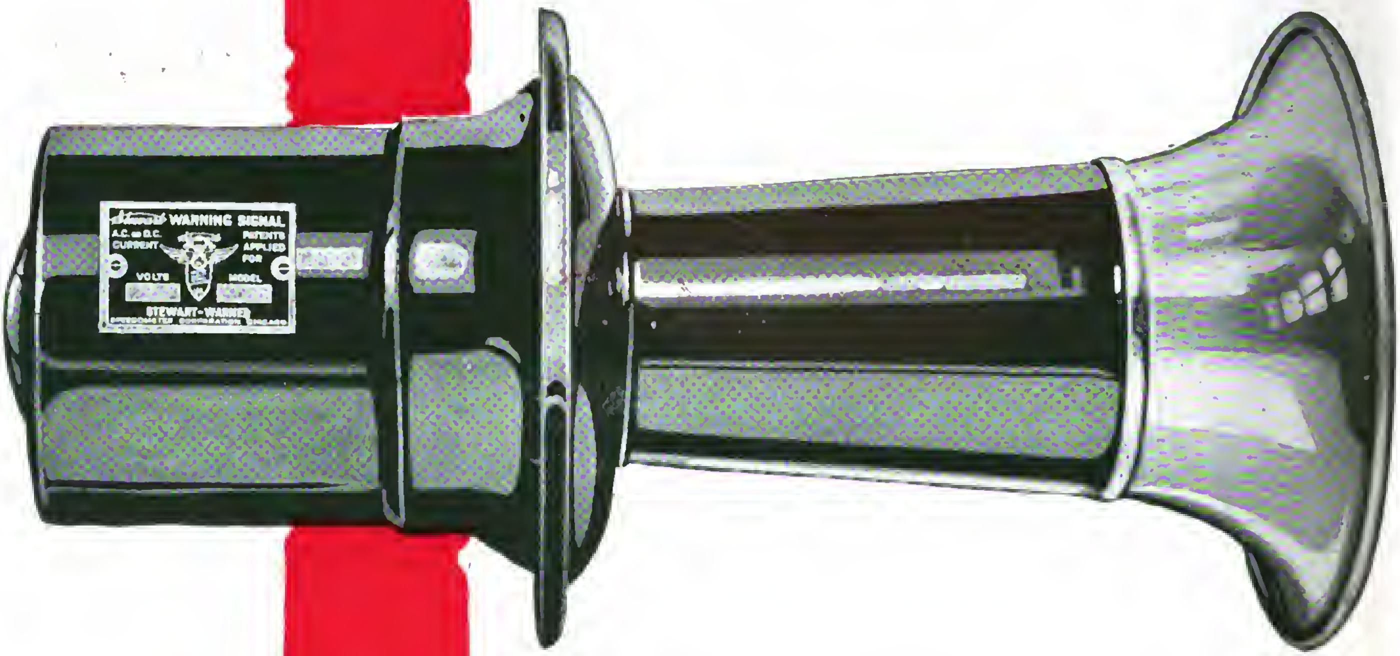
This is why Gray & Davis units consume so little of the engine's power.

Every instrument is *the same!* Every instrument is *right!*

GRAY & DAVIS, Inc., Boston, Mass.

Stewart $6

Motor Driven Warning Signal



Some Orders—

Last week we took an order for 10,000 Stewart Warning Signals.

Only a couple of weeks ago we took another order for 40,000.

Several days ago we received one for 8,000.

And so it goes.

The Stewart Warning Signal is the recognized standard signal of the industry.

It has the quality and the "staying powers."

It's the fastest selling signal in America.

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation
Chicago, Ill., U. S. A.

Vol. XXXIV New York—Thursday, June 22, 1916—Chicago No. 25

The Automobile

Steamship Waubic, at Killarney, from which point the S. A. E. made a trip through the islands

S.A.E. Decides To Change Title

To Include Aeronautic, Tractor and Motor Boat Engineering—New Name Society of Automotive Engineers

THE S. A. E. may change its name without changing its initials. In consequence of the wish of the United States Government to get all the help it can, especially for army and navy purposes, from the engineering societies, the summer meeting on board the S. S. Noronic was asked by President Huff, by Henry Souther and by Howard E. Coffin, whether it would enlarge its field and take steps to become of as great a value to the other engineers mentioned above as it has been to the passenger car and truck industry. Such an enlargement, according to President Huff, would mean an extension of the membership list to huge proportions. To-day there are 2000 members, and the bigger total of 5000 should be easily reached.

It is obvious that the development of aviation and tractor engineering is very rapid at the present moment and it has been suggested that the society ought to make quite clear the fact that its scope includes these branches of the automobile industry. It has been suggested by prominent men in the world of aeronautics that the society should immediately start work on standards for aircraft. The tractor manufacturers have need for certain standards and on these the S. A. E. and the National Gas Engine Assn. have been in close touch.

Meanwhile, a large number of motor boat engineers have intimated a wish to become members of the Society if it is possible to care for the standardization of certain special things used in motor boat construction. Consequently, it is suggested that the title of the Society be changed from "automobile" to "automotive" engineers; that the Society shall be managed by a board of fifteen directors, there being one president, one first vice-president and five second vice-presidents; the council

As the boat approached the shores of Mackinac

being enlarged correspondingly to include the new interests.

In order to change the constitution of the Society it is necessary to obtain the approval of the general meeting, then to circularize the information to all the members and take a final vote by letter ballot before the next semi-annual meeting, which in this case will take place in January.

This is the most important business done on the 1916 summer cruise. The only other business matters discussed besides those necessary amendments to the constitution for altering the name, were a new method for choosing the nominating committee and the creation of a new class of membership; both being accepted with but little discussion.

The subject of the constitution of the nominating committee came up at the January meeting, and the problems then appearing are now solved by a resolution that the nominating committee shall have a member appointed by each section, and three other members, no two of whom may be resident in any one sectional district.

The other motion made was to alter the constitution of the Society so as to include a new grade of membership known as the United Service Engineer. The qualifications necessary are the same as those for full membership in the Society, but the initiation is reduced to $10 and the annual dues to $5, without the privilege of voting. This is done in order to allow engineers in the United States army, navy and other departments whose work brings them into close touch with transportation problems, to enjoy the benefits of S. A. E. membership at a price which will coincide with the relatively low incomes of such engineers.

Trip Brilliantly Successful

That the four day scheme is adopted for good, if indeed there is not a move to add yet another day next year, has been settled by the unanimous vote of those who took part in the cruise this year. The only fly in the ointment was the limited time available for discussion, and there was considerable regret that the full program of papers could not be covered, several being left over at the close of the meeting on Friday afternoon when within hailing distance of the dock. It would seem almost worth while to hold a session in Detroit, later on, to take up some of the papers again and discuss them more fully.

The papers committee did their work nobly. Never has so fine a collection been got together, never has so wide a field been covered.

Taking up the itinerary from the time of sailing from Mackinac Island on Tuesday afternoon; the first event was the entertainment features provided by the Pennsylvania and Cleveland sections. The former arranged with Henry Hess to give a lecture on color photography, and he held the convention salon crowded while picture after picture illustrating the newest of the arts was thrown on the screen. Apart from the artistic value, Mr. Hess showed that color micrographs were going to be of great value in metallurgy, showing many things that did not appear in monochrome.

Cleveland had an operatic entertainment to offer of an extremely high order of merit with songs and music of a quality seldom encountered off the concert platform.

Sports Enjoyed Greatly

All day Wednesday was spent at Killarney, a diminutive fishing island inhabited by some 250 Chippewa Indians. Fishing, athletic sports and an East vs. West baseball game were the main features of the day. At night the Detroit section produced a five-act melodrama which was universally voted one of the funniest performances ever put on the stage. It had very little to do with automobile trade matters but was just a farcical

A professional session of the engineers on board tne Noronic

rendering of the old-time drama in the most approved manner.

Thursday was to have contained a stop at Owen Sound in the afternoon, but the Noronic lay fogbound at Killarney all night and, on getting away about 9 o'clock Thursday morning, headed direct for Detroit. Practically every available moment of Thursday and Friday was filled with the reading and discussion of papers and Thursday evening the Metropolitan section produced a revue which, while shorter than the Detroit play, was quite as much appreciated. The "book" consisted almost entirely of trade jokes, mainly at the expense of the Detroit section membership which were greatly enjoyed by the latter.

Discussions Limited

With Detroit in sight on Friday afternoon it was found that quite a number of papers remained, for the reading of which no opportunity had offered. It appeared to be the general opinion that the papers committee had provided ample on the program for an extra day or more of professional sessions. Even to cover the papers which were discussed it was necessary to read them in abridged form, and the speakers in the discussions were limited to a very few minutes each. This meant that many of the papers were not discussed as fully as they would otherwise have been and obviously next year it will be essential to make some arrangements whereby two papers on quite different subjects can be read simultaneously in different parts of the ship. This was the original scheme on this occasion, but the lower deck accommodation, fitted up as a theater for the entertainments, had very inadequate lighting, making it distinctly unsuitable for a meeting held in the daytime.

One of the outstanding characteristics of the trip this year was the absence of any new special topics of paramount interest. Last year every few yards along the deck would be found small groups of engineers discussing the eight- and twelve-cylinder engine, or if this were not the subject of the conversation it would be light weight. This year the burning questions of 1915 seem to have been settled and no others have, as yet, quite taken their place.

Future of the Tractor

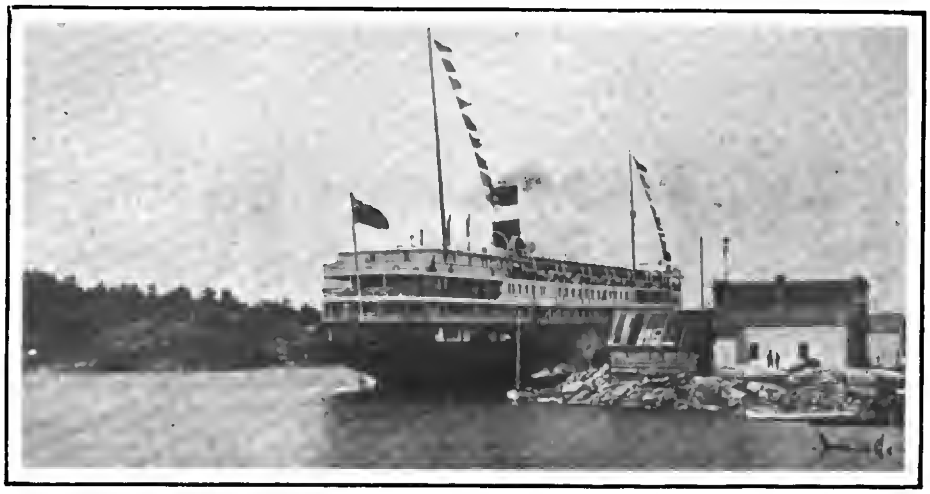
The future of the tractor is one of the most frequently discussed subjects, or rather the exact place which it is going to take in the automobile world. The general opinion is that there is a better market for a thoroughly well-made machine than for one which is merely cheap. Furthermore, that careful design and good workmanship mean economical operation which is really more important to the farmer than low first cost.

The pros and cons of differentials are also a subject to which some attention is being given, and it seems likely there will be a general move to try out some of the differential substitutes on a large scale in the 1917 cars.

Aeroplane Paper Provokes Big Discussion

Neil MacCoull opened the Thursday session with his paper on aeroplane engines, in which the recent developments are reviewed. Discussion on the paper was short as far as the original subject was concerned, but it opened up the question of the participation of the Society of Automobile Engineers in aeronautical work. G. M. Muffly said that the rotary type of motor, for which credit is generally given to foreign engineers, originated in this country in the old Adams-Farwell automobile. Rotary engines were equipped with double ignition on account of the belief that one set was apt to fail. What failures there were, however, were generally from the sooting of the plugs due to feeding too much oil.

"Aeroplane engines," continued Mr. Muffly, "are continually operating under racing conditions and hence care must be used in the speed for which they are designed, as they are run at full speed all the time. I also predict that rotary valves will be used to a greater extent and in fact am work-



The Noronic docked at Killarney, the Indian fishing village

ing on one now which will be distinctive in that it will be muffled.

"The advantage of twelve-cylinder motor installation is that it is possible to keep a constant torque and hence a constant speed on the propeller, thus reducing the tendency towards fluttering of the propeller. Where the rotary motor has fallen down is in the lack of economy of gasoline and oil. The reason for the great oil consumption is in the method of application of the oil and the greater clearances used with the steel pistons working in the steel cylinders.

"The rotary motors have also had a shorter life, which has been due to the attempts of the designers to secure abnormally light weight. Such a motor is naturally lighter than a reciprocating type and there is no necessity for cutting down life for the sake of the saving in weight. I prophecy that the new types of rotary will have higher efficiency and economy then the reciprocating engines."

Suggests Change of Society's Scope

Howard E. Coffin then spoke upon the widening activities of the Society. He said that the organization was originally intended to go beyond its present scope. In fact if the definition of the word automobile is looked into closely it will be seen that it covers any mechanism which is self-propelling.

It is necessary that cognizance be taken of the labors in other fields—high-speed motor boats aircraft, both heavier and lighter than air; and the S. A. E. should make itself responsible for this development. The time has come, he explained, for the Society to make itself active in all lines that are really covered by the term automobile in its broadest sense.

Mr. Coffin called on Henry Souther, who has just been made consulting engineer in the government aeronautical service, to talk on the aeroplane question. Mr. Souther said there is so much to the subject that it is difficult to select the high spots. The art is changing so rapidly that every 2 months makes a vital difference in practice. "We must all get together to accomplish something," said Mr. Souther. "In years past there were restrictions between the governmental departments and the industry, but on the other hand, the engineering problems in connection with military work were very few and unimportant. Now they have been multiplied tremendously, therefore it has become necessary to remove the obstacles. A body of men has recently been formed, which reports only to the president; its title is the National Advisory Committee on Aeronautics. Some of the members are Dr. Walker of the Smithsonian Institute, Mr. Marvin of the weather bureau, and Dr. Stratton of the Bureau of Standards. Others comprise professors of important subjects from seats of learning and all operate in conjunction with several officers representing the army and navy.

"Last week a conference meeting was held and they brought together members representing the entire air industry, having a very illuminating discussion regarding the state of the art from the standpoint of the user, flyer and engineer. An active committee has been appointed to co-operate in carrying on the work. Dr. Dickenson represents the Bureau of Standards on the committee, Lieutenant Young the navy, and myself, the army.

"The whole course of action has been tentatively laid out. For the present the army and navy will be the principal users and must take the initiative and the first work of this sub-committee will be to draw up a set of specifications. The army, navy and Bureau of Standards will come to agreements on the specifications and these will be brought to the

The Indian band which met the Noronic at Killarney rendering a selection

attention of the engineering body most active in this work, and there is no reason why the S. A. E. should not be this.

"The standards committee of this body can then meet with the committee of the United Services, to clear up the specifications. These should be particularly valuable because they will be backed by the government departments and they should be developed rapidly.

Introduces "Automotive"

"Mr. Coffin has broached the subject of national alliance with bodies that are active in the motorboat, air machine and tractor fields. There seems to be no reason for hesitation. The name of the Society of Automobile Engineers has gone around the world and carries as much if not more weight in manufacturing circles than any other society I know, because it is a society whose work is practical.

"It is unfortunate that the word automobile, in the name of the society, is restricted by common usage to pleasure cars, but, if the name is restrictive, the difficulty is not insurmountable as some other word such as automotive could be used. If that were the only obstacle in the way of uniting the societies with common interests it could readily be overcome."

Howard Coffin then spoke of the importance of the air service abroad. He said that there were 30,000 men behind the lines training for positions as aviators. This is on the Western front alone, and does not include those who are already fighting. He said that Glen Curtiss had told him, in a recent conversation, that not one of the several thousand aeroplanes shipped to the other side by his concern has gone to the front, as it takes two weeks to get the latest practice and by the time they get to Europe they are fit only for school purposes.

"The object of Mr. Kettering's talk the other evening was to make us think, and this is the object of this talk on the subject of industrial preparedness."

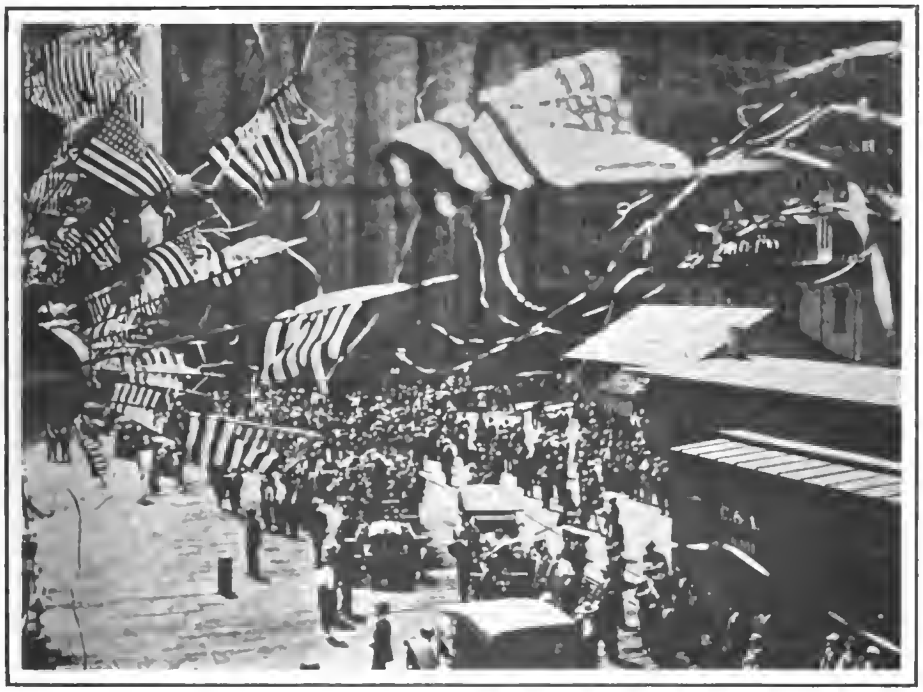
Mr. Coffin then read a large part of the address on industrial preparedness and the automobile industry which he made on May 29 at Indianapolis (reported in THE AUTOMOBILE for June 1).

Afternoon of Business

A. J. Slade's paper on Mechanical Transport Mobilization concluded the Thursday morning session and the afternoon was given to a meeting to accept the reports of the standards committee and to pass the constitutional amendments. The standards reports are printed on page 1116 and the details of the other business have already been mentioned.

On Friday, the ball was opened by B. Liebowitz with his paper, The Dynamics of Vehicle Suspensions. This is a lengthy treatise on the mathematics of springs and the principal speaker in the discussion was Henry Hess, who stated that a better suspension could be obtained from a single spring leaf backed by solid "cams" than from springs with multiple leaves. The paper in an abridged form will shortly be published in THE AUTOMOBILE, together with the scheme sketched by Mr. Hess.

Professor Lucke's paper, Kerosene versus Gasoline in Standard Automobile Engines, was digested by K. Zimmerscheid, Dr. Lucke not being on the boat, and this also is reserved for a future issue. Time did not permit much discussion, P. S. Tice speaking at some length, however, and promising to submit a written discussion on the subject, going fully into the points on which he differs.



Flags waved and excitement reigned as the Noronic left Detroit

Jacob E. Gramlich,
Thermoid Rubber Co.

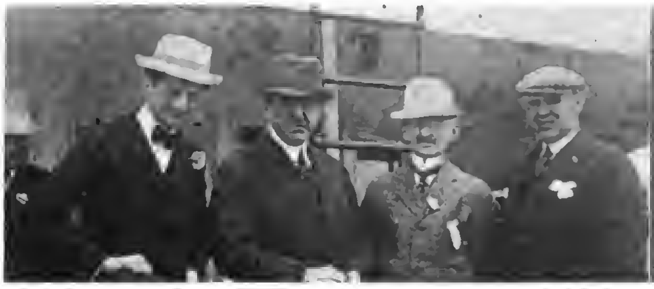
Herbert Chase,
Automobile Club of America

Neil MacCoull,
Westinghouse Mch. Co.

Alanson P. Brush,
Brush Engineering Assn.

Arthur J. Slade,
Consulting Engineer

Russell Huff,
Dodge Bros.

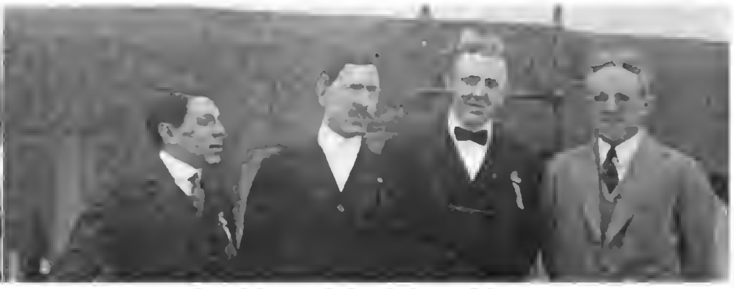


V. W. Kliesrath,
Bosch Magneto Co.

F. E. Moskovics,
Nordyke & Marmon Co.

A. Schwalbach,
Perlman Rim Corp.

Harry Fosdick,
Wentworth-Fosdick Co.



W. H. Conant
Gould Storage Battery Co.

W. A. Brush,
Brush Engineering Assn.

Henry G. McComb,
General Motors Co.

George W. Dunham,
Consulting Engineer

Henry G. McComb,
General Vehicle Co.

A. K. Brumbaugh,
Autocar Co.

A. B. Cumner,
Autocar Co.

B. B. Bachman,
Autocar Co.

J. E. Schipper,
THE AUTOMOBILE

Leonard Kebler,
Ward Leonard Electric Co.

D. J. Burns,
Ward Leonard Electric Co.

C. H. Foster,
Gabriel Horn Mfg. Co.

Albert Champion,
Champion Ignition Co.

Ernest E. Sweet,
Cadillac Motor Car Co.

Arthur M. Laycock,
Sheldon Axle & Spring Co.

E. W. Acker

G. P. Dorris,
Dorris Motor Car Co.

J. G. Vincent,
Packard Motor Car Co.

F. R. Hoyt,
Wagner-Hoyt Electric Co.

George F. Walker,
Royal Equipment Co.

A. Ludlow Clayden,
THE AUTOMOBILE

K. W. Zimmerschied,
General Motors Co.

C. F. Van Sicklen, Van Sicklen Co. *John T. R. Bell, Norma Co. of America* *C. F. Scott, Sprague Electric Wks*

Miss McCormack and Miss Cohn. S. A. E. Staff

R. M. Owen, R. M. Owen & Co. *R. R. Owen, R. M. Owen & Co.*

C. F. Kettering, Dayton Engineering Laboratories Co.

R. H. Combs, Prest-O-Lite Co., Inc.

David Ferguson, Pierce-Arrow Motor Car Co. *Alanson P. Brush, Brush Engineering Assn.*

Representatives of the Splitdorf Electrical Co. Left to Right—Top Row—E. R. Hodges, A. D. T. Libby, W. J. McIntyre. Bottom Row—V. A. Nielson, H. W. Scholl

Willard Storage Battery Co. Men. Left to Right—Top Row—C. S. Whitney, E. M. Coe and H. S. Gardner. Bottom Row—A. J. Nightingale and A. C. Hyser

Above—The winning baseball team representing the East which defeated the Western aggregation 15 to 2 at Mackinac Island Below—Staff of the S. A. E. Daily, produced on Noronic Above Right—The Perfection Spring Co. Aggregation. Left to Right —Top Row—J. G. Utz, A. C. Bergmann, H. H. Newsom, W. P. Culver and W. E. Dunston. Bottom Row—H. E. Figgie, R. H. Brown, C. S. Pelton, F. A. Cornell, C. E. Clemens and C. W. Hatch. Below Right—A group of tire men. Left to Right—J. T. Kennedy, Goodyear; G. A. Dodge, Dayton Rubber; J. H. Waysenhorst, Goodrich; G. F. Fisher, United States; W. A. Allen, Goodrich; C. C. Carlton, Firestone; C. J. Welsh, United States; J. E. Hale, Goodyear; and H. J. Palmer, Goodyear

Standards Divisions Report Progress

Standard Nomenclature Now a Fact—Several New Standards Accepted—Electrical Equipment Division Has Majority of Recommendations Ready—Standard Piston Ring Grooves Accepted

AT the opening of the session devoted to receiving the reports of the standards committee which took place Thursday afternoon, the chairman, A. Ludlow Clayden read the condensed report of the work of the past 6 months which follows:

On this occasion, the standards committee has but a few things which it asks you to accept as recommended standard practice. The divisions of the committee have been extremely active and we have some excellent progress reports to lay before you. I am going to ask you to regard the few reports presented for acceptance as a tribute to the thoroughness of my predecessor. Mr. Zimmerschied saw to it that before he relinquished the reins of office he had practically everything cleaned up.

At the end of February there was some reorganization of the standards committee; several committees whose work seemed to be at an end or who were for other reasons inactive were discontinued.

Recently, within the last 2 weeks, a new division has been created, and in the light of the interest which the society is certainly going to take in aviation and also possibly in motor boat engineering, it is probable that still more divisions will be added.

I wish briefly to review the work of the different divisions since the January meeting in New York. Taking them in order, the Ball and Roller Bearing Division has followed out its original plan and prepared a suggested series of standard sizes for taper roller bearings. Certain matters relating to ball thrust bearings are now under consideration.

Carbureter Fittings

The Carbureter Fittings Division has arrived at the stage when the bulk of its work appears to be done, at least for the present, whatever may happen in the future. The division has been engaged in the consideration of various details, such as throttle lever throw and threads on the rod ends. Various matters in connection with gasoline and other pipe sizes are also under consideration. Similarly the double outlet carbureter used for V engines will offer opportunities when it is certain that a definite practice can be recommended without in any way restricting the development of design.

Standards Recommendations

Nomenclature for all parts of an automobile. Standard Words accepted for chassis and body parts.

Standard sizes for flexible metallic tubing from 3/16 in. to 1 in. inside diameter, inclusive.

Three standard forked type lamp brackets of 7¼, 8¼ and 9¼ in. span.

Resolution that head lamps should be mounted at least 3 ft. from the ground, measuring to the center of the lamp.

Resolution that dimming devices which operate by reducing the current to the head lamp bulbs are of no value FOR THE PURPOSE OF ELIMINATING GLARE.

Resolution that focussing devices should not revolve the bulb nor cause it to move out of center.

Resolution that the slots in the bulb socket should be set so that the pins on the bulb stand vertical.

Resolution that bulbs for use with three cell batteries shall be known as 7 volt bulbs, and those for six cell batteries as 14 volt bulbs.

Resolution that the storage battery should be grounded by only one conductor and that the switch for the starting motor should be placed on the ungrounded side between battery and motor.

Standard throttle lever rod end to be 3/16 for carbureters from ½ to 1 in. and ¼ for larger sizes.

Carbureter throttle lever throw to be 1¼ for ½, ⅝ and ¾ in. carbureters, 1¾ for 1 to 2 in. carbureters inclusive, and 2½ for larger sizes.

Standard charging plug receptacles for electric vehicles.

A new high carbon nickel steel.

New table of physical properties of sundry S. A. E. steels, and some new recommendations relating to test specimens.

Formula and table of standard sizes for piston ring grooves covering every size of piston used in automobiles.

Increase of ¼ in. in the length of thread on the standard S. A. E. bolts.

Series of standard sizes for taper roller bearings making for interchangeability and following the previously accepted standards for ball bearings.

The work of the Chain Division has been interfered with to some extent by the war, since the co-operation of the foreign manufacturers is sought to aid the division's endeavor to standardize dimensions so that chains of different kinds can be used on the same sprockets with equal success. In this connection, F. L. Morse, chairman of the division and president of the Morse Chain Co., has offered to allow other companies to use one of his patents if this assists standardization.

Electrical Equipment

The Electrical Equipment Division has been the most active this year. It has before it some of the most difficult questions which have yet been offered to the standards committee for settlement and the progress which it has made is excellent. At the present time it has two main objectives; one is to lay down some really scientific rules for the construction of lamps which shall give the right sort of light. A sub-committee of the division has been conducting actual tests of a very careful kind, and in a very short time it will be possible to recommend specific dimensions for the different parts of a headlight which will give a light strong enough for safe driving, yet so disposed as to overcome glare.

Another sub-committee of this division is dealing with the other difficult subject of starting motor generator and ignition unit standardization. Here the situation is as follows:

The aparatus is in course of development. It is admitted by everyone that electrical equipment is a long way from being in final form. This makes standardization difficult because it is not easy to be sure of the shape, size or disposition of generators and starting motors, say 2 years hence. Simultaneously, we see a great number of needless patterns being made to suit the idiosyncracies of various engineers. There may be excellent scientific and engineering reasons for a generator maker to have seven or eight patterns, but there can be no possible sense in making seventy or eighty differing from each other by very small degrees. It is the hope of the division to be able to strike some sort of happy mean between a standardization which might cramp development and the present chaos.

The division is also dealing with a number of matters of detail such as standardization of flexible metallic tubing, of tail lamp glasses, of headlight brackets, etc.

Electric Vehicle

The principal matter before the Electric Vehicle Division is the evolution of some scheme whereby vehicle batteries of different makes may be readily interchangeable, thus facilitating the running of fleets of electric trucks. The basis of such a standardization is to be found in the jars of which the battery is composed. These are made in a great variety of sizes, and many matters of scientific correctness of design have to be agreed upon in addition to the questions raised by the equipment with which different manufacturers are now working. The division has been investigating the subject very thoroughly, as it is felt that hasty action would probably be disregarded and that it is only of use to establish standards when there is a reasonable hope that they will be respected.

Engine and Transmission

The Engine and Transmission Division is paying close attention to the work of the Electrical Equipment Division with respect to starting motors and generators. The subcommittee appointed to deal with this subject contains members from both the electric equipment and engine and transmission division. The compilation and comparison of engine characteristic curves commenced last year is progressing. Arrangements have been made for elaborate tests of V belts, for driving fans, etc., and there are sundry other matters upon which action may be expected during the fall.

Foreign Co-operation

The Foreign Co-operation Division has found its work brought to a standstill by international conditions. At the commencement of its activity early in 1915 such correspondence was conducted with England and the outlook was very promising. Since that time the British engineering standards committee has had its personnel almost entirely absorbed by other work and consequently no committee can be got together on the other side and nothing can very well be done. There is no doubt, however, but that progress will be rapid as soon as the tension eases.

Miscellaneous

The Miscellaneous Division has always an extremely lengthy program. At the present time there are some fifteen or sixteen items before it. A recent attempt to standardize fittings for the attachment of the speedometer drive to the transmission has had to be abandoned owing to the extremely wide variations in practice discovered. It may be remarked that this type of standardization which seems so easy at the outset is really one of the most difficult and the explanation to my mind is that there is no fundamental reason why a speedometer should be driven in any particular way. There are a number of methods, each equally good, and the gain in selecting one of them for universal adoption is scarcely great enough to make it worth while at the present time for automobile manufacturers to depart from their pet ideas.

This division offers for your consideration a suggested series of piston ring standards, these being based upon both theory and practice insomuch as an empirical formula has been worked out which appears to give good results.

Another item before this division which may be mentioned as indicating the ever-growing character of the work of the standards committee is the additions which are suggested through the S. A. E. standard yokes and rod ends. This, one of the earliest S. A. E. standards, has been found to require extension in order to cover the sizes necessary for truck work.

Nomenclature

The Nomenclature Division has been something of an experiment in that its procedure has not followed the regular rules of the standards committee until quite recently. The idea of selecting standard names for readily recognizable parts of an automobile chassis is an old one and several attempts were made to bring it to fruition. A meeting was called in Detroit last summer at which a number of service men, not necessarily members of the society, were asked to be present and a start was made. Since then there have been many informal meetings and, finally, a sufficient number of members were appointed to make a division of the standards committee in accordance with the constitution of the society.

Within the year the whole chassis has been covered from end to end, owing to the strenuous labors of Mr. Zimmerschied and the recorder, A. C. Woodbury. To these two gentlemen the thanks of the whole world is due.

In his paper on the use of automobiles in the great war, which will be read on board the Noronic, the author comments on the fact that endless confusion has been caused through different American manufacturers adopting different nomenclature for the main portions of their trucks. I know from personal experience that in the early weeks of the war the confusion in the spare parts department at Aldershot was indescribable. This means that the amount of time wasted by manufacturers, dealers and users of automobiles through lack of clearness regarding the meaning of any particular name, must in a year total up to a sum of staggering magnitude. The list of names which the division has compiled does not include every small detail. Obviously such things as the internal parts of a carbureter must have different names depending upon the details of its design, but the list covers the vast majority of the parts which go to making a complete machine.

I would wish to lay stress upon the fact that many of the names chosen are debatable. Doubtless many of you who see this list for the first time will feel disposed to ask the wisdom of choosing such and such a particular word to describe a particular part. I have personally been able to attend a number of the meetings and have no hesitation in saying that not a single one was chosen without the most careful consideration of many alternatives. When the work was commenced it appears that it might take years to complete. By the end of the second meeting it was obvious that a generous give and take would bring matters to a speedy conclusion and it has indeed done so. It is suggested that the list submitted and the method of grouping the different parts should be followed by automobile manufacturers as completely as possible, and we have the support of many of the most powerful firms. I think it is quite probable that in years to come this list of names will show up as one of the most important and valuable things for which the S. A. E. has ever been responsible.

Research

The Research Division has been occupied exclusively with the elaboration of a test which will show the ability, economy; in fact, the all-around efficiency of a car taking the word efficiency in the widest sense possible.

At the January meeting this division submitted a suggested form for a fuel economy test. This was not accepted, owing to the fact that the standards committee considered the conditions were insufficiently rigid. Consequently, the division arranged a far more elaborate test from which it would scarcely be possible to read false conclusions. This was sub-

(Continued on page 1145)

Constant Pressure Cycle Possibilities—II

Further Advantages of Constant Pressure Cycle—No Starter Required—Description of a Proposed Engine

By Arthur B. Browne
Consulting Engineer
and Herbert Chase
Chief Engineer, Automobile Club of America

THE first installment of this paper, which was read at the Summer meeting of the Society of Automobile Engineers during the cruise on the SS. Noronic, June 12 to 16, appeared in part in THE AUTOMOBILE for June 15. The balance of the abstract of the paper follows:

Excellent Scavenging Properties

4—The scavenging in a four-stroke constant volume engine is never complete because of the large clearance space required. This results in several drawbacks, among which is a loss in volumetric efficiency and a dilution of the incoming charge with inert gases. These faults are not present in constant pressure engines, because an excess of air can be forced through the cylinder while the piston is at or near the lower dead-center.

5—*Volumetric Efficiency.* In the constant pressure engine using the working cylinder for a compressor, losses from decreased volumetric efficiency are precluded by the nature of the cycle. The air that may be normally pumped is in excess of the requirements of the working stroke on account of the subsequent expansion by heat. Hence there is always an excess of compressed air from which to draw on the working stroke. The piston cannot move until the volume behind it is sufficient to afford the necessary pressure. For peak loads the normal maximum pressure can even be temporarily increased, so that volumetric losses do not exist. This is in marked contrast to the constant volume cycle, in which the volumetric efficiency is not high, even at low speeds, and usually decreases as the speed increases.

Operation on the Two-Stroke Cycle

6—Constant pressure engines will operate much more satisfactorily on the two-stroke cycle than will engines of the constant volume cycle, because scavenging in the former can be more nearly perfect, through the use of an excess of air to remove the products of combustion, whereas unless fuel injection with its inherent difficulties is resorted to, engines of the constant volume two-stroke type must depend upon the incoming charge to scavenge the combustion chamber. This inevitably results in a loss of fuel. Under these circumstances not only is a four-stroke cycle unnecessary in a constant pressure engine but all the advantages of the two-stroke cycle without any of its disadvantages are realized. The four-stroke cycle with its two idle strokes is an engineering anomaly that need be no longer tolerated when the constant pressure cycle is employed.

Low Operating Temperatures

7—The specific heat of air at constant pressure is 0.2375, while at constant volume it is 0.1689. If a given weight of fuel containing a certain number of heat units be mixed with a sufficient weight of air for complete combustion, and the fuel ignited, the temperature attained will be much higher if heating takes place at constant volume than if the volume be allowed to increase at such a rate as to hold the pressure constant, although the work that can be done in either case is the same since the energy liberated is the same in both cases. In practice, however, it is probable that the longer continuance of the lower temperature of the constant pressure cycle will offset the higher temperatures of short duration and the greater flame-swept area in the constant volume cycle so that the heat losses through the cylinder walls will be approximately the same. The temperature of the exhaust gases in the constant volume engine will also be higher at the same exhaust pressures and this will represent a greater *total* heat loss than that in the constant pressure engine.

No Fuel Injection Pump Necessary

8—The operation of engines of the constant pressure cycle is not dependent upon any fuel injection pump as is that of engines of the Diesel and semi-Diesel type. Aside from the purely mechanical difficulties and complications of such pumps, the metering of the fuel for varying loads presents some exceptional difficulties, especially in small units. From all such difficulties the constant pressure engine is free, an advantage worthy of special mention in comparing the strictly constant pressure engine with one of the Diesel or semi-Diesel type.

No Starter Necessary

9—In practically all types of Diesel engines some form of high compression air starter is necessary on account of the high compression pressures attained. No such complication is necessary in the constant pressure engine. A small quantity of air under a pressure of perhaps 1 to 5 lb. will be sufficient to start the engine. When once started the engine will quickly pump air up to the predetermined maximum of the cycle and the pressure will then remain constant.

Combustion in the Constant Pressure Cycle

The constant pressure cycle comes closest to fulfilling all the conditions for efficient combustion. Combustion takes place under Class C conditions. It is highly efficient because: (a) The density of the charge is limited by structural considerations only; (b) It is possible to raise the temperature of the compressed air to a high degree, prior to the introduction of fuel, by utilizing the exhaust heat (which is commonly wasted); (c) The proper proportions of fuel and air can be automatically maintained without mechanical complications; (d) On account of the appreciable time that elapses between the entrance of the fuel and its final combustion, its complete vaporization and diffusion, even though it be of low grade, is assured by its introduction into the highly heated air, noted in (b) above, and (e). As was seen under heading of "scavenging properties" little if any dilution is due to presence of burnt gas in the mixture so that except for the presence of atmospheric nitrogen, which of course cannot be excluded, dilution is at a minimum.

Proposed Constant Pressure Engine

Cylinders *1*, Fig. 2, serve as both compression and working cylinders in which move the differential pistons *2*. Air first enters the compression spaces *3* of the larger diameter of the pistons through pipe *4* on the in-stroke and is compressed on the out-stroke. This air need never be raised to more than 5 lb. pressure, and this may be accomplished by other means than a differential piston if more desirable. The air thus compressed serves to scavenge the adjacent cylinder, entering the latter via port *5*. The products of combustion leave the cylinder through port *6* (unless some other valve be provided in or near the cylinder head as a better means of exit). As the pistons move on the outward stroke, ports *5* and *6* are closed and the air remaining in the cylinders is compressed and discharged through the valves *7* into the receiver *8*.

Since the clearance space between piston and cylinder head is practically zero, substantially all the air is expelled on the outstroke. Just as the crank passes top-center the admission valve *9* is opened and the mixture is admitted to the burner through piping *10* (where its temperature has been raised by contact with the hot inner piping *11* through which the exhaust gas, discharged after the previous working strokes, has passed). The mixture, still under high pressure, passes into the burners *17*, which are in reality a part of the combustion spaces, as the pistons are forced downward. In the burners (the construction of which will be fully described later) ignition by spark from plugs *19* occurs and *complete combustion at constant pressure* ensues until the mixture is cut off as a result of closing the admission valves *9*.

During the admission period the heat gradually liberated as a result of combustion enables the products of combustion to expand *without loss of pressure* and thus do work on the piston. After cut-off the hot gases expand, with decreasing pressure, and continue to do work until the exhaust port opens. The burned gases, still at high temperature, then pass through the pipes *11* provided for this purpose, and give up to the walls of these pipes and the compressed air surrounding them a large portion of their heat before escaping to the atmosphere. Thus there is saved to the succeeding cycle much heat that would otherwise be entirely lost, as it is in most if not all other types of internal combustion engines. Furthermore, the addition of heat to the air in the piping *10* takes place *after* the air has been compressed. Thus its temperature is raised with corresponding increase in ability to do work.

Suppose now the compression pressure decided upon as most desirable be assumed, for the moment, to be 150 lb. Even at normal full load with cut-off at say one-third stroke it is evident that *all* the air compressed in the working cylinder cannot be utilized. Hence the pressure in the receiver will build up rapidly unless some relief valve be provided. To put this on the receiver would, of course, mean the loss of much of the work of compression. Hence a single unloading valve *15*, operated by piston *14*, is provided. When the pressure in the receiver rises above the 150 lb. desired, the valve *15* is forced open against its spring and the air in the cylinder is simply discharged to atmosphere with only slight loss of power.

If for any reason a momentary overload is to be carried by the engine some device such as *16* for increasing the tension on the spring that normally holds the unloading valve closed, can be brought into play. In the case of a motor car engine such a device could be operated by a simple dash control.

Fuel is supplied to the engine as follows: The pump *13*, positively driven from the engine, draws the fuel from the main supply tank and delivers it to the reservoir *18* in which a float or some other device maintains a constant level. Any surplus fuel pumped is by-passed or returned to the main supply tank. The small tank *18* is maintained at a pressure somewhat less than receiver pressure, depending upon the air velocity through the restricted area *22*. From this tank the fuel is drawn through the spray nozzle *12* by the injector action of the air passing the nozzle. The flow of fuel will of course cease immediately when the air flow ceases on account of the closure of the admission valves *9*. A correct proportioning of fuel to air may be accomplished by proper adjustment of the regulating valves *23* and *24*, Fig. 2. As the velocity through the atomizer *25* increases the natural tendency toward over-richness is counteracted by the proportionately diminished pressure in the restricted area at *22*.

The admission valves *9* can be made of the Corliss, slide or

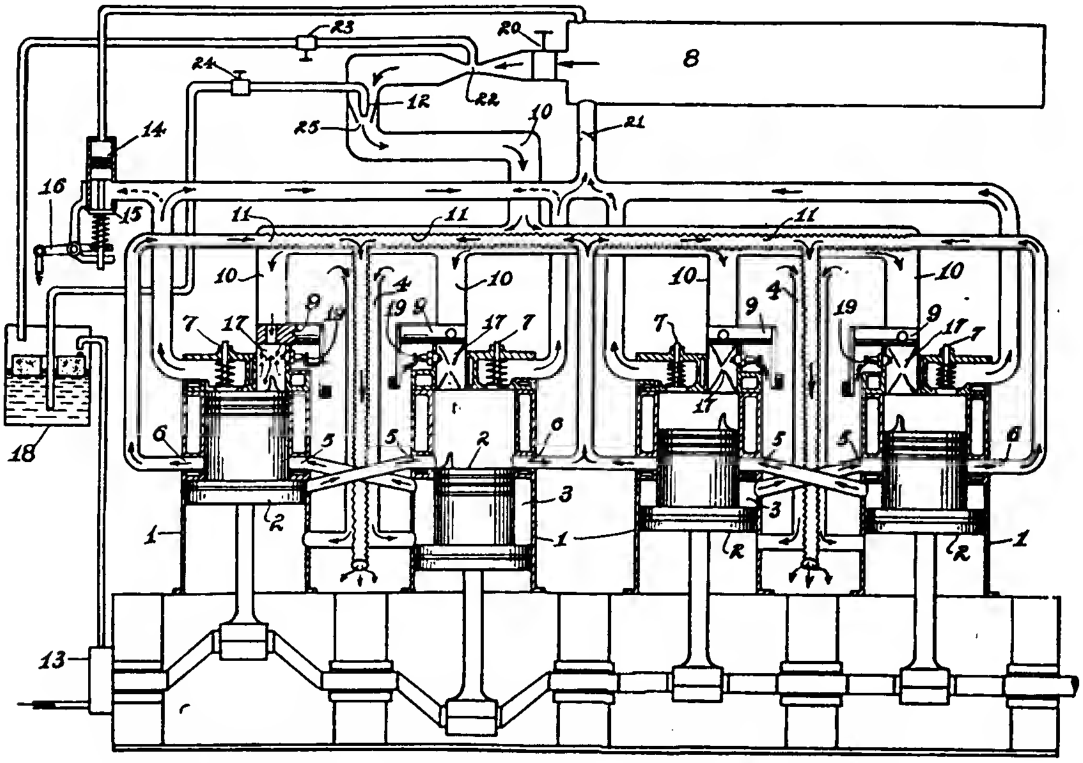


Fig. 2—Diagrammatic representation of four-cylinder engine operating on proposed cycle

poppet type, as proves most desirable, and be operated by any conventional cut-off device such as, for example, is used in steam engine practice. In the case of a motor car engine the point of cutoff would be varied by a device operated in precisely the same manner as is the throttle on an ordinary Otto cycle engine. The throttle valve *20* shown in Fig. 2 would be used only in starting.

The check valve *21* prevents air in the receiver escaping to atmosphere when unloading valve *15* is open. The admission valve can, if desired, be left open during practically full stroke when a heavy torque is required. The card would then be practically square and resemble closely a card from a steam pump. Under this condition the fuel consumption would of course be much increased because the gases would not be allowed to do work in expanding after cut-off. The periods when such a late cut-off might be used would be short in an engine properly proportioned to the load.

The striking similarity of the constant pressure cycle to that of a steam engine is at once apparent. But while the results are equal in every way to those accomplished with the steam engine, the engine is self-contained and does not require the boiler, condenser and other elaborate external apparatus necessary in the case of the steam engine. An engine operating on the proposed cycle has all the advantages of the steam engine without any of its disadvantages and at the same time possesses characteristics that should render it much more efficient and practicable for motor vehicles and many other types of service than is any type of internal combustion engine now in use.

Description of the Burner

The operation of the proposed cycle is dependent to a large extent upon the functioning of the burner marked *17* in Fig. 2 and shown in detail in Fig. 3. To understand the operation of this burner it is necessary first to have clearly in mind certain fundamental laws governing flame propagation. Imagine a tube composed of material that is a non-conductor of heat, this tube being closed at one end and open to atmosphere at the other. Now suppose the tube be filled with a highly combustible mixture of air and gas. If the mixture be ignited near the open end of the tube the flame will travel toward the closed end at a rate of speed dependent chiefly on the quality, temperature and pressure of the mixture.

Suppose now a vessel containing a combustible mixture under pressure be connected to the open end of the tube. If the end of the tube formerly closed is then opened the combustible gas in the vessel will flow out through the tube at a rate dependent upon the pressure. If now the mixture be ignited at a point midway of the tube the flame will propagate itself either toward the vessel or away from it according to the relation between the velocity of the gas and the rate of flame propagation. If the rate of flame propagation be greater than the velocity of the gas through the tube the flame will travel against the flow of the gas and ultimately enter the vessel from which the mixture is issuing. If the velocity of the gas is greater than the rate of flame propagation the flame will travel with the flow of gas and ultimately blow out at or near the open end of the tube. If, however, the rate of flame propagation is equal to the velocity of the gas the flame cap will remain stationary, the combustible gas approaching it from one side and the products of combustion leaving on the other.

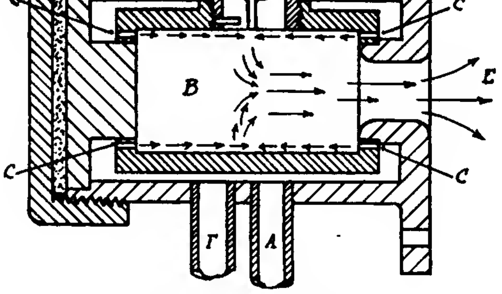


Fig. 3—Representation of burner

In the case of the burner shown in Fig. 3 the combustible mixture enters under pressure through the pipe *A* and fills the annulus (called the diffusion chamber) surrounding the combustion chamber *B*. Entrance to the latter is afforded by openings *C* so arranged that the streams of gas come from opposite directions and meet at a point where their velocity is zero. The velocity at the point of entrance to the combustion chamber of the burner will depend upon the pressure difference between the combustion chamber and the chamber from which the gas issues. Suppose now the pressure difference is such that the velocity at the point of entrance is 100 ft. a second and that the rate of flame propagation in the particular mixture under consideration is 50 ft. a second. If the gas be ignited by spark plug *D* after entering the combustion chamber, the flame cap will travel against the gas current until it reaches a point where the velocity is the same as the rate of flame propagation, in this case, 50 ft. a second.

Such a point must exist between the point where the velocity of the gases is zero and the point of entrance. Otherwise the flame will travel through the opening through which the gas is entering, and ignite the mixture approaching the burner. To confine the flame within the burner it is therefore necessary at all times to maintain at the point of entrance a velocity higher than that of the flame propagation. This will result in maintaining the flame within the burner and the products of combustion will issue from the outlet *E* of its combustion chamber.

In practical application of the burner already made it has been found that the burner can be operated over a wide range of pressure differences without adjustment and it has also been found possible to use the burner with the heaviest and cheapest grades of oil obtainable and still secure complete combustion, at least so far as the eye and nose can detect.

Heating the Air

In case liquid fuel of low volatility is used it is of course necessary to heat the air in which the fuel is mixed and see that the latter is finely divided. In practice this is done as follows:

The air, passing through the atomizing device *25*, Fig. 2, becomes impregnated with fuel mist and is immediately conducted through tubes where its temperature is raised by contact with the hot walls of the inner tubes *11*, carrying exhaust gases. This exhaust heating at constant pressure, not only effects the material increase in efficiency already noted, but serves to make a fixed gas of the mixture, which may thereafter be safely conducted to the point of combustion without fear of condensation. With gasoline this fixation is unnecessary. Hence a ready means for starting a cold engine is available.

In applying the burner to an engine it is necessary simply to see that the conditions outlined for properly mixing and volatilizing the fuel are met. If the temperature of the air passing the nozzle *10*, Fig. 2, is sufficiently high to cause immediate ignition of the fuel, two alternatives are open. The first is to maintain a velocity in the mixing chamber that is always greater than the rate of flame propagation in the mixture. The second is to make provision as by valves *23* and *24*, Fig. 2, whereby the mixture while on its way to the burner is too rich to ignite, that is, until sufficient air entering through auxiliary inlet *F*, Fig. 3, is added to this over-rich mixture in the space surrounding the combustion chamber so as to secure complete combustion.

The degree of rapidity at which the heat is liberated in the burner is indicated by the fact that it has been found possible in tests already made to melt a bar of steel inserted in a burner made of brass. The design of the burner is such that the gases entering insulate the walls so that the latter remain comparatively cool.

High-Lights of the Discussion

Hiram Percy Maxim:—In the opinion of the writer, the Society is to be congratulated upon having a paper on the Constant Pressure Cycle at this time. When the Otto cycle engine is offered in units having no less than twelve separate cylinders, such as our modern twin sixes, the question of casting about for a better cycle becomes a matter of necessity.

Engineers look at this question of a better cycle than the Otto in two different lights. Those of us who must design and build something this month, which can be sold next month, with 2 per cent for cash in 10 days, one of the very important factors, regard anything other than the Otto cycle as partaking of the fanciful or hare-brained. On the other hand, those of us who are not actually dependent upon the immediate sale of the design are keenly interested in anything which promises better thermal efficiency than the Otto cycle. They even date the obloquy of their associates to the extent of going back as far as the old Brayton engine, which we all studied when we first bought all the gas engine books. This is just what Messrs. Browne and Chase have done, and they are to be complimented for their courage.

The writer frankly states that he belongs in the same group as Messrs. Browne and Chase. He had an active part in the early development of the gasoline engine, and is one of those who are not yet over wondering that it works as well as it does. Its status in his mind is anything but that it is the final type of engine. Rather than this, the writer feels that the Otto cycle engine has succeeded in spite of, and not on account of, its principles.

The tremendous losses at the exhaust, the losses due to the adulteration of the fresh charge of the large quantity of burned gas from the previous charge and those resulting from ignition at lowered compression, as when running throttled, cannot long go on. The only way we can admit them is by having no other alternative. But this only places a premium upon developing an alternative, and this is just what Messrs. Browne and Chase are trying to do. They present the diagram of a reciprocating engine in which the explosive mixture is burned in the new flameless burner which Dr. Lucke has told us about in the past, instead of being burned on a gauze, as was done by Brayton.

A Continuous Rotary Design

The losses in the principle laid down in the diagram shown by Messre. Browne and Chase, would be undoubtedly very much less than the losses in the Otto principle, and the writer has no comment to make upon the analysis of these losses which is given. He believes, however, that the authors go only part way when they pick up the old constant pressure cycle and apply it to a multiple-cylinder reciprocating engine.

Answer to Mr. Maxim

Herbert Chase:—We heartily agree to most that Mr. Maxim says in his discussion. The possible development of a turbine operating on the constant pressure cycle has long been predicted. By utilizing the burner described in the paper such a turbine can doubtless be made to operate, providing the problems involved in cooling can be solved. The chief obstacle seems to be that of compressing the air necessary for combustion of the gas. We hear that some moderately efficient rotary air compressors have been developed in France, but I have yet to lay hands on any thoroughly reliable data regarding these. Of course if a reciprocating compressor must be employed there would seem to be no object in using a turbine in which to do the work of the cycle, since this may be done to better advantage in the compressor cylinder exactly as shown in the paper. Granting, however, that an efficient turbine will be developed, it does not follow by any means that it will replace engines of the reciprocating type. Witness conditions in the steam engine field, where in the smaller units the reciprocating type is not only more efficient but is more readily adaptable to most conditions of service. Unfortunately the turbine, whether steam or gasoline, is essentially a high-speed machine. On this account its application to motor vehicle service where comparatively slow speeds and high torques are ultimately required is no simple problem and it is by no means certain that even a highly efficient gas turbine will, if developed, replace the reciprocating engine for this class of work.

Smith Suggests Use of Fan

George W. Smith, Thos. B. Jeffery Co.:—I believe it possible for you to throttle the intake of pipe 4 as shown in Fig. 2, in such a way that you can regulate the amount of air drawn in in direct proportion to the amount of air injected into the cylinders during combustion. There would be a slight saving in power in so doing but the principal advantage, I think, would consist in eliminating the noise of the exhaust that might result from ejecting the air past regulating valve 15. I have also considered the advisability of a multiple sirocco type of fan in place of the truncated piston as shown in Fig. 2. The fan would lend itself very readily to the varying requirements of the engine in regard to volume of free air at the different speeds, and I believe possesses sufficient merit to be considered at least in the discussion.

Wilkinson Doubts Engine's Efficiency

John Wilkinson, H. H. Franklin Mfg. Co.: — I have always been very much interested in possibilities of the constant pressure cycle. First, because I was familiar with the old Brayton engine which was used at Cornell University for many years. While I never remember seeing it running, it was a very familiar sight in the days when I attended the university. Secondly, in 1900, I attempted to build an engine of this type. It was not any sort of a success, principally, I think, because we were not able to handle the ignition question satisfactorily at anything except very low speeds. Also, most of us remember the efforts of the Association of Licensed Automobile Manufacturers in connection with the Selden patent to build an engine of this type which would run. Many thousands of dollars were spent and it would be interesting to get the experience of the men who worked on this development.

There should be nothing inherently difficult about producing a satisfactory engine of this type, although doubtless some inventive ability will have to be displayed for some of the features.

I very much doubt the statement that the theoretical efficiency of this engine is as high as 84 per cent. In fact, as used under full load in an automobile I doubt if the efficiency would be as high as in our present engines, although perhaps it would be considerably higher at the light loads.

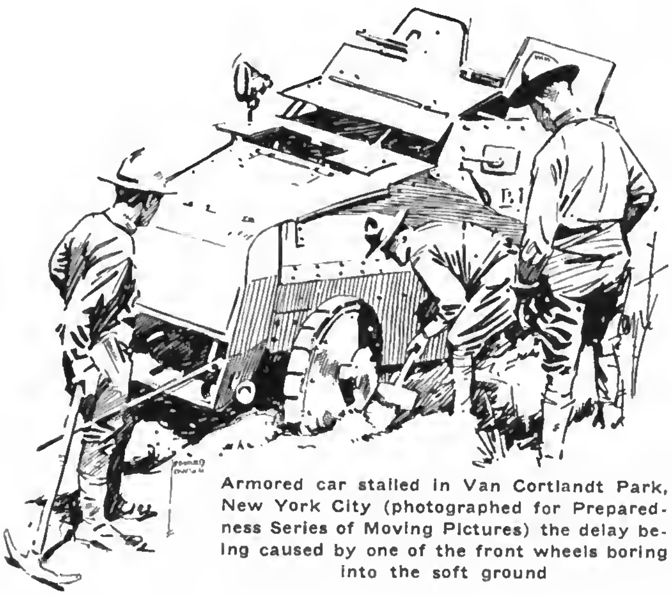
Answer to Professor Diederichs of Cornell

Herbert Chase:—We of course realize that it is exceedingly difficult to predict just what the thermal efficiency of the proposed engine will be. We fail to see, however, why the mechanical efficiency should be much, if any, lower than that of an Otto cycle engine. We believe that the thermal efficiency should be a good bit higher partly because higher compression pressures and better conditions of combustion prevail, and partly because a good bit of the heat which ordinarily would go out with the exhaust is utilized.

The Search for the Army Truck Wheel

The Composite Type of Wheel (1) as Front and Trailer Wheel, (2) as Driving Wheel—An Examination of Its Possibilities

By Marius C. Krarup



Armored car stalled in Van Cortlandt Park, New York City (photographed for Preparedness Series of Moving Pictures) the delay being caused by one of the front wheels boring into the soft ground

LESSONS from war service with regard to automobiles and motor trucks emphasize traction troubles and troubles due to injury from bullets and shells. They are probably usually accepted with a large grain of reservation as to their importance for average civilian motor vehicles. But it is realized that, aside from the need of guarding against projectiles, the military requirements are after all little more than civilian requirements for very rough and variable service. Ability to get from one place to another with maximum load, with regularity and without injury to the vehicle, rapidly if roads are good and less rapidly, but still reliably, where roads are bad or don't exist—covers in general terms what is wanted for the hardest kind of commercial work as well as for war. But only few vehicles need to measure up to these requirements under peace conditions, while all war vehicles should do so to the last letter.

One of the main questions with regard to the possibility of fitting a large number of ordinary automobiles and commercial motor trucks for military work on very short notice, therefore takes the form: Can the ordinary motor vehicle by some simple change in its equipment be made fit for operation under the most adverse road conditions, while still retaining its suitability for the easier, but much faster, service on fair roads?

Naturally, the first thought in this connection is aimed at improvement of the driving wheels. If a type of wheel having the desired effects may be devised and may be substituted for the type of wheel ordinarily used, it might be called the Wheel of Preparedness, to fall in line with the current phrase. But even simpler means are tried.

The use of traction chains on the wheels is the most obvious and convenient provision of this nature, but according to all reports from the war correspondents, it is of small benefit with heavy loads on soft ground or snow, and does not prevent a vehicle from being mired, while on rough and hard roads the chains wear out too rapidly. Their advantages are insufficient for military work. The large, pivoted traction blocks, on the other hand, with which ordnance and heavy tractor wheels are equipped, reduce the speed on fair roads unduly. The differential lock is useful and helps out in combination with the traction chains, but of course only if the difficulty does not apply to both driving wheels. With regard to the special wheels said to be used on Italian trucks, the reports which have been published have not been explicit, but these wheels seem to be mainly designed with a view to securing traction on hard but slippery mountain roads at low speed.

In addition to these efforts for improving traction, front wheels have been arranged with enlarged surfaces, in various forms, to prevent them from sinking into soft ground, and the principal objection to this provision lies in poor steering and inconvenience of the attachments, while it can also not be combined suitably with armoring of the vehicle.

On the whole, little has been done to make the front wheels pass over obstructions and over soft ground in such a manner as to help in reducing the traction work to be done by the driving wheels, excepting only the four-wheel drive and steering system, which however represents a complication not required for the majority of commercial motor vehicles, and one which cannot be introduced offhand when these are to be used for military or other emergency work.

With all these considerations in mind, the advantages of a wheel construction based on the principle shown in Figs. 1 and 2 seem to be so pronounced as to suggest that it should be tried out, especially where war is in progress or preparedness for war under discussion. The bearings of the hub, the drive and the means used for locking the wheel on the axle, and holding the components together, are omitted, as they can be anything desired and customary.

The construction is merely an improved form of the compound or composite wheel in which the vehicle wheel proper rolls upon a circular track formed as part of a separate road wheel, but it is so compacted that the whole wheel is not necessarily of larger diameter than an ordinary motor truck wheel, and its components are so aligned that no other relative movement is possible than the rolling movement of one component upon the other. The road wheel component rolls on the ground without tractive relations to the latter, whether the vehicle wheel component drives the road wheel component or only rolls on it. The large thrust bearings, (in conjunction with the customary means for holding the wheel on the axle) hold the components in lateral alignment but have little work to do, as the road wheel component has almost the same angular velocity as the vehicle wheel sheaves. The central device maintains constant contact between the components, so that the wheel must act as a unit on the roughest road.

The advantages of this construction for front wheels and trailer wheels are perhaps less important but also less subject to doubt than those relating to its use for driving wheels, and may therefore be referred to separately and first.

For Front Wheels

It may be said that the simplest manner of improving front wheels (to make them surmount obstacles more readily, make them less liable to sink into soft ground and more easily pushed out of a hole) is to make them larger, and there can be no doubt that it always would be an advantage for driving on rough or soft ground to have the front wheels as large as proper regard for the steering permits, but any change in size, as compared with the front wheels of ordinary commercial vehicles would mean a higher front axle and a change in general design and lines of the vehicle. If sufficient to be of much value the change would be a radical one. The composite front wheel, on the other hand, can have the axle at the normal height with its road wheel component only 1½ to 2 in. higher than a normal wheel and extending only ¾-in. to 1-in. farther back than the normal wheel does at the middle portion which determines the sharpest possible steering angle. And it has some advantages which a considerably larger front wheel would not possess.

When a road obstacle is struck, the vehicle wheel with its loads runs forward and smoothly upward on its road wheel track and tips the road wheel over the obstacle without abrupt shock, the momentum of the vehicle assisting, and the components of the wheel adjust themselves afterward to their normal relations, in which the vehicle wheel is supported in the road wheel track slightly forward of its lowest point—somewhat more forward the faster the vehicle is moving and the lighter the front axle load is.

On soft ground there are two important considerations: To obviate the sinking of the wheel and to push it out if it is in a hole or is mired. When a front wheel of ordinary type begins to sink, the push from the rear axle is likely to aggravate the situation unless it is immediately effective. With the composite wheel the track on the road wheel component remains clear, and the vehicle wheel in moving forward on this track turns the road wheel over the danger spot by gradually increasing pressure from the load and without boring forward in the soil. The momentum of the load moving gradually upward on the track should be sufficient to turn the road wheel over even if the resistance is so great that the vehicle wheel finally strikes the track of the road wheel directly in front of the front axle and at dead center with the thrust from the rear axle; for at such a moment the lowest portion of the road wheel would be released from the vehicle load, and the momentum of the impact would only have to turn the weight of the road wheel component alone around the resisting front edge of the hole, whereafter the relations would at once be favorable for progressing.

The whole action can be easily perceived, though a complete description becomes lengthy and tiresome. Under all circumstances, on miry as well as on rough ground, all futile pushing of the wheel against the soil is minimized, being resolved into a gradual climbing of one wheel component in the other, thereby storing the propulsive power of the vehicle momentarily and making its accumulation assist in effecting rotation of the wheel and progress of the vehicle.

That a wheel of this type is naturally armored against rifle fire should mean a valuable weight reduction for the front of armored cars with machine guns, and, as dangerous stalling of such vehicles seems to be mostly ascribed to miring of the front wheels due to excessive front load, the advantage of the composite wheel type may in this respect be two-fold and important.

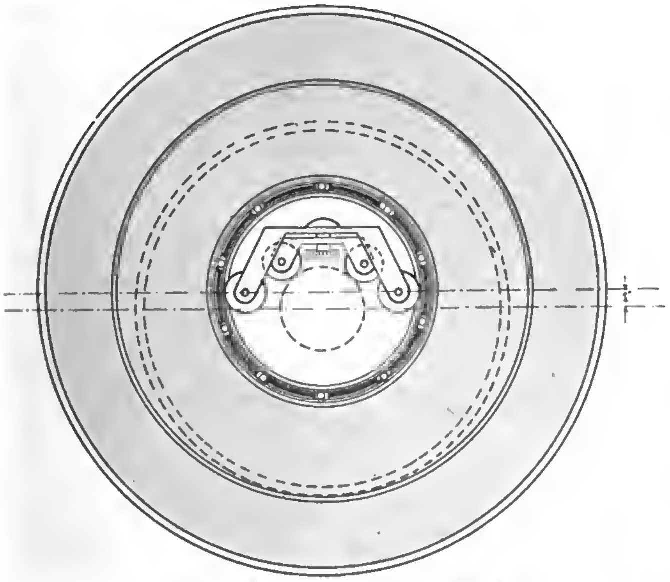
The type also offers an opportunity for doubling the cushion effect of solid rubber tires by having both the vehicle wheel component and the road wheel so shod, and this arrangement may permit dispensing with pneumatic tires in cases where these otherwise would be preferable. The vehicle wheel tires, being of small diameter and width and removed from contact with the road would be inexpensive and would perhaps protect the road wheel tire sufficiently to offset their own cost.

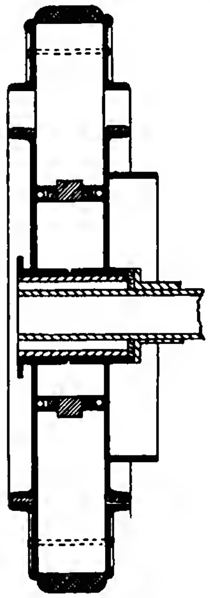
For Trailers

It is understood that the use of trailers for military transportation and hauling was practically discontinued in the European armies before the war began, mainly because the additional load which could be safely hauled by means of them was found to be greatly reduced by difficulties in starting them whenever they had been left standing for a short time on any ground not absolutely unimpregnable. The same objectionable feature naturally reduces the utility of trailers for commercial work. Springy couplings have not so far been found a sufficient or desirable remedy for this shortcoming, largely because they reduce the safety of the coupling on hills and at sharp stops, and any great increase in the diameter of the trailer wheel militates against a short turning radius, so much more as the trailer at a turn is pulled around on a shorter curve than the tractor unless special mechanism is installed to the contrary effect.

It seems evident, on the same principle as with regard to front wheels, that the composite wheel would reduce the power and traction requirements for starting the trailer over a considerable range of unfavorable conditions, the maximum within this range being always that needed for making the vehicle wheel travel over the gradually rising curve of its artificial track until it begins to slip. The change in the location of the load pressure must be sufficient to turn the road wheel over before the point of slippage is reached.

As the load cannot gravitate at any other than a certain rate, determined by the load, the resistance and the general laws of gravitation, and the tractor may not pull at a rate of progress agreeing exactly with this action, it is clear that some see-sawing may take place between the vehicle wheel component and its road wheel mate, but the start at all events can be effected if it can be begun,





Figs. 1 and 2—Diagrams showing principal features in wheels of composite type

Fig. 1—Side view of the middle or road wheel component with tracks and thrust bearings. Device for maintaining contact of wheel sheaves with the tracks is shown in the central circular opening. Relations to axle and hub carrying the wheel sheaves are indicated in dotted lines

Fig. 2—Vertical section of assembled wheel, with omission of hub details and the central device. Without brake drum the diagram would also represent front wheel construction approximately

while only experience can devise the best means for making the acceleration smooth and unobjectionable. In this respect the nature of the coupling between tractor and trailer may be important, since it might tend to suppress or accentuate irregular movements, according to its mode of uniting the two vehicles.

With due allowance for the uncertainties of this or similar nature that may be involved in the use of the composite wheel type for trailers, there does not seem to be room for doubting that it would increase the average and permissible load for this class of vehicles, partly through assisting in overcoming large starting resistances and partly through the same sort of action on rough or soft ground that makes it desirable for front wheels. As the relative movements of the wheel's component parts take place in the plane of the wheel, no appreciable effect on steering movements should result, except to make them safer in case an obstacle in the road tends to interfere with them.

Although the advantages of the type for front and trailer wheels always depend in part upon the vehicle wheel component assuming the functions of a driving wheel in relation to the road wheel component, the use of the type for driving wheel purposes nevertheless brings factors into play which must be considered separately. It will not function properly at high speed as a driving wheel, though as a front wheel it can operate at any desired speed, and it is necessary to figure out just how fast it can be operated as a driving wheel under given suppositions of loads, dimensions and resistances.

Another chapter must be devoted to this task.

(To be continued)

Paragraphs on Current Topics

By Marius C. Krarup

Motto: Radical Thought, Conservative Action

Invention of motor fuels has reached the popular stage. In addition to the Burton process used at S. O. refineries, the Rittman process acquired by the Government and already peddled out in licenses to about a score of concerns, and the Charles S. Palmer process which has just been announced as capable of putting gasoline—real gasoline—back to a cost of 9 cents and a sales price of 15 cents per gallon, three gentlemen of Greenville, South Carolina, have discovered a chemical by means of which three parts of kerosene mixed with one part of gasoline are made into just what the motorist wants. Frank Watson of Iowa has a water mixture at four cents per gallon which drives a Ford car 20.6 miles (note the decimal) without adjustment of the carbureter. There is also a promise that 85 million gallons of benzol will be thrown upon the market annually as soon as the war is over, at whatever price it will command. Charles Jason Greenstreet of Saint Louis, with three refineries at his command, has a "Gasoline Corporation" under way which will make gasoline from crude oil at one cent per gallon and from distillates at 4½ cents, thus being liable to get into an interesting competition with itself, than which there is nothing more stimulating, it is said. From the Indiana gas fields we hear that 1000 cubic feet of gas will yield five gallons of gasoline by compression and can yet be used afterward for fuel and light, and that three plants are being erected to take advantage of these practical arithmetics whose conflict with specific gravity figures is a detail. Hine Smith, a farmer of Sparta, Michigan, has an attachment to his motor which makes kerosene alone all right. Frank R. Blamey, a grain and feed dealer of Bloomfield, N. J., is on the same track as the South Carolina men, having found a chemical that makes a kerosene-gasoline mixture just the thing. T. S. Causey, of Dallas, Texas, has a "Thermal Generator" which utilizes the heat of the exhaust and, after starting on gasoline, makes crude oil an acceptable fuel.

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Turning from these more or less optimistic engineering projects to the latest batch of S. A. E. treatises, we find the possibilities of the constant pressure cycle for automobile motors confidently but carefully discussed by Arthur B. Browne and Herbert Chase and don't read very far before we have the proposed motor identified with everybody's dreams, and we have yet to make sure that the presumable flaws really exist in the conception of it which is here presented; the first one without apparent bias in any direction. It makes use of almost any hydrocarbon fuel, kills off the suction-carbureter and makes us understand that the reason why the vacuum gasoline feed system tarried so long in coming, though so nearly self-evident, was because all suspected, without exactly knowing why, that it might soon be superfluous. Anticipating things a trifle, it may be suggested that the new motor, when the time for baptismal rites arrives, shall be called neither the constant pressure cycle motor nor the carbureter-less motor, but something euphonious, such as the All-Fuel or the Browne-Chase. Meanwhile there is an alluring pastime in trying to specify the reasons why it will never come into existence. It is at least good enough to justify such an effort.

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Hush! The S. A. E. is going to change its name to S. A. E. with a different spelling for the A, or has already done so. The difference between Automobile and Automotive is nothing to speak of etymologically, both being hybrid words and both suggesting anything with "self" and "motion" in it, but in practice it means about 1000 more members, whereas it also confers with one stroke new capacities in aeroplane and motor boat engineering upon all the old merely automobile members. Just as before, however, each one will have to disprove or sustain the allegation by his own unaided activities. Societies have ceased to be endorsements. They are only opportunities. That is, they are worth more for the right man and less for the wrong one than they used to be.

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No sooner has the Society of Automobile Engineers finished the work of finding names for everything that anybody could possibly desire to mention in connection with automobiles and of sticking these authorized names on to stay, in the form of a long list soon to be published, than the Society of Automotive Engineers has to take up the same work for the added crafts and issue a new edition. It would only be fair to posterity—since posterity always suffers from too much nomenclature—to appoint a committee to conduct proper burial services, from time to time, over the words which fail to survive, dying from lack of red corpuscles or because enterprising inventors and designers introduce new realities which make them superfluous. We notice words which have been dead for years spooking around in new books and daily papers—and other ones which a properly constituted committee could kill quietly and bury publicly without anybody weeping. Oh, for a list of proscripted words with the next S. A. E. effort in the field of nomenclature! In the meantime, private lists of 50 to 100 useless automobile words are welcomed for an eventual bonfire in these columns.

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F. W. Lanchester studies the best proportions of streamline bodies, with sole reference to air resistance, in *Engineering* of May 19. When length is 5 or 6 times the diameter or more, exact shapes are unimportant, he finds, but with the length relatively smaller "we get to a point at which streamline flow becomes unstable, and when this point is reached the resistance responds in an acutely sensitive manner to the slightest change of shape." And yet the racing cars with the longest tails have not always won.

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"The weight of the entire axle builds up around the driveshaft diameter," says H. D. Church with a happy turn in the phrasing, and this is his reason for keeping the shaft slender despite high stresses. "Also a good reason for taking the shaft out of the axle," comments the advocate of internal gear drive. Both are right, and so one is reminded that even the best reasoning has to make good in practice. Mr. Church has many another phrase in his S. A. E. paper which appeals to a broader public than the bulletin readers. For example, he has "never seen any grease cup having sufficient power to force grease into the loaded side of the bearing, even with no load on the truck," and he shows how oil can be made to do the work better than grease, as many truck owners need to know. The argument could also be used in favor of a graphite addition to the oil, since a little of the graphite will always get under the load.

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A few blossoms from Mr. Bradley's paper will also bear repetition as examples of expressive diction full of meaning in a few words. "Any military type of truck that can be developed," he writes, "is bound to be swamped by the thousands of purely commercial models that will have to be enrolled when the nation goes to war." And in another place: "A 3½-ton truck is not so light as to be constantly threatened with overloading," which makes us reflect again upon the peculiarity that the factor of safety with regard to overloading, though it is in the hands of the public, is so much smaller than the factor found advisable against stresses which can be closely calculated. Summing up war experience, Mr. Bradley also writes: "Brake rods should be regarded as organs needing protection" and "Engines under the seat will no longer be accepted" in the French army, omnibus chassis excepted. One may be inclined to quarrel about the latter conclusion, so long as the general truck type may yield to something better any day, but scarcely about the needed protection for brake rods, which may be hit by any board that is tripped up.

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From the same paper one gleans the idea of a new accessory of value for all hauling work that may leave the vehicle exposed to low temperature at night. It refers to a pail for draining water from the radiator and motor. This pail should have a filter-funnel at the bottom for slowly refilling the organs in the morning while the motor is heating up, and, by means of this funnel, it should be able to stand alone on top of the radiator, so as to engage the driver's attention and time as little as possible.

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Cottoning to the supposed prejudices of car owners or the automobile industry is an art requiring skill and up-to-dateness. As the prejudices have practically vanished the sly art is most safely cultivated by saying nothing, and here the skill lies in using an extravagant number of words for saying it.

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Should the chauffeur be a servant? A momentous sociological problem, Madam, yet we solve it offhand. The answer is: Perhaps, but it is easier to make the servant a chauffeur; also cheaper.

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Optimism always wins in the long run, for the simple reason that pessimism can't win anything, aiming for nothing that is not already there. Hence, when we have downed a proposition, engineeringly speaking, we may well be prepared to find out later that it won't stay down.

Of all that has been said to explain why the great projected merger did not materialize only one remark is entirely fit for publication. According to this version all the parties concerned were too intelligent and wideawake. When 90 per cent brains is added to more 90 per cent brains, the sum still becomes nothing better than 90 per cent brains. The waste of human capacity for directing big affairs that was involved in the contemplated amalgamation was too appalling to contemplate.

—

Car Control for Legless Persons

WITH the deplorable increase in the number of mutilated persons in France, new means are being devised for adapting the control mechanism of automobiles to physical deficiencies in the drivers. Among these arrangements one proposed by R. C. Baudry for the use of persons whose legs have been amputated or paralyzed has received an award from the *Société d'Encouragement pour l'Industrie Nationale* and is shown in the accompanying diagrams. For operating, it, only the hands and the back of the driver are engaged. Braking is effected by backward movement of the body.

The clutch pedal is operated by means of a second handwheel which slides on the steering pillar and is connected with the clutch pedal as shown in Fig. 1. The steering wheel A carries the accelerator P. The clutch wheel B with tubular hub C terminates with an annular shoulder V which abuts against collar D fixed upon the steering pillar. The square-section rod X is mounted to slide in this collar D and the similar collar D1, lower down, and its upper end S hooks over shoulder V. The cable F with adjustment Y is attached to lug R on rod X and passes over the grooved pulley K, secured to the steering gear box M, to clutchpedal L.

To unclutch, wheel B is raised toward wheel A, while to engage the clutch it is allowed to be pulled down, and, as the wheel B can turn on the pillar, following any steering movements of wheel A and the hands guiding it, simultaneous steering action does not interfere with any desired gradation in the engagement of the clutch. The shoulder V may be provided with a ball bearing to reduce friction under the hook S, thereby further assuring the smoothness of operation, and the cable may be replaced by a mechanical articulation.

The brake control, Fig. 2, comprises the adjustable rod K attached to brake pedal H at one end and at the other to lever D which is pivoted to seat A at E and carries at the top the backrest C which is normally held forward by retractile spring L. To operate the brake, the driver thus simply leans back against C with more or less force.

The designer, both of whose legs are paralyzed, has this equipment on a light car and experiences no difficulty in exercising complete control over the vehicle. — From *Le Génie Civil*, April 29.

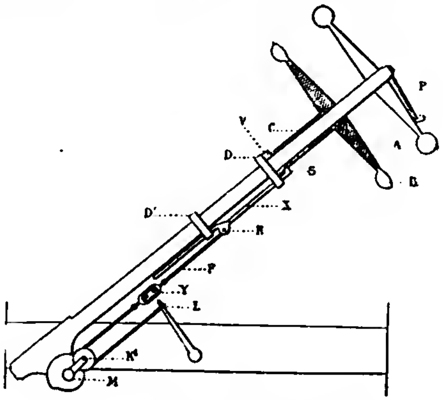


Fig. 1—Clutch and throttle control

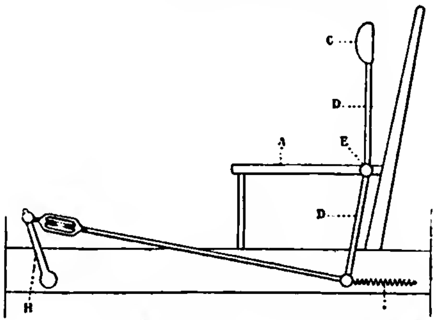
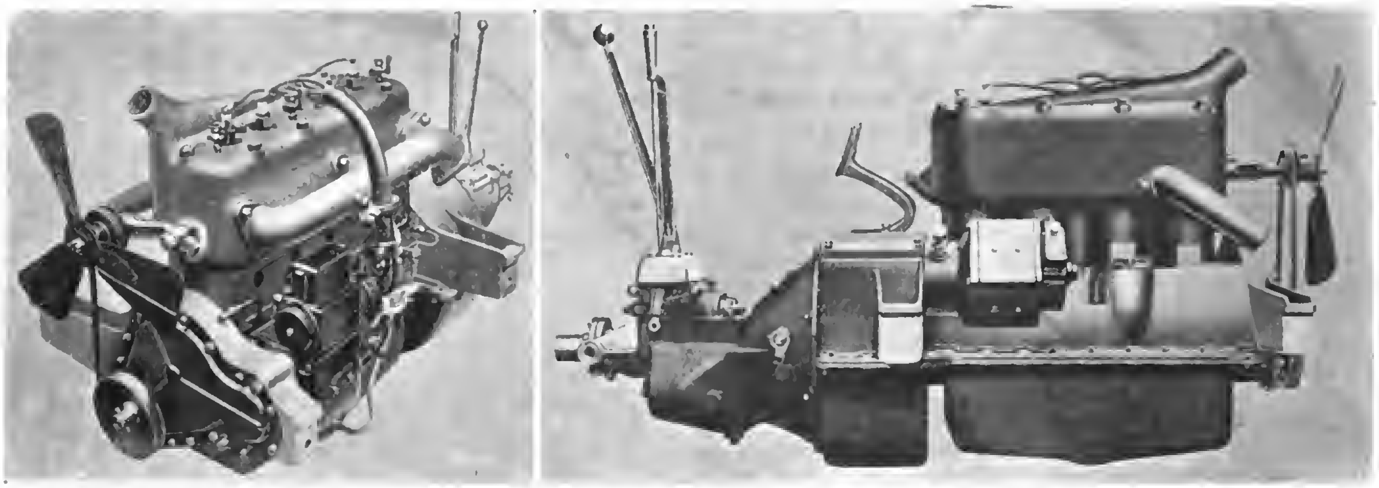


Fig. 2—Arrangement for applying the brakes



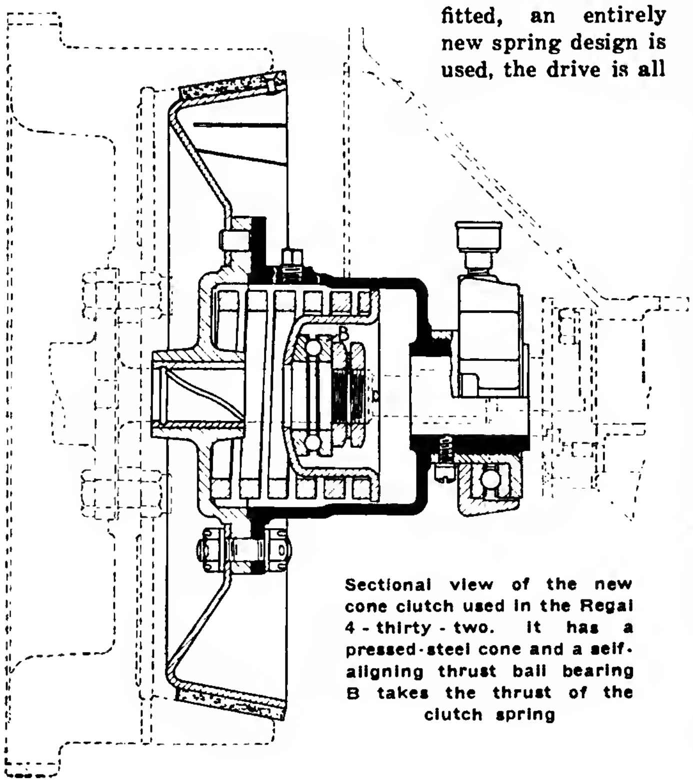
The new 3½ by 4¾-in. engine used in the Regal for 1917, showing the mounting of the electric units

Better Engineering in New Regal Four

3½ by 4¾-in. High Speed Engine Develops 32 H.P.

SELLING at $695, the new four-cylinder Regal is an entirely new design throughout and is undoubtedly one of the best in engineering detail on the market at this price. Certainly it is a better car than Regal has heretofore offered in this price field, and a great deal of thought has been paid to every detail, more of the parts being designed and built in the concern's own shops than ever before. For instance, the clutch and universal joints, parts that are very often bought from specialists in these units, are designed and manufactured wholly under the Regal roof for the new model, which is styled the 4-thirty-two.

Its engine is new throughout; the frame is of tapered form instead of being straight as in previous cars, the gearset is in unit with the engine, a new starting and lighting system of Heinze make is fitted, an entirely new spring design is used, the drive is all changed, a better rear axle has been adopted, the gasoline tank has been removed from the cowl and placed at the rear and a new body and hood of tapered form have been fitted. With all these differences over previous construction, the new Regal is therefore not a refined edition of any previous model, but may be regarded as a brand new car from stem to stern.



Sectional view of the new cone clutch used in the Regal 4-thirty-two. It has a pressed-steel cone and a self-aligning thrust ball bearing B takes the thrust of the clutch spring

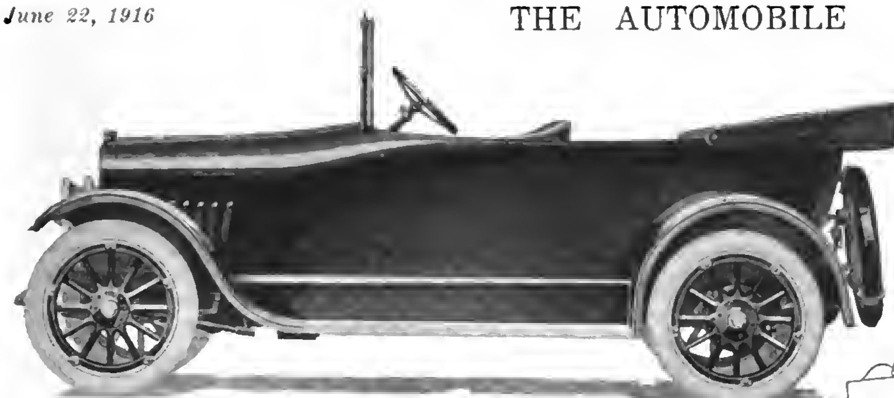
The new motor, which is designed to operate at higher average speed than previous power plants, in accordance with engineering dictates of the day, normally develops 32 hp. It has a bore of 3½ in. and a stroke of 4¾ in., giving a displacement of 183 cu. in., and a formula rating of 19.6 hp. A rigid engine is obtained by casting the upper half of the crankcase in unit with the cylinder block, this construction calling for a detachable head so as to make it easy to get at the interior for adjustment or repair. By making the cylinders and that part of the crankcase carrying the bearings of the crank and camshafts in one piece, it is possible to secure correct alignment of all the cylinders and the bearings, a feature which does its part in the securing of a smooth-running motor.

Valve Adjustments Accessible

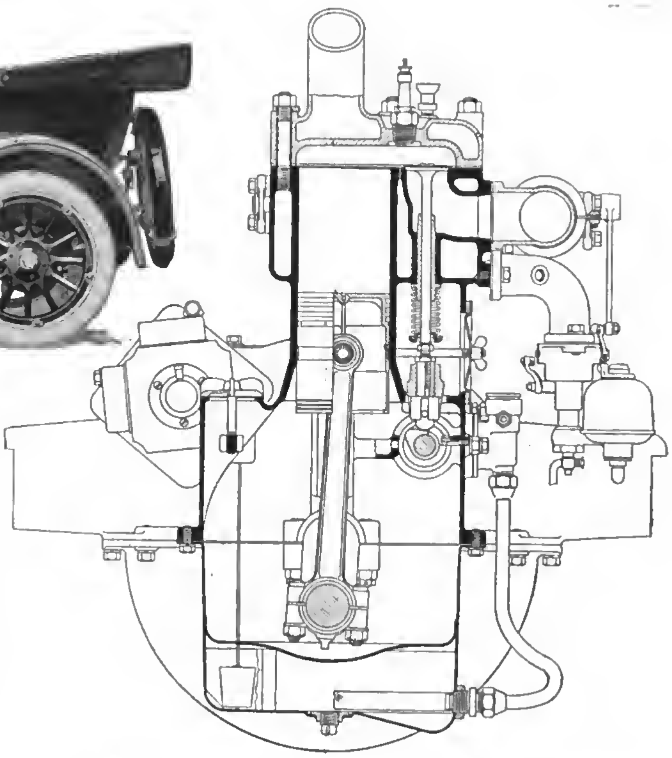
Valves are on the left and by a judicious placing of the exhaust manifold, carbureter and generator, which are the main units on this side, it is no trouble to get to the valve adjustments, after having removed the covers that inclose them. In connection with the valve adjustment, a refinement is noted that is bound to be appreciated by the man who has to take up the valves. The tappets are secured in their holders in such a way by means of a pin that they cannot revolve, but simply have up-and-down movement. Thus when a valve must be adjusted, it is not necessary to hold the tappet portion with one wrench while turning the adjusting nut with another wrench. Only the tool necessary to turn the one nut is needed, and after the right clearance has been secured, a lock nut sets it. The tappet assembly for two cylinders is removable from the top as a unit.

Very Long Pistons Used

Special mention should be made of the unusually long pistons that are used. These are made of cast-iron, but the section is very light and well proportioned so that there is



Regal 4-thirty-two five-passenger touring car which sells for $695



Transverse section through the new 3½ by 4¾-in. Regal engine

no excess weight. They measure 4½ in. from top to bottom, affording a long bearing surface that distributes and reduces wear and also practically eliminating any chance of slap. Three eccentric rings are fitted, and there are oil grooves at the bottom of the skirt to carry the oil down, besides a chamfered groove below the last ring slot, this being provided with a number of oil holes to return any excess lubricant to the crankcase. Thus, practically every possible precaution has been taken against oil getting into the combustion chambers to smoke and carbonize. The piston pins are also quite large —¾ in. diameter—and are secured to their pistons by tapered dowel screws.

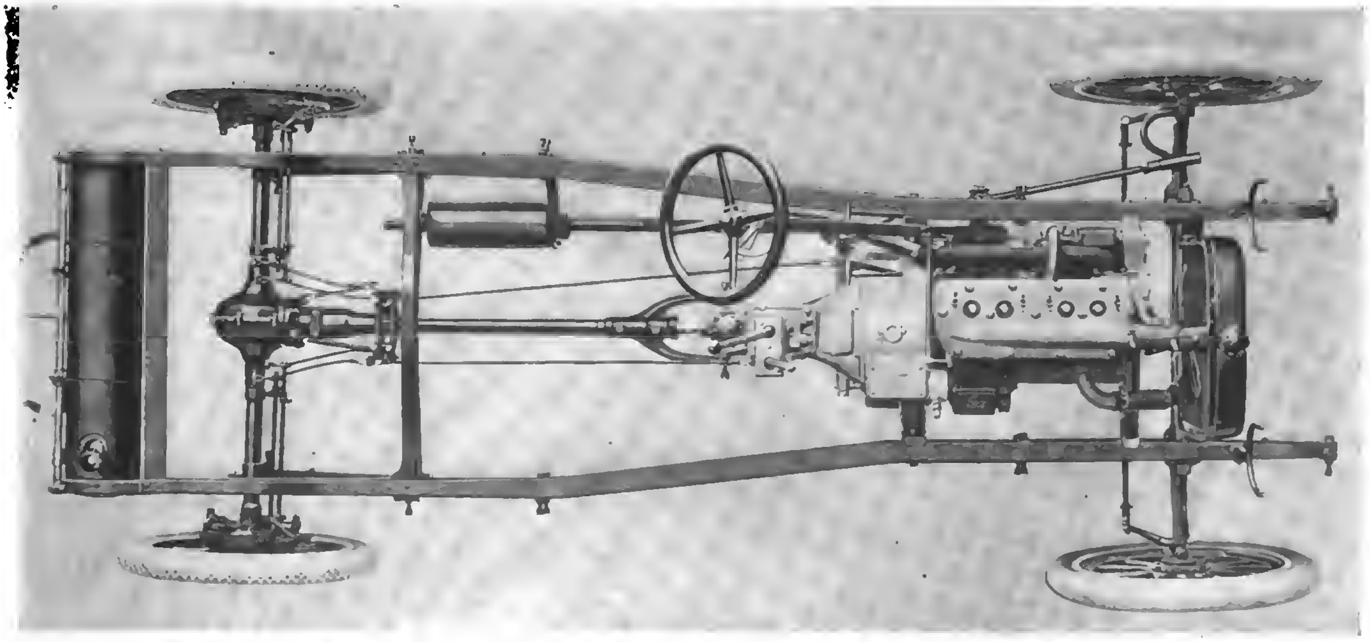
The rotating members are of ample proportions, the crankshaft being 1⅝ in. in diameter and having three die-cast babbitt bearings that are 2⅝, 2¼ and 3¼ in. long, front to rear, respectively. The flywheel bolts in place by a flange of large diameter, and the camshaft and generator shafts are driven from the mainshaft by helically-cut gears, the crankshaft gear being steel and the other two cast-iron for reasons of silence, since steel runs quieter against cast-iron. These are in a separate case from the crankcase and inclosed by a pressed steel cover.

Oiling System Well Worked Out

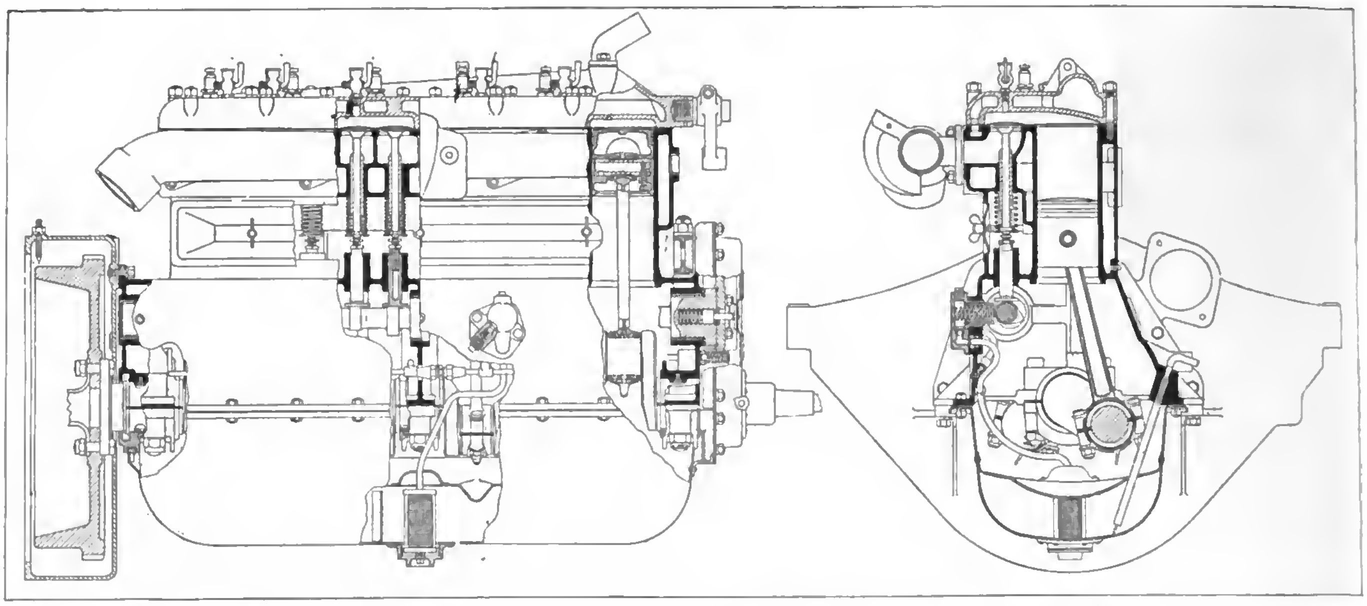
Special attention seems to have been given the oiling system in this new motor, for it possesses several commendable refinements in addition to the special provision in the pistons against leakage into the combustion chambers. A plunger oil pump, operated from the camshaft, draws the oil from the pressed-steel oil pan at the bottom of the engine, and after it has been strained it is led to the splash troughs in the usual way. A special lead runs to the point of mesh of the camshaft gear with the generator gear, but to insure its also getting to the mesh point of the camshaft and crankshaft gears without undue complication, a simple and effective scheme was hit upon. A little baffle plate was placed on the inner side of the inclosing case, and the oil, when thrown off by the camshaft gear, strikes this baffle and is directed straight onto the mesh point desired. Breathing is obtained through space provided around the tappet assemblies, and a large filler and oil gage are placed on the right side of the crankcase in convenient position.

One thing that has been especially looked to in the design of this motor is the clear valve passages. These have been

(Continued on page 1145)



Chassis of the new Regal model, showing the tapered frame, unit power plant, rear mounting of gasoline tank, etc.



Sectional views of the new light six motor used in the Kissel Hundred Point model, showing details of design

Kissel Brings Out Light Six

3¼ by 5-in. Motor, 117-in. Wheelbase, 32 by 4 Tires and Light Weight Render New Car Very Economical

THE Hundred Point six recently brought out by the Kissel Motor Car Co., Kenosha, Wis., as reported in THE AUTOMOBILE for June 8, is the smallest six-cylinder car which that company has produced and sells at the lowest price, both touring car and roadster listing at $1,095. The 6-42 model is continued.

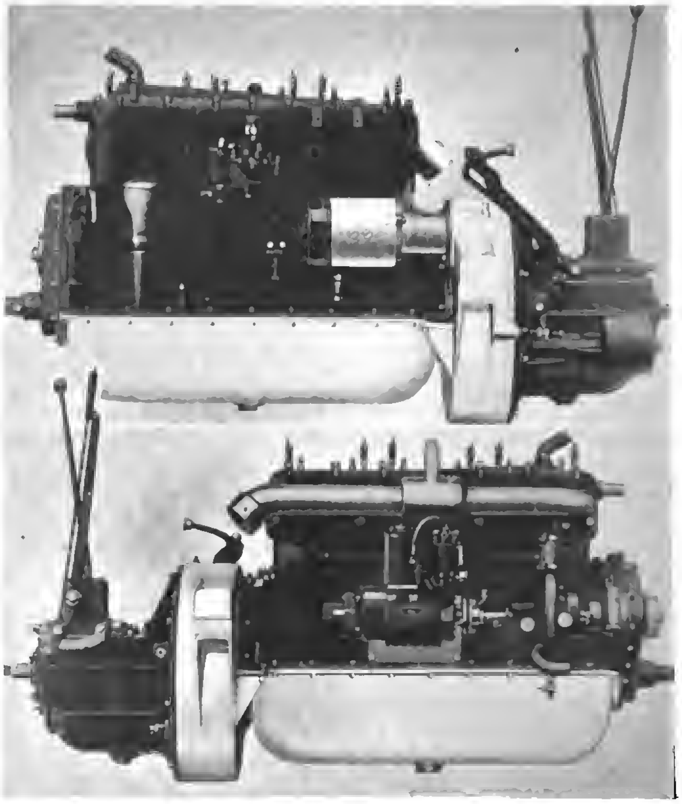
An Economical Car

The motor used in the new car has a bore of 3¼ and a stroke of 5 in. and develops 52 hp. The bore is ⅜ in. smaller than that of the model 42 and the stroke is ½ in. shorter. The wheelbase is 117 in., or 5 in. shorter than on the 6-42, rendering possible a considerable reduction of weight throughout the chassis so that 32 by 4-in. tires are of ample size for the load. This is one of the features of economy of the Hundred Point six which are made possible by the general weight reduction, smaller motor and other refinements of design.

Features of Motor

The motor is, in several ways a departure from former Kissel practice. The block cylinder casting forms the upper half of the crankcase and a pressed steel case completes the assembly. Bore is 3¼ in. and stroke 5 in. The valves are completely housed and have a 1⅝-in. clear opening. Special lightened annealed iron is used in the pistons and they are balanced to one-half an ounce before grinding. Leak-proof type rings of gray iron several degrees softer than the cylinders minimize wear on the cylinders.

The crankshaft is 34 5/16 in. long and operates in Fahrig metal bearings of the following sizes: Front, 2¼ by 2 1/16 in.; center 2¼ by 2½ in.; rear 2¼ by 3 in. Cams, bearings and all parts of the camshaft are machined from a one-piece drop forging. Camshaft bearing sizes are: Front, 2⅛ by 1 3/16 in.; center, 2 1/16 in. by 1 in.; rear, 1¾ in. by 1 in.



Exterior views of the new Kissel unit power plant, showing the neat and compact design. Note the high mounting of the carbureter. The starting motor is carried at the left rear to engage the flywheel, and the ignition and lighting unit on the right with the water pump

The timing gear construction makes use of one pressed Fabroil gear working between two steel helical gears. The Fabroil gear is instituted both to give the highest degree of wear and guard against noise. Lubrication is by combination force feed to the main crankshaft and splash to the connecting-rods and pistons. The number of grease cups on the motor is reduced to two as oil cups are substituted at all lubricating points except at the circulating pump. An entirely new Kissel-Stromberg carbureter has been designed for use on this particular motor. The carbureter is fed by a Stewart vacuum system.

The differential case is a malleable casting and all differential parts are interchangeable. High carbon strip steel is used in the side rails of the frame, which is designed to give absolute rigidity and freedom from weave. Rattling and sprung doors are eliminated by this construction. The side members are narrowed to permit a short turning radius.

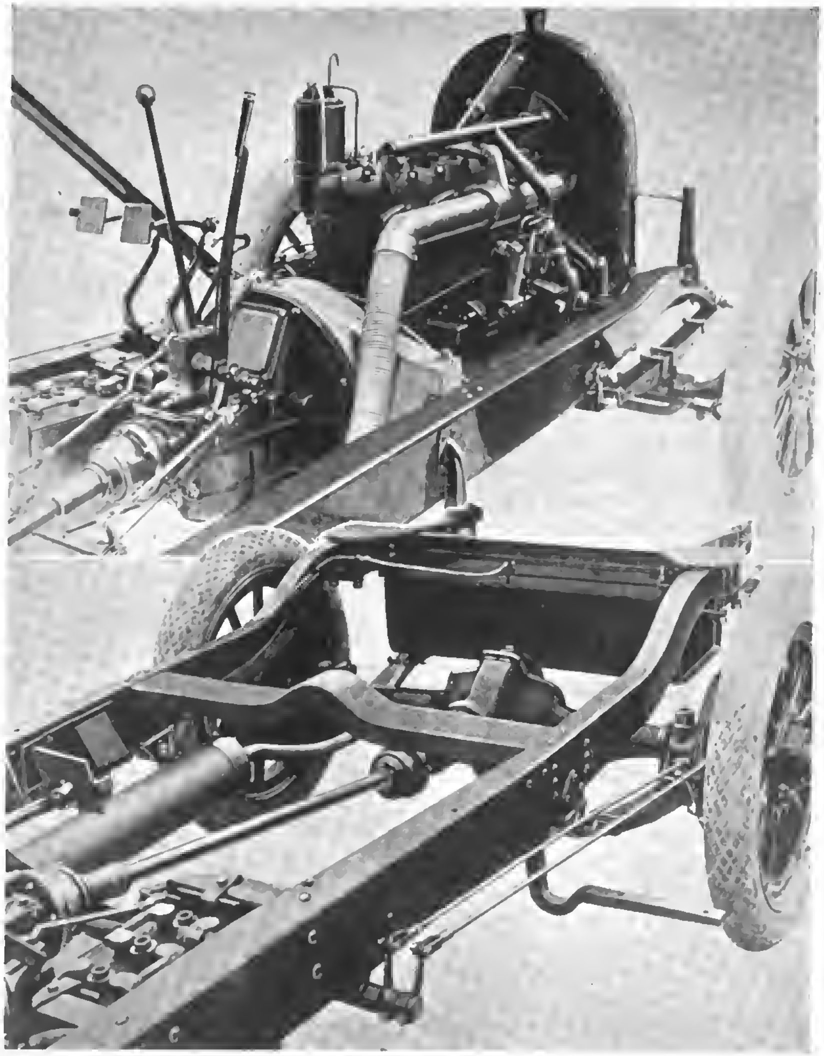
Double External Brakes

The distinctive floating rear axle with its design permitting easy adjustment of all bearings and of the pinion and ring gears is retained without change except for size reduction. The Kissel type of two sets of external contracting brakes, with 14-in. race and 2-in. diameter, is also evident. The elimination of internal brakes has as a purpose the riddance of rattling rods and levers.

A new feature for the 1917 six is the institution of oil bolts throughout the chassis in place of the conventional grease cups. These bolts are wicked from the bearing surface to a drilled hole through the center. The end is capped with a steel grease cap in the side of which is an oil hole. To lubricate the bearing, wherever it may be, it is only to twist the cap until the holes in the cap and the bolt match up, and squirt in lubricant from an oil can. There are only two grease cups to fill on the chassis.

An Easy-Riding Car

Due to its long, wide three-quarters elliptic springs the new car is as easy riding as the larger model 6-42. In the touring car the front seats are divided, a feature Kissel claims to have originated. Every feature of the body design savors of roominess. Black finish of all metal parts in the body interior gives a distinctive richness.


Two chassis views. Note the mounting of the Stewart vacuum fuel feed system, the flexible exhaust line and the deep section frame. Also the battery mounting and the speedometer drive off the rear of the gearbox

Remy ignition, Remy generator and starter with Bendix drive screw inclosed in a housing, in conjunction with a Willard battery, make up the electrical system. The clutch is integral with the transmission and is a leather cone with two adjustable fiber-faced spring plungers acting as brakes against the rim of the clutch when disengaged. The clutch spider is a steel stamping. The transmission is of the selective type with three speeds forward and reverse. The main shaft is mounted on larger annular ball bearings. Gears are drop forged of nickel steel. The driving mechanism between the gearset and the rear axle consists of a set of two universal joints with a connecting shaft. The floating rear axle has spiral bevel gears. Pinion and driving gears can be adjusted without disassembling the other parts. Timken bearings are used throughout. Drive and torque are taken through the rear springs with the Hotchkiss principle of drive.

Some of the other features of the new Kissel model are: Big door openings, extra deep upholstery of leather, cushion springs and curled hair. The driver's seat is adjustable to any length of reach and the indicating instruments are mounted in a straight line on the cowlboard. A pedal button is used to start the engine. The body is mounted over a felt packing on the frame which is very deep and constructed in such a way that it will not deflect and cause the doors to work loose and rattle. The body is given twenty-two finishing operations, being of 20-gage, silver finish sheet steel.

Sedan, coupé and town car tops are furnished for the new model, all being built in connection with an extra-strong lower body called the Gibraltar. The town car may be transformed into a victoria in fair weather, the sedan being quickly converted into a touring car and the coupé into a roadster.


Five-passenger Kissel touring car with individual front seats and selling at $1,095. The motor is 3¼ by 5 in. and tires are 32 by 4

Preparedness and Motor Trucks—Part III

Troubles, Weak Points and Requirements in Vehicles for Military Work as Revealed by the Great War

By Donald McLeod Lay

MAGNETOS cannot be relied on for more than 6 months average under war conditions. At the end of that time they have lost much of their magnetism and various screws have begun to work loose.

English trucks using force-feed lubrication had trouble with the external pumps breaking due to vibration and causing burned out bearings resulting from the loss of oil. It was found that frequently the ignition system was not adequately protected from water, this giving much trouble. Insufficient clearance caused the steering gear tie rod to strike the ground, throwing the gears out of line. Cooling and lubrication were found the greatest difficulties. Fan belts were too light and fans too heavy. Another trouble was in adjusting brakes, the adjustments being frequently inaccessible or requiring special tools which were invariably lost. Load platforms were of varying heights from the ground and tail boards were of many different designs, causing much trouble in loading and unloading.

Springs Frequently Broken

In the German campaign in Russia the bad roads frequently broke front springs either at the front end of the first leaf or just in front of the clips. Solid rubber tires gave out rapidly. Radiators were frequently pierced by bullets and shrapnel although protected from collision by fender rods. Carbureters frequently gave trouble and dual tanks suspended at the rear of trucks were always dented and frequently broken from striking stones, etc.

With the Allied armies there have been many cases of axle housings failing due to heavy loads shifted to the right side of the truck. Loads of shells are particularly liable to slip this way. Shackle bolts and springs gave considerable trouble under the stress of war conditions while the poor driving frequently made short work of clutches of all kinds.

Solid tires were found to wear well although there was a tendency to pulp up in certain parts, the wear seeming to be irregular, and large pieces breaking off. Owing to dense traffic behind the lines, convoys frequently had to get off the crown of the road to allow others to pass, this alternate contact with the dirt service and the edge of the granite blocks used in Northern France and Belgium causing a lateral frittering away of the solid rubber tires. Wheels with twin tires sometimes have the inner tire worn completely away while the outer one is in comparatively good condition. Trouble was also experienced with tires stretching and pulling off the rims due to the strains to which they were subjected when pulling out of a difficult position with wheels skidding violently.

An important feature of the automobile and motor truck branch of the service is the proficiency of the drivers. Inexperienced and poor drivers cost the French and British armies a tremendous amount of money and time, while the men who were really fitted for this work were digging trenches or in some other branch of the service where their special abilities were of no value.

Early in November, 1914, W. F. Bradley reported that the most suitable type of truck for war purposes is a vehicle carrying a useful load of 2½ to 3 tons and driven by a four-cylinder motor of 3¾ to 4-in. bore. This vehicle is illustrated in the accompanying diagram, which shows the necessity for certain features which was evident even during the first 3 months of the war. These are adequate clearance, stout sprags to prevent running backwards, towing hooks front and rear, four-speed gearboxes with a low emergency gear, interchangeable carbureters and magnetos, gasoline tanks of large cruising radius which are easily filled and emptied, drain cocks for cylinders and radiators and the ability of each truck to tow another of equal weight over ordinary roads. Provision should also be made for a reserve supply of fuel and oil. Towing ability is very important as trucks are frequently temporarily disabled and if they cannot be towed back to the repair shop at once it may be necessary to destroy them or allow them to fall into the hands of the enemy.

Touring cars on war duty should have space without littering the body for carrying 2 gal. of reserve fuel, 1 gal. reserve oil, two spare shoes, five or six tubes, a more complete set of tools than usual and a small selection of spare parts.

For military work controls should be simplified. The ideal is fixed ignition with magneto only and accelerator pedal. A lever on the dash should regulate minimum throttle opening and cut off the ignition when fully closed. The use of a motor governor is preferable, the war having converted the European manufacturers to this viewpoint.

Very useful if not indispensable accessories are differential locks and towing hooks, front and rear. Despite careful driving, a truck would sometimes get off the road into the mud; with hooks, a rope and differential lock, the other vehicles in the convoy could quickly extricate it, whereas without these accessories serious delays often ensued.

Detachable Wheels Valuable

Detachable wheels are valuable, as sometimes tire changes must be made under fire and time is precious under such conditions. For military work it is important that tires be the same size all around, the use of different sizes on front and rear wheels necessitating the carrying of spares for each while in the event of an excessive number of punctures or blowouts the available supply of spares for that particular size is insufficient.

Many trucks, especially the De Dion ammunition wagons, were fitted with powerful winding drums with steel cables, making it possible for the vehicles to haul themselves out of tight places. Electric starting systems have been found unnecessary, the batteries being generally removed from the vehicles and used for lighting trench quarters.

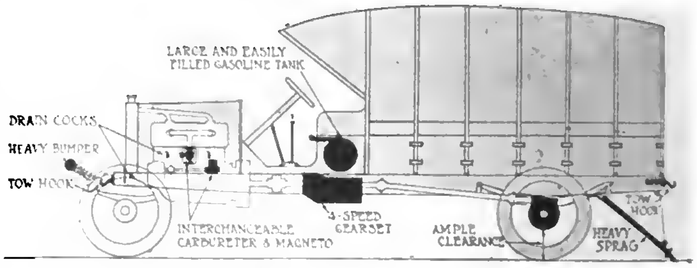


Diagram of important features of ideal truck for military purposes

The FORVM

BLANK DIFFERENTIAL IS BEST APPLIED ON SOLID TIRES—ONLY OBJECTION TO IT IS POSSIBLE USE OF UNEQUAL DIAMETER REAR TIRES—STEERING MECHANISM PRACTICE IS UNSCIENTIFIC

Facts in Favor of the Blank Differential

By Arthur M. Laycock

Chief Engineer, Sheldon Axle & Spring Co.

I HAVE read with great interest the comments with regard to the abolition of the differential. There is evidently considerable misunderstanding in regard to my meaning and the summary was undoubtedly overlooked altogether, which reads as follows:

"After considering all the various points, it is well not to become too enthusiastic, as the introduction of a blank differential on the face of it is so drastic that one must of necessity move with extreme caution."

While I do not wish to retrench from what I have said in one iota, I think that it is out of the question for anyone to take this type of drive to meet all conditions. For short wheelbase, wide track, and trucks which have to maneuver a good percentage of their total running time it would be out of the question, but for bus work, army service work and for contractors' wagons it has decided advantages.

In going over the good points in my previous article, it might be well to mention the disadvantages which we have encountered in this drive through extended experimentation.

Best with Solid Tires

So far as we can see, the blank differential is best applied on solid tires.

Where pneumatics are used, proper inflation of the rear tires is absolutely essential—in other words, it is very necessary that not only should both tires be the same diameter, but the pressure in each should be about the same. This, of course, might be looked upon as a disadvantage, but it has its good points as well.

Even with the conventional differential it is very necessary that these conditions exist if the maximum efficiency be realized.

In high-speed pleasure car work, the car cannot be held as steady when running over rough roads. However, side skidding from braking is greatly minimized—in other words, it is infinitely safer to apply the brakes on a greasy pavement with the blank differential than with a conventional one. This, of course, applies to bus work and heavy trucking as well, and gives one confidence in city driving, which is readily appreciated.

Only One Real Objection

In all the correspondence the only real objection brought against the blank differential is the probability of using unequal diameter of rear tires. This, of course, would be very objectionable, but does not apply in ordinary service as much as one would think.

In a good many instances, where tires on one side of the truck are worn off first, the truck is kept in operation until both sides go before making the change. This is very general practice.

It is well to remember that the best design is only a compromise, and this is no exception to the rule, but with so many things in its favor, we are very certain of a large following in this direction.

General Steering Mechanism Practice Is Unscientific

By Theo. D. Stanley

General Service Engineers Co.

WITHOUT any purpose to extend further the argument on the methods of installing the steering mechanism in a car than to point out in the article of Leon A. Chaminade, in THE AUTOMOBILE for April 27, he seems to have overlooked the main point in my statement of the flexibility in the spring producing a degree of influence on the steering mechanism which applies to all forms, including his own, of fore and aft mounting.

The method submitted by Mr. Chaminade in shortening the link, also accentuates the influence of changes in the wheelbase as indicated by A. L. Clayden in the issue of Sept. 2, 1915. This changing of the wheelbase of a car is particularly noticeable in a truck, on which it may amount to as much as 3-in. difference in the wheelbase betwen a loaded and an unloaded truck, owing to the flattening of the curvature of the spring forms affecting both the brake and steering mechanism.

The theory and practice in steering and steering mechanism is receiving considerable attention and the general practice is found to be unscientific. The fore and afte method of installation is the least scientific or practical in several particulars. This method requires an extra knuckle steering arm or lever which has only one point of highest leverage, which is when the car is moving in the straight forward direction. It is the turning condition which requires an increase in leverage in steering a car, for the straight forward direction is more or less automatic.

The steering-link also is in an objectionable position and often has to be bent to clear the wheel movements. True, this curvature gives certain flexibility, but that should be provided for by other construction forms, and, theoretically, the more rigid the steering mechanism throughout, the greater the efficiency.

Deflection, especially under high speed, is responsible for the larger per cent of wear on all parts of the car, and to be provided against as far as possible.

If the roadway was of a fluid nature the feel of the helm might be interesting, but still far from ease of operation, and any sailor knows the feel of the helm is a hardship as the speed increases, and, with power-driven vessels useless for efficiency, Mr. Clayden to the contrary notwithstanding.

It is probable the latter part of the first paragraph of the contribution by Mr. Chaminade is accidentally misstated, since it appears rather contradictory, as "advantages" should not "cause bad wobbling" logically.

The History of the Pneumatic Tire—7

Invention of Pneumatic Tire by Dunlop in Ireland —Difficulty of Repairing Inner Tube—The Thomas, Bartlett, Overman, B. & C. and Other Cushion Types

The History of the American Automobile Industry—34

By David Beecroft

EARLY in 1890 the Sweeting Cycle Co. of Philadelphia received a shipment from England of bicycles with pneumatic tires. At first received with derision, the success of the bologna tire on the track as well as its comfort on the road quickly made it popular. The first ones were about 2¼ to 2½ in. in diameter, which made them look almost balloon-like as compared with the ⅞, ¾ and even ⅝-in. solid tires then in use, and as a result they advertised themselves very rapidly.

Dunlop Invents Pneumatic Tires

These first pneumatic tires were the invention of John B. Dunlop of Dublin, Ireland, and while following the general idea of Thompson, as laid down in 1845, seem to have been an independent development, and in some respects, not so well worked out. Dunlop's tubes were inclosed in a jacket of Irish linen which was held to a rim almost flat by linen flaps pasted with rubber solution to the inner surface of the rim. The linen jacket was then protected by a tread of vulcanized rubber pasted on its circumference and lapping down almost to the rim or even up on it as did the linen flaps. This material was found unsuited for tire manufacture by reason of inability to stand flexion and the working of warp and filler threads in use, resulting in mutual destruction.

Inner Tube Inaccessible

When in place, this tire was rather wider than deep, and being of large size did not need high inflation, so that it rode very easily over any rough road. When permitted to stand for some time after being made up, the rubber solution held quite well, but if used quickly, it softened under heat and some parts were likely to come loose. Its particular defect, however, was the difficulty of getting at the inner tube for repair purposes. The casing or cover had to be loosened by soaking the solution with gasoline, followed by opening the linen jacket which afterward had to be repaired by sewing and solutioning a patch over the opening. Naturally, such difficulty displeased users and hindered buyers, but so busy were the makers supplying orders that they did not stop to concern themselves with improvements.

The Thomas patents controlled by Bidwell seemed to offer a more satisfactory arrangement, while other inventors began to get into the field with other devices. The Dunlop patent of March, 1890, was followed almost immediately by the Wilson patent, in August, which showed an arch of rubber with its ends abutting between the sides of the rim and which could contain an air tube or some yielding material, like sponge or hair. In the same month, the Bartlett tire appeared in England. This was very similar to the Wilson, in that it was arched in shape, the base of the arch being its widest portion and the tire being rather V-shaped instead of cylindrical, as modern tires are made. Bartlett's tires attained some prominence on the market in England, probably because they were properly pushed.

The Overman Cushion Tire

The A. H. Overman patent on a cushion tire was brought out in the early fall of 1890 and the Banker & Campbell tire quickly followed. The former was arched in shape but contained no fabric, and was introduced as a substitute for the pneumatic, instead of falling in with the public's fancy and attempting to supply it. It was marketed on Victor bicycles for several years until the insistent demand for pneumatics suppressed it. The Banker & Campbell tire was circular in section but instead of the single hole in the center such as the earlier carriage types used, it had seven holes with fairly strong walls between them. This was offered as a substitute for the pneumatic but did not prove to be such. The resiliency of an all-rubber tire is less than that of an air tire; the weight is more for a given size, and in most tires, having the holes running lengthwise, the constant bending along a certain line eventually cracks the rubber on the inside. Just why rubber will stretch on the outside of a bend without damage but breaks on the inside where it is compressed seems difficult to understand but such is the fact, and many tire makers were obliged to learn this simple thing by costly experience.

Another Cushion Type

Early in 1891, the A. Strauss cushion tire, held in place by bolts, having their heads in the central hollow and their stems passing outward through the open base, was brought out by the New York Belting & Packing Co.

The Rostrum

No Lag in True High-Tension Magneto

EDITOR THE AUTOMOBILE:—We have noted in THE AUTOMOBILE for April 27, your reply in the Rostrum to L. L. S. of Columbus, Ohio, stating that the spark is advanced on an automobile, when cranking on the magneto, to take care of mechanical and electrical lag, and to make the explosion occur as nearly as possible to upper dead center. You also advise your correspondent that "set ignition is used simply in order that the explosion resulting from the spark will occur as near upper dead center as possible."

Please be advised that in the true high-tension magneto no lag whatever exists, either mechanically or electrically speaking. When starting on the magneto, where manual advance and the independent type of magneto are resorted to, it is customary to advance the spark about half way, this giving about 17 deg. advance before upper dead center, for the reason that the spark in that position is stronger than in full retard and cannot cause a back kick on account of the fact that if the engine is turned over at a speed sufficient to cause the magneto to overcome the resistance of the spark plug gap the flywheel will also be turning at sufficient speed to carry the engine over center.

Set spark magnetos giving from 17 to 20 deg. advance ahead of upper dead center are used to a considerable extent on motor trucks in order to eliminate the possibility of low efficiency or damage to the engine resulting from irresponsible drivers leaving the spark control levers in either full advance or full retard positions, paying no attention to spark position at any speed or load.

Set spark ignition in such work insures about as good average results as does the manually advanced magneto on the average pleasure car when handled by the owner.

New York City. ALBERT H. ZIEGLER,
Technical Dept., Bosch Magneto Co.

Likes Horn on Cadillac 8

Editor THE AUTOMOBILE:—What make is the horn used used on the Cadillac eight?

2—Is it vibrator or motor-driven?

3—Its price?

Battle Creek, Mich. W. H. G.

—The type 53 horn is known as the Auto horn and is manufactured by the Dayton Engineering Laboratories Co., Dayton, Ohio.

2—It is of the vibrator type.

3—The price of this horn is $12, purchased at the factory of the Cadillac Motor Car Co., Detroit, Mich.

Information on Charging Batteries

Editor THE AUTOMOBILE:—Kindly inform me of the cheapest and most efficient way of charging six 6-volt storage batteries or a total of eighteen cells where the only available current is 110 volts A. C. and 235 volts D. C. I am figuring on an average of six batteries per day.

Also kindly give me the comparative costs of charging with rectifiers, motor generators, resistances and lamp banks.

Newark, N. J. R. C. R.

—The 110-volt A. C. is absolutely of no consequence, unless it is converted by means of a rectifier or motor generator set, and in view of the tremendous loss in efficiency, we would not recommend the use of 235 volts D. C. to charge an average of six batteries per day. The average voltage of six 6-volt batteries arranged in series would be 48.

The following table will give you a very good conception of the efficiency of charging through mercury arc rectifiers and motor generator set as compared to resistance in the form of a rheostat, or bank of lamps:

	Battery Voltage	Charging Voltage	Efficiency of Charge	Efficiency of Gen.	Total Efficiency
Arc Rectifier	48	48	100	85	85
Motor Gen. Set ...	48	48	100	88	88
Resistance	48	110	42.5	100	42.5
Lamp Bank	48	110	42.5	100	42.5

A Special Paint from Japan

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for Jan. 20, 1916, page 118, I saw that the Fleetwood Metal Body Co. exhibited a car painted green in which brush marks are plainly left using a special paint that does not need either dryers or varnish applied with the brush and not rubbed smooth and in use it wears smooth and gives a dull finish that has the most durable wearing qualities. What kind of paint is used?

2—Where can it be bought?

3—How is this paint mixed?

4—How many coats are applied and how long does it take to dry?

Kansas City, Mo. J. W. A.

—This car was painted with a green color called E. R. H. Special No. 2000 and No. 1051.

2—Manufactured by Egan-Ronan-Hausman Co., Brooklyn, N. Y.

3—This color is ground in Japan, thinned to a paste with turpentine and then linseed oil added to obtain the proper working quality.

4—Two coats are applied with an ox-hair brush, then lightly rubbed with pumice and the last is applied in the same way, very lightly rubbed again. It is then brightened up with linseed oil rubbed on with cheesecloth and thoroughly rubbed dry. Each coat will air dry in about 24 to 30 hr.

Pressure Required to Close Brakes

Editor THE AUTOMOBILE:—Relative to the answer to my inquiry entitled Pressure Required to Close Brakes, I am afraid I did not make my request quite plain enough. About the direct pressure necessary to throw the emergency brake on so as to stop a car within twice its length going at approximately 25 to 30 m.p.h., I was told that it would take 1000 lb. The 20 lb. you speak of refers to throwing on the service brake gradually through the medium of levers.

Springfield, Mass. C. M. E.

—The exact amount of pressure applied on the drum will, of course, vary with the co-efficient of friction of the brake material and the weight of the car as well as with the other factors you mention. Your question can be answered most

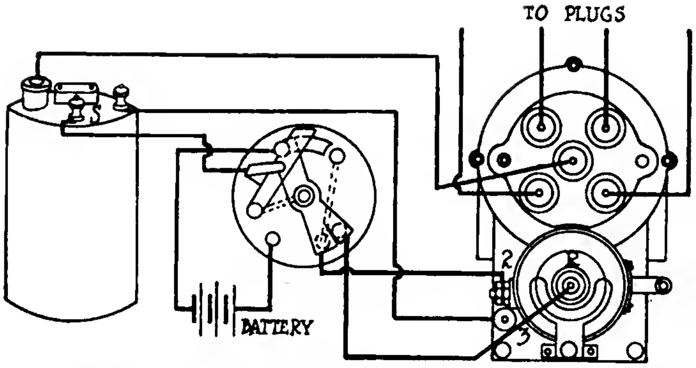


Fig. 1—Wiring diagram of the Splitdorf ignition system used on the 1910 model Cadillac, showing the various connections from magneto to coil and switch and also battery connections

clearly by giving an explanation of the work done by brakes. Where W is equal to the total energy absorbed in accelerating the mass M from zero to V ft. per sec; w = energy per second absorbed under the above conditions $= \frac{W}{f}$ where f = time required for acceleration in seconds. θ = tangent of the grade angle, or the per cent of grade; F = accelerative force applied by the propelling system; g = gravity = 32.2. Also

$$W = MV\begin{pmatrix} Q & V \\ F & 2 \end{pmatrix}$$

where $\theta = o$ and

$$f = \frac{MV}{F}$$

Energy required to be absorbed by the brakes when stopping a motor vehicle, on the level, from full speed is equal to

$$E = \frac{MV^2 + Mg\theta fV}{2}$$

$$f = \frac{MV}{F - Mg\theta}$$

using the same symbols as for the clutch formula but applied to retardation instead of acceleration.

The brake size and pressure is figured out in this way mathematically for the size and weight of car and then a reasonable factor of safety is allowed.

Regulating the Timing on a Magneto

Editor THE AUTOMOBILE:—In regulating the timing of a magneto on what point past dead center on the power stroke of the piston should the explosion take place when the magneto is fully retarded. In other words, when the magneto is retarded should the explosion take place before piston reaches dead center or passes on the power stroke, and if so, what distance before or after dead center?

Newark, N. J. C. N.

—In regulating the timing of a magneto the spark should occur on upper dead center in the full retard position.

Gear Ratios of Several Cars

Editor THE AUTOMOBILE:—What is the gear ratio of the 1916 Oakland six, 1916 Saxon six and 1916 Hudson 40?

Kellogg, Minn. J. D. C.

—The gear ratio of the 1916 Oakland six is 4.25 to 1. Of the 1916 Saxon six it is 4.75 to 1 and on the Hudson the gear ratio is optional although there is a standard which is generally furnished of 4.45 to 1.

Plug Points Too Far Apart

Editor THE AUTOMOBILE:—Please tell me the cause of an Eisemann dual magneto spark jumping across the safety gap when idling. The wiring is in good condition and it does not cause the motor to miss.

2—Please publish wiring diagram of a Splitdorf ignition system such as used on 1910 Cadillac.

Wilmington, Ill. M. L.

—The cause of an Eisemann dual magneto spark jumping across the safety gap when idling is that the spark plug points are too far apart. For general guidance we suggest that the gap be made 1/64 to 1/32 in., but never more for a high-tension magneto. Then the cable connections from the distributer plate to the spark plugs may be burned at either end or somewhere along their length, which would inhibit the spark from jumping in the spark plugs and it would be referred back to the safety gap. Then too, unless the carbon brushes in the distributer arm should make good contact either the spark may jump at the brush or be referred back to the safety gap depending upon where the greatest resistance is. Likewise the mixture, its consistency or density at times plays a part in causing the spark to jump the gap.

2—Wiring diagram of Splitdorf ignition system used on 1910 Cadillac is shown in Fig. 1.

To Prevent Overcharging Battery

Editor THE AUTOMOBILE:—How can a switch be put on different makes of starting and lighting systems to keep from charging the battery when fully charged, or is it only necessary to place a switch so as to open one side of your generator line? Does it harm the generator?

2—I would like to know how to tell platinum points from tungsten points and what difference it makes with the running of the car when you use tungsten magneto points or genuine platinum points.

3—Is there a good substitute for platinum?

4—What amount of voltage does a Ford magneto have when engine is speeded up? In using two 9-volt bulbs in series it must produce 18 volts to light them brightly.

Parker's Prairie, Minn. H. S.

—With the majority of equipment a switch put on the open side of the generator line is all that is necessary. It cannot harm the generator in any way.

2—The only way to make certain of a composition of sparking points is chemical analysis. Tungsten magneto points are claimed to give at least as good service as platinum points.

3—There are many substitutes for platinum, but absolute proof regarding their quality is at present lacking.

4—Approximately 21 volts.

Wiring Diagram of Deaco System

Editor THE AUTOMOBILE:—Kindly publish wiring diagram of Deaco lighting and starting system on a 1914 Maxwell special Model A-35.

Scranton, Pa. L. J. S.

—Diagram of Deaco lighting and starting system on 1914 Maxwell model A-35 is shown in Fig. 2.

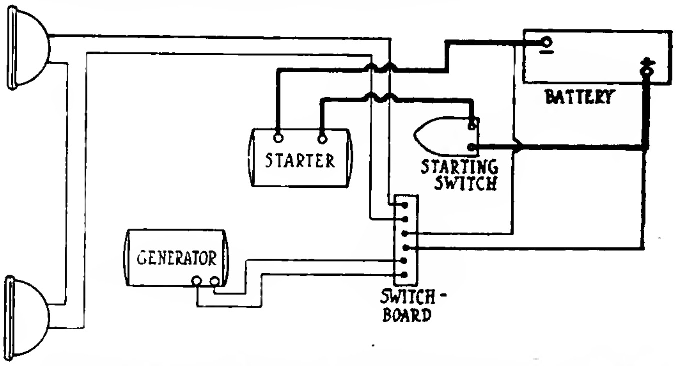


Fig. 2—Diagram of the wiring of the Deaco starting and lighting system used on the 1914 Maxwell model A-35, including connections to generator, starting motor, battery and switches

ACCESSORIES

G-P Muffler Cut-Out

THE quiet running which characterizes modern automobile engines and especially those of the multi-cylinder type renders a muffler cut-out particularly useful in detecting missing cylinders or other irregularities in operation. The G-P muffler cut-out, illustrated herewith, has been brought out to meet the requirements for such work as well as for use where it is desired to relieve the engine from any back pressure which the muffler might cause. The construction of the valve tongue and its seat is such that when the cut-out is opened the line to the muffler is completely shut off and a correct angle is obtained to deflect the exhaust gases freely without back pressure. The cut-out is made in two parts, allowing ready access to its interior. When it is closed the pressure of the exhaust gases cannot open it and the course the escaped gases must take tends to prevent carbon accumulation on the valve or its seat. The area of any section of the cut-out is at least 25 per cent greater than that of any section of a corresponding size exhaust pipe. The cut-out is not attached by means of flanges, the ends being bored to the exact size of the exhaust pipe with shoulders at each end while set screws, as illustrated, prevent shifting and insure rigidity.

A table of exhaust pipe sizes of various makes and models of cars has been compiled and embodied in a convenient wall hanger which can be had for the asking.—Cut-out is manufactured by the G. Piel Co., Long Island City, N. Y. Cut-out and hanger are distributed by the Edward A. Cassidy Co., 30 East Forty-second Street, New York City.

G. P. muffler cut-out in section

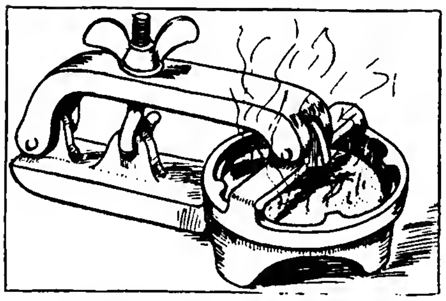
Brugan Economy Valve

Auxiliary air is automatically supplied to the manifold by this valve. The valve casing is screwed into the intake pipe and houses a valve which is closed by a spring. At low speeds, the valve remains closed, but as suction increases the valve opens and air enters through the small ports in the end of the valve housing. Price $4.—Brugan Co., Bangor, Me.

Left — Brugan economy valve. It gives additional air Below — Red-I-Cut body for Fords. Car weighs 1150 lb.

Marvel, Jr., Vulcanizer

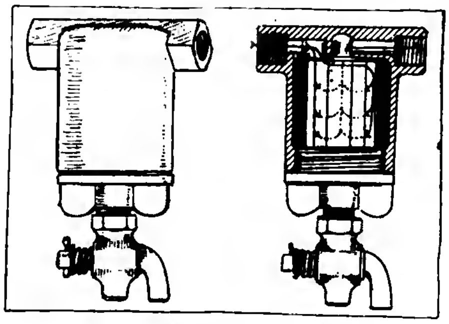
Simplicity is a leading feature of this little vulcanizer. It consists of a pair of arms terminating in a stationary disk and a swiveled disk with a cupped upper surface; the cupped piece is on the upper arm and the two disks are pressed together with the tube to be repaired between them by means of a thumb-nut. The heating medium is a disk of prepared fuel which is placed in the cup of the upper disk and ignited with a match. It burns, or rather glows, without flame and produces exactly the heat required. Patches are applied without cement. The process is to clean the tube, apply the patch, clamp it in the vulcanizer, light the disk and let it stand for eight minutes after lighting. A patch so vulcanized cannot be removed without tearing up the tube. Fuel disks and patches are supplied with the vulcanizer. Price, $1.50.—Marvel Accessories Mfg. Co., Cleveland, Ohio.



Marvel, Jr., solid fuel vulcanizer

10 in 1 Gasoline Strainer

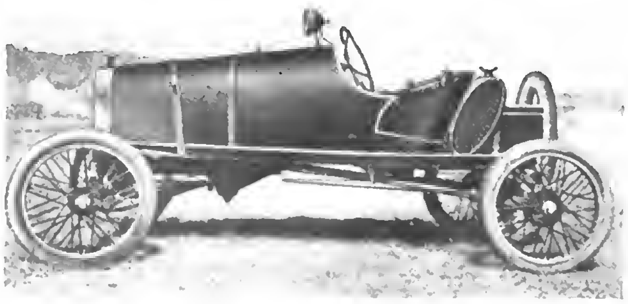
In this device a series of cylinders of straining gauze offers such a large surface that clogging is practically eliminated. The cylinders are set up on the sediment cup, which screws out for cleaning. A drain cock at the bottom is provided for draining off water or getting gasoline. An arrow on the pipe connection shows which way the device should be attached. The strainer sells for $2.—10 in 1 Strainer Co., Inc., Brooklyn, N. Y.



10 in 1 gasoline line strainer

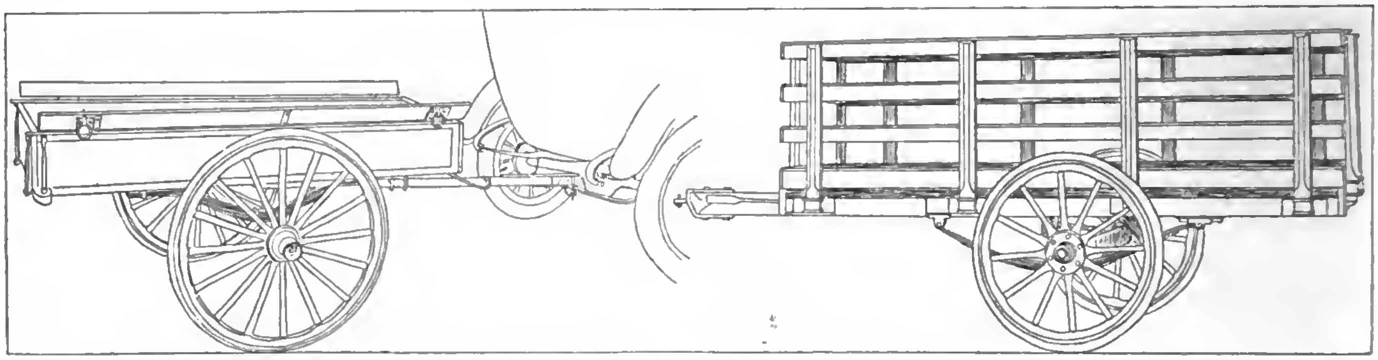
Red-I-Kut Ford Body

Complete directions and drawings are furnished for equipping a Ford with a racing body, all the material required may be obtained at any hardware store and no tools are required other than a hammer, saw, tinner's shears and ordinary wrenches. The weight is 300 lb., bringing the total weight of the car to 1150 lb. Improved appearance, increased speed and hill climbing ability are the particular features claimed for this body construction. Speedster body patterns for all makes of cars together with complete instructions are furnished for $10. Price of patterns, $5; complete body, price on application.—Kuempel Co., Dubuque, Ia.



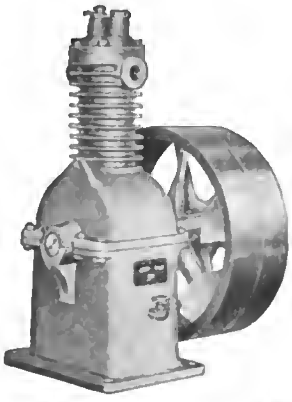
Stinson Tire

The product of 10 years' work, study and experiment, the Stinson tire has been developed and tested under all sorts of road and season conditions. It consists of a broad, flat outer rim and a narrower flat inner rim connected by coil springs under slight tension, the springs being set in sufficiently from the edges of the outer rim so that, while they are



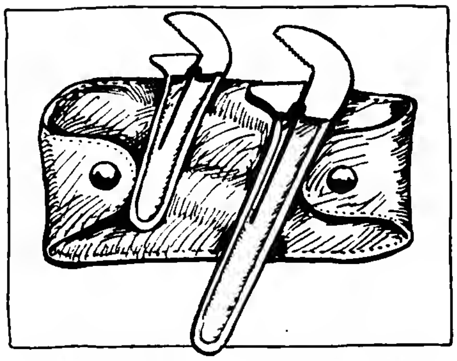
Bettendorf trailer which is made in 800 and 1200-lb. capacities, method of attachment being shown at the left

easily accessible for replacement, no amount of lateral displacement of the outer rim will expose them to thrusts from the road. The springs are set sufficiently close together to form circumferential screens at each side of the tire to exclude the larger pebbles. To prevent over-stretching the springs, a continuous rail or buffer is fastened to the inner periphery of the outer rim and extends toward the inner rim, restricting the motion of the wheel toward the outer rim to ⅛ in. As this tire is a suspension type and all values are figured from the top instead of from the bottom, this limited motion does not destroy its resiliency. In striking an obstruction the tire does not take a thrust direct to the spokes but a torsional movement is set up between the inner and outer rim, this torsional resiliency being of great value in starting and braking. The driving power is transmitted to the top of the tire, the weight of the car tending to increase the tension at the top and to decrease it slightly at the bottom. The tire can be painted as easily as the car and is very durable.—Stinson Tire Associates, Gardner, Mass.



Curtis air compressor for garages

Stinson spring-cushion tire



Shaw wrenches and leather case

Curtis Air Compressor

This single-cylinder, air-cooled compressor is offered with a variety of mountings to suit various garage needs. The intake valve is a poppet and the exhaust a cone valve, spring-seated. Lubrication is by splash, and is so controlled that no oil will be carried out through the air-discharge valve. One pint of oil is ample for 100 hr. There is a high and low level gage, the flywheel has fan blades to assist in cooling, and the head is removable without breaking pipe connection or bending any pipes. There is only one gasket. The crankshaft is drop-forged and the bearings are die-cast. A hand unloader permits starting against pressure. The pump is made in five sizes, from 1⅝ by 2 to 4½ in. square, corresponding capacities being 1.2, 1.8, 2.99, 4.32 and 10.4 cu. ft. per min. Prices, less 10 per cent, are respectively $19, $21, $26.50 and $60, with tight pulley only. The style W comprises a compressor driven by belt by an electric motor, the whole being mounted on a cast-iron base. The price, complete, varies from $72 to $253, depending on the size of the unit and whether A.C. or D.C. current is required.—Curtis Pneumatic Machinery Co., St. Louis.

Bettendorf Trailer

Bettendorf trailers are two-wheelers, with wood wheels and solid rubber tires. The specifications of the smaller model, which has a capacity of 800 lb., are as follows: Body, solid panel, 72 by 51 in., 10 in. high with 6-in. flareboard; springs, semi-elliptic, underslung; axle, ¼-in. square; bearings, ball; wheels, hickory with 30 by 1¾ solid clincher tires; painting body red and wheels yellow with black striping; weight crated, 375 lb. The 1200-lb. model specifications: Stake body 8 by 4 ft.; side and end gates 18 in. high, all removable; springs semi-elliptic, underslung; axle truck type, I-beam section, 2 by 1½ in.; bearings, Bower or Timken roller; wheels hickory with 32 by 2 solid clincher tires; painting black; weight crated, 445 lb. Automatic couplers are fitted, and these can be attached and detached in a few seconds. The 800-lb. trailer sells for $75 and the 1200-lb. for $100.—Bettendorf Trailer Co., Bettendorf, Iowa.

Shaw Automatic Wrench

This wrench has a V jaw with one part toothed and the other flat. The two jaw members are split so that when a pull is applied to the handle the jaws take firm hold of the work, whether it is square, round or hexagonal. It is thin, enabling it to go into tight places, requires no adjusting, is in one piece, lets go instantly, light and strong. The 4 and 6-in. wrenches are supplied in an imitation seal case at $1, and $1.25 in pigskin and morocco. These sets are especially for the use of motorists. Price, 4-in., 35 cents; 6-in., 60 cents; 8-in., 75 cents; 10-in., $1; 15-in., $1.25.—Shaw Propeller Co., Boston, Mass.

Zit Dry Wash

Zit is a body polish which is designed to take off the dust and restore the original luster. The body is sprayed with the liquid and then polished with cheesecloth. The sprayer is also furnished.—Westfield Chemical Co., Westfield, Mass.

The Automobile

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More Discussion

BRILLIANTLY successful as the recent convention of the Society of Automobile Engineers was, there are always some thoughts of constructive criticism which arise after a meeting of this kind. This time the thought which stands out above all others is that there should be longer and better discussions on the papers that are presented.

It would be hard to improve on either the program or the papers that were given at this last session of the society. It would be a mistake to curtail the number of the papers and it would also be wrong to shorten the papers themselves, yet the discussions, in order to bring out the full value of the session, must be longer.

With the general public and the industry at large, the question which naturally springs to the mind is, "What is the use of having all these engineers together in convention unless they comment freely on the subjects under consideration?" and truly, this thought is but natural and right, for if the discussions are not full and thorough, the great potential value of a gathering of this kind is lost and the natural tendency is toward a drop from the level of an engineering session to a non-commentative lecture audience.

It may seem that the remedy would be difficult if the program were not to be curtailed and the time of the convention lengthened, but this is not necessarily so. The activities of the S. A. E. can be readily classified into different fields and there would be no difficulty, even on a vessel such as the *Noronic*, to have two sessions under way at once. Perhaps while tractors are being discussed on the upper deck, aeroplanes may be under consideration in the hold, and men who were roaming the deck because the particular paper under consideration did not interest them, would be in active attendance and, perhaps, stirred by the impulse of animated discussion to shed illumination on a topic that would otherwise remain obscure because of the lack of opportunity or time to properly warm up the arguments.

Mobilization

DEVELOPMENTS in the controversy with the de facto government of Mexico will be watched very closely by the automobile and motor truck industry which would be one of those most affected if actual hostilities should begin. Already the United States Government has placed several orders for motor vehicle equipment which is needed on the border for the use of the troops already there and if the militia forces now mobilizing all over the country are sent to these points further orders will doubtless be placed.

Aside from the necessity of co-operating with the Government authorities in making quick delivery on orders received, which the factories have already demonstrated their ability to do, the automobile and motor truck industry can be of assistance in many other ways in the present crisis. Some of these are: Co-operating with the industrial preparedness committee of the naval consulting board; facilitating mobilization by protecting employees on military duty from financial worries; supplying trained men and comprehensive information for transport work of all kinds; preparing for future requirements of the government, etc.

S. A. E. Expansion

THE proposal to widen the scope of the S. A9. E. and to make it include all sorts of automotive activity comes as a natural step in the progress of internal combustion engineering as applied to motive power. Gradually the aeronautical, marine and tractor fields have acquired the same tendency toward standardization and economic production that has made the automobile what it is to-day.

With this state of affairs existing it would be uneconomical and against that very spirit of standardization which is so desirable in these arts, to have more than one parent organization which fosters the development of design and manufacture. There are certain basic principles in all these kindred industries which are so closely alike that it would be wrong to set up a different set of standards for each when it is so readily possible to unify these departments of the same development and to allow them to march side by side down the same avenue of progress.

Civilian Trucks for U. S. Army

Truck Club Has Plan of Pledging Vehicles for Purchase by Gov't.

NEW YORK CITY, June 21—*Special to* THE AUTOMOBILE—A plan for obtaining civilian motor trucks for the United States army along the Mexican border, should war eventually result from the present strained relations between the two countries, will be discussed at the meeting of the Motor Truck Club of America to be held in this city to-night. The calling out of the militia of all States is expected to result in an additional need for several thousand trucks and the plan of the Motor Truck Club seeks to enroll civilian machines for this work, should the American commercial vehicle manufacturers be unable to supply the demand within the required length of time.

If the procedure followed by the foreign governments of commandeering all civilian vehicles at the outbreak of war is adhered to in this country, it will cause great hardship to the owners of the vehicles and perhaps failure, due to the fact that the motor trucks now in use in this country are now carrying on a large percentage of the nation's transportation. The plan to be discussed by the club would seek to eliminate any such possibility by having a large number of owners pledge a certain proportion of their trucks to the government in case of war. The plan at present outlined contemplates the placing of a certain price on each vehicle by its owner, this price to be the original cost of the vehicle, its body and equipment less a certain sum due to depreciation of the vehicle over the number of years it has been in use. After this has been done and the vehicle pledged to the government in case of war by means of a special form filled out by the truck owner and a representative of the club these forms will be grouped according to the make of vehicle and sent to Washington to the Secretary of War. If after this has been done, war should be declared and it is found impossible to obtain the requisite number of trucks, the War Department will then take over the trucks, issuing bills of purchase.

Another Gasoline Hearing

WASHINGTON, D. C., June 17—A special hearing has been set by the Federal Trade Commission for next Wednesday to enable the Standard Oil Co. of Ohio to explain why it is able to charge several cents more a gallon for gasoline than is charged by its competitors.

At a hearing a week ago the commission reached the conclusion that the failure of the Standard Oil Co. of Indiana to compete in the Ohio territory permitted the higher prices there, and was one of the underlying causes of the demoralization of the oil industry.

Investigations have shown that there is a decrease in the production and an increased demand that justifies part of the increase in price, but the commission is convinced that there is no economic justification for the enormous raises that have been put into effect.

Chrysler Buick General Mgr.

DETROIT, MICH., June 21—Walter P. Chrysler is not to leave the General Motors organization. He has been advanced from the position of factory manager of the Buick Motor Co. to general manager, filling the vacancy occasioned by the resignation of President C. W. Nash of the General Motors Co., who was also president and general manager of Buick. Mr. Chrysler has been prominent in Buick affairs for several years, and to him must be given a great deal of the credit for the wonderful growth of the Buick organization.

Macauley Packard President—Joy Heads Board of Directors

DETROIT, MICH., June 16—At to-day's meeting of the board of directors of the Packard Motor Car Co., H. B. Joy was elected chairman of the board and Alvan Macauley was formally elected president. The 50-per cent. stock dividend on the common stock was ratified. In an interview following the board meeting, Mr. Macauley denied current rumors to the effect that the Packard company had entered, or was about to enter, any of the prevalent combinations or consolidations.

Cole Earnings for 1916 Estimated at $360,000

INDIANAPOLIS, IND., June 20—Earnings of the Cole Motor Car Co., this city, for the fiscal year ending June 30, 1917, are estimated at $360,000, or 36 per cent on the stock, which would allow a dividend of 12 per cent per annum, and leave a surplus of $40,000.

This company is offering an issue of common stock at 120 and announces that there are no bonds and no preferred stock. The capital is $1,000,000. Earnings in April were $52,243.13.

Emerson-Brantingham to Build Bodies

ROCKFORD, ILL., June 17—The Emerson-Brantingham Co., this city, for 62 years manufacturers of farm implements and who are the builders of the Big Four and Emerson farm tractors, plan to install, about Aug. 1, a department for the manufacture of automobile bodies and fenders.

Auto Body Capital $1,000,000

Increased from $500,000—209 Per Cent Stock Dividend Declared

LANSING, MICH., June 13—The Auto Body Co. will increase its capitalization from $500,000 to $1,000,000, the increase having been authorized at a meeting of stockholders Monday afternoon. A 209 per cent stock dividend was authorized for distribution among stockholders of record July 1, with a cash dividend of 5 per cent June 30.

Increase in business for 1916 has necessitated another addition, now in process of building, which will double the shop capacity, and add several hundred men to the present force.

Canadian Corporation to Use Greenstreet Gasoline Process

PORT HOPE, ONT., June 18—The Canadian Gasoline Corp., with a capital of $3,000,000, has acquired the Canadian patents for the Greenstreet process of gasoline manufacture. The company will be opened as a subsidiary of the Gasoline Corp. of the United States, according to the present plans. The syndicate financing the proposition is headed by H. T. Bush, president of the Standard Ideal Co., this city. Sir Donald Mann and Nathaniel Curry, president of the Canadian Car & Foundry Co., are represented in the syndicate.

Changes Name to Bound Brook Oil-less Bearing Co.

BOUND BROOK, N. J., June 19—The Graphite Lubricating Co. has altered its title to Bound Brook Oil-less Bearing Co., the better to indicate the nature of its business. Some confusion had resulted from the old title, which gave the impression that graphite greases, lubricants, etc., were produced, whereas the company produces only graphite and bronze oil-less bearings and nigrum treated wood oil-less bearings.

Fenders on Chicago Trucks

CHICAGO, ILL., June 20—For the second time in the last 2 years, the Chicago city council passed an ordinance requiring fenders on motor trucks. The new ordinance becomes effective Jan. 1, 1917, unless it is again repealed before that time. The first law was held illegal.

Dealers' organizations and heavy users of motor trucks in this city who were first influential in proving the original ordinance unconstitutional are as thoroughly convinced of the unfairness of the new law and will probably strongly contest its adoption.

Body Features 1917 Dorris Six

Lubrication Is by Force Feed —Few Mechanical Changes —Price Unchanged

ST. LOUIS, MO., June 19—The Dorris IB-Six for 1917 is an entirely new car in appearance, having a body of better lines and a radiator which is a distinct departure from the former type. The mechanical changes are few; in fact no radical alterations have been made except in the oiling system, which is now of the force-feed type. The price of $2,475 remains unchanged.

The fundamental construction of the car has not been changed in 11 years. The motor is 4 by 5 in., in unit with the clutch and gearbox. The valves are in the head and the wheelbase is 128 in. and tires 36 by 4½ in.

The gear train drive of starter has been discontinued and the Bendix system is used in its place. The two-unit Westinghouse starting and lighting system and Bosch magneto ignition are continued without material change except in the starter drive as mentioned above, and the routing of wires from the new aluminum dash.

No Summer Changes by King

DETROIT, MICH., June 19—Artemas Ward, Jr., president of the King Motor Car Co., has issued a statement to King dealers that, following the policy of the King Motor Car Co. in preceding years, this company will make no mid-year announcement of new models or prices.

Walsh Joins Chalmers

LOS ANGELES, CAL., June 16—Christy Walsh, for more than 2 years advertising manager with the Greer-Robbins Co., Southern California and Arizona distributors of the Chalmers and Hupmobile, has resigned to accept the appointment of Pacific Coast advertising manager for the Chalmers factory. Mr. Walsh was a newspaper cartoonist before his début into the automobile industry.

Lie Joins Maxwell

DETROIT, MICH., June 17—Christian Lie, with an extensive knowledge of automobile activities in foreign countries, has joined the Maxwell Motor Co. He will represent that company in Scandinavia.

K. P. Mfg. Co. Formed

NEW YORK CITY, June 19.—The K. P. Mfg. Co., this city, has been incorporated and takes over all of the interests, including the trade name, trade marks, patents, good will, etc., of the former copartnership known to the trade as the K. P. Foot Rest Heater Co.

This new company will continue to make the K. P. foot rest heater as well as the K. P. universal rim tool and other specialties soon to be announced. It is incorporated at $25,000, the capital being fully paid in.

It is the new company's intention to make the heater in three sizes and prices; the $25 model for high-priced cars, another model at $15 and another one for the smaller car trade. The rim tool will be continued at $2 for the present.

Smith Succeeds Stewart

CHICAGO, ILL., June 15—The directors of the Stewart-Warner Speedometer Corp. have elected C. B. Smith president to fill the vacancy caused by the death of J. K. Stewart. Mr. Smith was secretary and treasurer. Vice-President T. T. Sullivan has been chosen to assume additional duties of treasurer, and W. J. Zucker has been elected a vice-president and secretary. Mr. Zucker has been elected a director to fill the vacancy in the board resulting from Mr. Stewart's death. L. H. La Chance has been elected chairman of the board.

Burdicks Leave New Era to Build Car

JOLIET, ILL., June 16—Winthrop and W. J. Burdick have sold their interests in the New Era Engineering Co., this city, and, backed by large capital, will introduce a new car in the near future. Winthrop Burdick was treasurer and sales manager of the New Era company and W. J. was purchasing agent.

Pennsylvania S. A. E. Meets June 22

PHILADELPHIA, PA., June 16—There will be a meeting of the local section of the Society of Automobile Engineers on June 22 at 8:15 p. m., at the Engineers' Club, 1317 Spruce Street. R. R. Abbott, metallurgical engineer, will lecture on Commercial Heat Treatments of Automobile Steels.

Aprahamian Returns to U. S.

RACINE, WIS., June 16—A. Aprahamian, who has been establishing connections for the past year in Australia and New Zealand for the Mitchell-Lewis Motor Co., Racine, Wis., has returned to America. On his return trip he investigated conditions in South America. He will sail soon to do similar work in South Africa, India and the Far East. Mr. Aprahamian has been unusually successful in this missionary work.

Roadaplane Is New Apperson

1917 Model Uses Eight- and Six-Cylinder Engines at $2,000 and $1,750

KOKOMO, IND., June 20—The Apperson Brothers Automobile Co., this city, is the maker of the Roadaplane, its 1917 model, which has been advertised so extensively with much secrecy as to the name of its manufacturer.

The Roadaplane is made in six- and eight-cylinder models, seven-passenger touring and the four-cylinder chummy roadster body being mounted on both chassis. The eight model, either touring car or four-passenger roadster, is $2,000. The six model, either touring car or four-passenger roadster, is $1,750. All prices are f.o.b. Kokomo.

Friction Is Minimized

This car is so built that friction has been reduced to a minimum and light weight is a feature. The six has a 3½ by 5-in. L-head block motor developing 48 hp., and the eight is a 3⅛ by 5-in., V-type, L-head 58-hp. motor in blocks of four. The wheelbase in both is 128 in. A float feed, automatic type of carbureter, positive pressure feed lubrication, hollow crankshaft, vacuum gasoline feed, dual system ignition with distributer and storage battery, two-unit 6-volt starting and lighting system, disk clutch of the dry-plate type, selective sliding gear transmission with three speeds forward and reverse, and worm and gear type of steering gear, are a few of the features of construction on both of the new models.

Other features include: tubular propeller shaft with two universal joints; shaft-driven, demountable floating type of rear axle; I-beam, drop-forged front axle; semi-elliptic springs on front and three-quarter elliptic on rear; service brakes, external contracting, and emergency, internal expanding; and left drive with levers in center.

Novel Top Arrangement

The colors for 1917 are mouse gray, Apperson special green or blue, coach finished with the metal parts in black or nickel. The equipment is complete including mechanical tire pump. The wheels are demountable and 34 by 4-in. non-skid tires are used on the rear. Upholstery is of genuine Turkish-type leather, the backs being made from a single hide.

If the roadster's rear seats are not used the top may be extended as a deck over them, affording protection from dust and rain. In this position it has the appearance of a two-passenger car.

Franklin Addition Under Way

Ground Broken for Extension of Plant Which Will Add 143,000 Sq. Ft.

SYRACUSE, N. Y., June 15—Ground has been broken for an extension of the plant of the H. H. Franklin Mfg. Co., this city, which will provide 143,000 additional sq. ft. of floor space. This is the fourth addition started by the company within 12 months. Upon completion of the building the plant will have facilities for the production of fifty Franklin cars a day. The structure, to be devoted to general manufacturing operations and the shipping department, will represent an investment of $500,000, including machinery. It will be three stories high and constructed of reinforced concrete. Provision is to be made for adding three more floors as requirements demand. The latest Franklin building will span four railroad tracks, permitting all loading under cover.

Perlman Building in Jackson

JACKSON, MICH., June 14—The Perlman Rim Corp. is completing a plant in this city. The new building is 360 ft. long and 100 ft. wide. A single line of columns down the center carries 50-ft. trusses and the roof trusses.

Schoeneck Plant for Tri-City?

ROCK ISLAND, ILL., June 17—The Owen-Schoeneck Automobile Co. of Chicago is planning to open a factory in one of the Tri-Cities and will select the one making the best site offer and which offers the best shipping facilities. The company has been manufacturing automobiles for 2 years, selling direct to the consumer and avoiding the wholesaler. The Schoeneck six was designed and constructed under the supervision of George Schoeneck. He has also designed a combination truck and tractor which has many novel features and which is designed to sell for $1,000. The Chicago factory has limited capacity, and it is desired to remove to an outside point where overhead expense can be kept to the minimum.

Studebaker Trust Formed

SOUTH BEND, IND., June 16—The Studebaker family composed of Clement, G. M., G. M., Jr., and Clement, Jr., have formed the Studebaker Bros. Trust for investment purposes. The capital of the trust is not given out, but it is announced that it is furnished entirely by members of the Studebaker family of South Bend, and that its business will be to hold and deal in investment securities exclusively on its own account.

Following are the directors and officers of the trust: Clement Studebaker, Jr., president; G. M. Studebaker, vice-president and treasurer; G. M. Studebaker, Jr., and Clement Studebaker are also connected with the trust.

Scott Brown, who was formerly general counsel and secretary of the Studebaker Corp., will be a director of the trust and have charge of its offices.

Comet Automobile Co. Formed with $1,000,000 Capital

ROCKFORD, ILL., June 17—The Comet Automobile Co., this city, has been incorporated with a capital stock of $1,000,000. The company will manufacture automobiles and commercial trucks. The former will be known as the Comet and will have six cylinders and a wheelbase of 112 in. The price will be about $800. The trucks will sell at about $1,000. The company has rented offices in the Rockford Trust Building. Several floors of this structure will be utilized for workout and testing purposes. Later, factory space will be secured with 50,000 sq. ft. of floor space. It is planned to put 100 men at work, increasing this number as business warrants. Following the acquirement of a temporary location, the company will construct a building with at least 300,000 sq. ft. of floor space. The officers of the new company are the following: President, Harry R. Sackett, Chicago; vice-president, Joseph Callahan, Chicago; treasurer and general manager, George W. Jagers. The secretary will be named later. He is at present engaged with another firm, but will shortly resign to join the Comet company. It is planned to place the first car upon the market Sept. 1. Mr. Jagers will be in active charge of construction. He is a practical engine man, also a body builder and will eventually build the bodies and motors in the Comet factory. The company has not asked Rockford for a bonus. The capital is being acquired from the sale of stock.

Bans Gasoline in Tank Cars

BOSTON, MASS., June 17—Fire Prevention Commissioner John A. O'Keefe, whose authority to regulate the storage and handling of gasoline in the Metropolitan district of Boston is supreme, has placed a ban on the hauling of the fluid through the streets in the big tank cars of the railroads. The commissioner made a very thorough study of the explosion that caused such tremendous damage at Detroit when some miles of streets were blown up, and then he began to look for possibilities of a like nature in Boston.

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The complete official roster of the Bour-Davis company is: President, Chas. J. Bour, president of the National Railways Advertising Co., vice-president of the Chicago, Duluth & Georgian Bay Transit Co., and a director in several other large corporations; vice-president and operating director, R. C. Davis, head of the Chicago, Duluth & Georgian Bay Transit Co.; vice-president and sales manager, C. F. Stewart, who has long been connected with the sale of motor vehicles, principally as distributor for well-known makes in the Pittsburgh field; chief engineer and production manager, A. A. Gloetzner, well known in the trade through his engineering connections with several prominent companies, and lately assistant engineer of the Chalmers Motor Co. The directors are Bour, Davis, Stewart and W. J. Harahan, who is president of the Seaboard Air Line Railway and a director in other enterprises.

R. & R. Absorber Increases Output

ELGIN, ILL., June 17—D. A. Russell, president of the R. & R. Shock Absorber Co., Elgin, states that this firm will make 100,000 sets of absorbers this year. The plant has been enlarged until its present capacity is 500 sets per day. Due to a scarcity of raw material it has been impossible to keep pace with the orders.

Oakland Branch Managers Meet

PONTIAC, MICH., June 17—The managers of the six branches of the Oakland Motor Car Co. were in session at the factory Thursday, Friday and Saturday of last week. This was the annual "get-together" of the managers, to talk over past and future business conditions. While in Pontiac they were the guests of the Oakland officials. Those present at the gathering were: E. J. Kilborn, Chicago; A. B. Tenbrook, Kansas City; R. S. Shoup, Indianapolis; R. L. Losey, Minneapolis; Z. S. Vertner, Philadelphia, and W. R. Tracy, manager of the Michigan branch at Pontiac.

600,000 Chevrolet Bodies

St. Louis Plant Gets Order for 200,000 a Year for 3 Years

ST. LOUIS, MO., June 17.—The revival of river traffic, which recently has begun to loom large to automobile dealers and manufacturers here, received a decided impetus this week through an announcement of Russell E. Gardner, president of the St. Louis Chevrolet company, that he obtained the contract for 600,000 Chevrolet bodies because he was favored with barge freight rates on 100,000,000 ft. of lumber that will be used in their construction. Also that river barge freight rates figure largely in the distribution of these bodies to assembly plants.

The hardwood will be brought from southern points on river barges which average between 750,000 and 1,000,000 ft. load. The factories to receive bodies from the St. Louis plant are located at Minneapolis, Kansas City, Atlanta and Oakland, Cal. The Kansas City plant is reached by Missouri river barges, which are in regular operation and the Minneapolis plant by the Upper Mississippi barges. The Atlanta and Oakland bodies can be shipped by river to New Orleans and then transhipped by Gulf steamers and through the Panama Canal. The 600,000 bodies are to be delivered at the rate of 200,000 a year.

The St. Louis Chevrolet company is now completing additions to each of its two plants, at Broadway and Bulwer and Second and Rutger Streets, at a cost of $50,000 each.

Chevrolet Builds in Bay City

BAY CITY, MICH., June 14—The general contract for the erection of a new building for the Chevrolet Motor Co. in this city, has been awarded. The structure will be 50 by 122 ft. and when completed will be used for storage and shipping purposes. A one-story garage, 26 by 83 ft., is included in the contract, besides a shipping platform 18½ ft. wide by 183 ft. in length.

Willet Takes Over Rub-On Products

BUFFALO, N. Y., June 19—W. Willet, who originated the Rub-On Mfg. Co. of this city, has taken over the company's line of dressings and finish materials and is now manufacturing under the name of Auto Products Mfg. Co. at 40 Allen Street.

Du Pont Buys Fairfield Rubber

WILMINGTON, DEL., June 17—The Du Pont Fabrikoid Co. has purchased the Fairfield Rubber Co. with plants at Fairfield, Conn. The Fairfield company manufactures a coated textile similar to Fabrikoid, and which is used extensively by automobile and carriage manufacturers.

All the present employees will be retained, the change affecting only the owners. The company will not consolidate with the purchasers, but will continue as the Fairfield Rubber Co., endeavoring to uphold, if not better the present standard of its product.

J. K. Rodgers, sales manager of the Du Pont Fabrikoid Co., will act in the same capacity for the Fairfield company.

Bates Is King Commercial Manager

DETROIT, MICH., June 21—G. J. Bates, for the past 10 years prominently identified with the tire business, has resigned from the Firestone Tire & Rubber Co. to become commercial manager for the King Motor Car Co., this city. Mr. Bates for the past 3 years has handled the manufacturers accounts in Michigan for the Firestone company and for 7 years previous to this he was a department manager for the Diamond tire company.

Corliss Truck Enters Field

MILWAUKEE, WIS., June 17—The incorporation of the Corliss Motor Truck Co., Corliss, Wis., presages the establishment of a large commercial car factory at Corliss in the plant formerly occupied by the defunct Wisconsin Engine Co. The corporate articles are signed by members of a law firm of Milwaukee.

Albion Bolt Co. Formed

GRAND RAPIDS, MICH., June 13—The Albion Bolt Co., incorporated for $10,000, is to engage in the manufacture of bolts and nuts for automobiles, with the making of other car parts as a side line. The officers and organizers of the company are Mark Merriman, president; C. B. Hayes, vice-president; Otto Schwacha, secretary, and W. C. Morrey, treasurer.

Thermoid Coupling on Velie and Reo

NEW YORK CITY, June 16—The Thermoid Rubber Co., Trenton, N. J., announces that the Velie Motor Vehicle Co. and the Reo Motor Car Co., Lansing, Mich., have adopted for standard equipment the Thermoid hard fabric flexible coupling.

R. C. Durant Goes to Oakland, Cal.

LOS ANGELES, CAL., June 17—R. C. Durant, Los Angeles, Cal., son of W. C. Durant, has left Los Angeles and will make his headquarters at Oakland, Cal., where he will have charge of the Chevrolet assembling plant with Norman De Vaux. Messrs. De Vaux and Durant have the Chevrolet distribution throughout California, Oregon, Washington, Idaho, Arizona and Nevada.

Texas Farms Bring Prosperity

Automobile Business Stimulated and Record Sales Are Predicted for 1916

DALLAS, TEX., June 16.—That conditions in Texas are better at this time than they have been since the establishment of the Federal Reserve Bank system is indicated by the June report of the system at Dallas. It is estimated that 40 per cent. of the $4,000,000 worth of paper on live stock, etc., is held by the Dallas bank as the result of the operations with the smaller banks.

This prosperity is throughout Texas and is caused by the prospects of the farm outputs for this year. North and Central Texas is in the midst of the harvesting season and indications point to a great harvest. Prospects are also good for a big corn and cotton crop.

These indications, automobile dealers declare, are stimulating the automobile business. Last year Texas did $25,000,000 worth of business in the Texas field and indications are that the business this year will be even greater. L. B. Alford, Texas manager at Dallas for the Studebaker Corp., has just returned from a trip through Southern and Central Texas. "Business compared with last year is much better," he said. "However the Southern part of the State is badly in need of rain. The drought is making business dull in that section of the State. In other parts, however, business is much better than at this time last year. For example, last year we did practically nothing in East Texas. This year we are doing a good business. In several parts of the State conditions are the same. Of course we can't tell what may happen. People throughout Texas, with the possible exception of the Southern part of the State, seem to be in a more prosperous condition than last year. This is proved by increased business in the automobile field."

D. F. Anderson, assistant manager for the Buick Automobile Co. at Dallas, declared conditions are so much better than in 1915 that there is no comparison.

New Law in Porto Rico — Car-Operating Costs High

SAN JUAN, PORTO RICO, June 15.—Beginning July 1 Porto Rico will have a new automobile law which will affect the 2500 cars of all kinds now here. Heretofore each car has paid into the Insular Treasury $5 a year and a special internal revenue tax against the declared value of the car. Now, however, the legislative bodies have decided to increase the Insular tax to 50 cents a horsepower for each car below 40 hp., and $1 a horsepower above that rating, the horsepower to be ascertained in every case by squaring the diameter of one cylinder, multiplying the result by the number of cylinders and then multiplying that result by 0.4. This will give the official horsepower, according to the local laws and will take precedence over the manufacturers' rating.

In addition to the foregoing, every prospective chauffeur will have to pay into the public coffers $5 to secure his papers to drive a car, and in addition to this will have to give unequivocal reference as to his ability and personal respectability and responsibility.

Jitneys, of which there are about 100 in San Juan and suburbs, will pay a license of $25 per year over and above the aforementioned taxes and will be held responsible for accidents occurring in their vehicles.

Automobile tourists from abroad will pay a tax of $1 per month on each car during their stay on the island.

As gasoline here now costs 36 cents a gallon and is still going up, with no prospect of relief from the two only companies here, many people of moderate means are selling their cars.

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Wolverine Capital Is $200,000

TOLEDO, OHIO, June 20—The Wolverine Automobile Co., capitalized at $200,000, will establish an automobile plant in this city, where it will manufacture a four-cylinder car. Manufacturing will be started about July 1.

The officers are: President and general manager, A. H. Collins of Detroit; secretary, E. W. Burg, Toledo; and treasurer, H. E. King, Toledo.

The Old Com-pakt furniture building on Dorr Street, with 9 acres of ground, will be used for manufacturing. About 1000 cars will be made the first year, it is said.

The company will make cars ranging in price from $1,500 to $2,500 in two, three and four-passenger roadster models, a four-passenger touring model, four-passenger sedan and a two-passenger coupé.

Stutz M. C. Co. of America

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H. C. Stutz Retained as Pres.—75,000 Shares of No Par Value

NEW YORK CITY, June 21—The Stutz Motor Car Co. of America will take over the Stutz Motor Car Co., Indianapolis, as a result of a new plan of re-financing the permit of expansion. Allan A. Ryan & Co., this city, G. H. Saylor of the Chase National Bank, S. A. Fletcher of the Fletcher American National Bank of Indianapolis, H. C. Stutz, H. F. Campbell, and R. E. Maypole will serve on the board of directors. Mr. Stutz will remain as president, Ryan will be vice-president, Saylor secretary and treasurer and Campbell chairman of the board.

The capital will consist of 75,000 shares of no par value, of which amount 37,500 shares have been syndicated and sold to the public at $55.

The Stutz company has no preferred stock or bonded debt. Earnings for the current year are running between $600,000 and $800,000.

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Copper Down ½ Cent

NEW YORK CITY, June 20—Copper and open-hearth steel featured last week's market quotations with drops in prices. Copper declined ½ cent on Thursday to 27½ cents a pound, and open-hearth steel went down to $40 a ton, a drop of $2. Both up-river Para and Ceylon rubber declined, supplementing the recession of the previous week. Para closed yesterday at 63½ cents a pound, a loss of ½ cent, while Ceylon closed ½ cent lower at 62.

The automobile makers continue actively in the market for special kinds of steel and automobile parts. The demand for rivets and bolts from this industry is especially pressing. One prospective contract covers 22,000,000 bolts and 20,000,000 nuts for shipment over the next 4 months. The general demand for rivets and bolts, however, has been well satisfied and manufacturers, with capacity well sold, are refusing to quote on some of the automobile manufacturers' inquiries.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.60	.60	.60	.63	.63	.63	+ .03
Antimony, lb.	.21½	.20½	.20½	.20½	.20½	.20½	— .01
Beams and Channels, 100 lb.	2.67	2.77	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	45.00	45.00	45.00	45.00	45.00	45.00	...
Copper, Elec., lb.	.27½	.27½	.27½	.27½	.27½	.27½	...
Copper, Lake, lb.	.27½	.27½	.27½	.27½	.27½	.27½	...
Cottonseed Oil, bbl.	10.75	10.90	10.60	10.57	10.60	10.90	+ .15
Fish Oil, Menhaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lb.	6.80	6.88	6.88	6.80	6.80	6.75	— .05
Linseed Oil, gal.	.66	.66	.66	.66	.65	.65	— .01
Open-Hearth Steel, ton	42.00	42.00	40.00	40.00	40.00	40.00	—2.00
Petroleum, bbl., Kansas, crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pennsylvania, crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.92	.92	.92	.92	.92	.92	...
Rubber, Fine Up-River, Para, lb.	.64	.64	.64	.63½	.63½	.63½	— .00½
Rubber, Ceylon, First Latex, lb.	.64½	.63½	.63½	.61	.62	.62	— .02½
Sulphuric Acid, 60 Baume, 100 lb.	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	43.50	43.25	42.75	41.50	41.50	41.00	—2.50
Tire Scrap, lb.	.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	...

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Mosler Need Not Change Form or Size of ½-In. Superior

NEW YORK CITY, June 17—Under the decision of Judge Hand, announcement of which was made in THE AUTOMOBILE for May 25, A. R. Mosler & Co. may manufacture and sell the Mosler Superior half-inch type plug in the identical form and proportions which have always characterized it, the only requirement being that no plugs manufactured and sold by the Mosler company can have the black finish nor the brand printed in red. The case was that of the Champion Spark Plug Co. against A. R. Mosler & Co. in the U. S. district court for the southern district of New York.

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Halts U. S. L. Stock Sale

NEW YORK CITY, June 16—F. A. Bagg, a stockholder of the United States Light and Heat Corp., yesterday filed in the Supreme Court an action to restrain the directors from selling preferred stock at $4.50 a share and common stock at $2 a share. He obtained a temporary stay.

Bagg charges waste and misuse of the company's funds by the officers and majority directors of the corporation. The defendants include J. A. Smith, president; E. H. Gold, vice-president; C. L. Lane, secretary, and A. H. Ackerman, treasurer. It is alleged they are about to sell $290,000 of preferred and $250,000 common stock at the above prices, which prices are about $1 less than the market.

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Dividends Declared

Linde Air Products Co.; quarterly of 1½ per cent on preferred and 2 per cent on common. Preferred payable July 1 to stock of record June 20 and common payable June 30 to stock of record June 20.

Edmunds & Jones; initial dividend of $1 per share, payable July 1 to holders of record June 20.

Billings & Spencer; quarterly of 2 per cent and extra of 3 per cent.

J. I. Case Threshing Machine Co.; quarterly of 1¾ per cent on preferred, payable July 1 to holders of record June 12.

Packard Motor Car Co.: 50 per cent stock dividend on common, payable Aug. 1 to stock of record June 16. The amount of common now outstanding is $7,771,830.

Springfield Body Corp.: 3 per cent on preferred, payable July 1 to stock of record June 22. This dividend covers 1 per cent from period from Feb. 15 to April 1, and regular quarterly of 2 per cent for quarter ended June 30.

Hupp Motor Car Corp.: quarterly of 1¾ per cent on 7 per cent cumulative preferred, payable July 1 to stock of record June 20.

Motor Products Directors Announced

NEW YORK CITY, June 6—The board of directors of the Motor Products Corp. will be composed as follows: W. C. Rands, D. B. Lee, C. F. Jensen, all of Detroit; H. H. Seeley of Ann Arbor, and Sol Wexler of J. S. Bache & Co. W. C. Rands will be president.

The tangible assets of the corporation aggregate over $2,500,000, or equal to $35 per share of stock.

Chalmers Earns $300,000 per Month

DETROIT, MICH., June 15—The earnings of the Chalmers Motor Co., this city, it is stated, are running better than $300,000 per month. In 5 months the sales were more than twice the shipments of any one year's business. The sales department to date is several thousand orders ahead of the production.

Moon's May Business Doubled

ST. LOUIS, MO., June 14—The business of the Moon Motor Car Co., this city, for May was double that of May, 1915, in cars shipped and four times the same month last year in cars ordered. The additional output was handled with only an increase of 33 1/3 per cent in the factory employees. The company has been receiving materials in larger quantities so that it has been able to keep about a month ahead of the demand.

Security Prices Tumble

Possibility of War with Mexico Influences the Downward Movement of Stocks

NEW YORK CITY, June 20—A sudden drop in automobile security prices occurred yesterday on the Stock Exchange and Curb market. The whole list was influenced by the troublesome Mexican situation and some of the declines were violent. Chevrolet reflected the small demand for it by selling off 9 points yesterday and 38 points for the week. Willys-Overland broke 5 points; and General Motors 14 points.

During the middle of last week when announcement of the abandonment of the big merger was made, Willys-Overland dropped more than 25 points but recovered some of the loss later in the day. The fact that there was no wide open break in the motor shares showed an absence of alarm in speculative quarters at the news. Immediately after the announcement reports were current that bonuses in stock are to be given out by some of the leading concerns. The stocks at present are selling so high that ordinary traders will not touch them because of the wide fluctuations that naturally result.

By issuing new stock the market price could be brought down to a figure where brokers would encourage transactions.

The present high scale of prices brings to mind the great boom in automobile stocks on the Italian bourses in 1905 and 1906, when the shares of the Fiat company went from 25 lire par, to 2300 lire. Possibly to broaden the market, the par value was reduced to 10 lire, and sold in November, 1906, at 750. In May, 1908, they fetched 34 lire in the open market. The American panic of 1907, bringing a smaller demand for foreign automobiles, had much to do with the collapse of the Italian motor boom.

The scarcity of Firestone stock has brought it up to 880. Firestone lately has changed hands in small lots only; nothing is announced as to melon prospects.

Firestone's $3,000,000 common now has a theoretic market value as made by quotations of materially over $26,000,000. There is a $1,000,000 par preferred outstanding.

Goodyear stood well under fire this week and a small lot brought 233. The preferred interim certificates had fairly brisk trade at 106½.

Third Dividend for Milwaukee Motor Creditors

MILWAUKEE, WIS., June 17.—The creditors of the Milwaukee Motor Co., bankrupt, are about to receive checks for a third dividend of 20 per cent, amounting to $53,598.73, declared at a meeting on June 16. At the same time a 100 per cent dividend of $7,179.89 was declared on wage claims, and a 10 per cent dividend on unsecured claims, amounting to $2,068.40, making a total payment of $62,847.02. Final settlement of the bankruptcy is delayed pending the settlement of a claim of $13,062.35 made by A. J. Farmer, Detroit.

Pilliod Motor Petitioned

TOLEDO, OHIO, June 16—The Pilliod Motor Co., this city, has filed a bankruptcy petition in the U. S. court. The liabilities are $30,320.55 and the assets $9,559.92.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	66	68	—2
Chalmers Motor Co. com	92½	95†	160	185	—80
Chalmers Motor Co. pfd	95	98½	100	103	..
Chandler Motor Car Co	..	..	107¼	108¼	—9¼
Chevrolet Motor Co	..	..	222	225	—38
Electric Storage Battery Co	..	..	63½	64½	+1½
Firestone Tire & Rubber Co. com	490	495	880	..	+20
Firestone Tire & Rubber Co. pfd	110	..	112	114	—1
General Motors Co. com	151	153	476	541	+1
General Motors Co. pfd	101	102½	113½	114¼	+ ½
B. F. Goodrich Co. com	51	53	74⅛	75	—3⅞
B. F. Goodrich Co. pfd	100	103†	115⅛	116	— ⅛
Goodyear Tire & Rubber Co. com	263	268	233	236	+3
Goodyear Tire & Rubber Co. pfd	106	107½	106½	107¼	+1½
International Motor Co. com	13	15	10	14	..
International Motor Co. pfd	34	36	20	25	..
Kelly-Springfield Tire Co. com	158	162	72	73	—2½
Kelly-Springfield Tire Co. pfd	86	87	94½	98½	+1½
Maxwell Motor Co. com	43	44	82¼	83	—2¼
Maxwell Motor Co. 1st pfd	86	88	87⅜	88	— ⅞
Maxwell Motor Co. 2d pfd	37	38	57¼	57½	— ¼
Packard Motor Car Co. com	103½	..	..	250	..
Packard Motor Car Co. pfd	96½	99	100	105	—1
Paige-Detroit Motor Car Co. (new)	..	..	53	57	+3
Peerless Motor & Truck Corp	..	..	24½	25½	—2½
Perlman Rim Corp	..	..	..	..	..
*Reo Motor Truck Co	14½	15½	37½	38½	+ ½
*Reo Motor Car Co	32	33	43½	44½	..
Saxon Motor Car Co	..	..	80	83	—4½
Stewart-Warner Speed. Corp. com	68½	69½	93	95	—9
Stewart-Warner Speed. Corp. pfd	105	..	..	..	..
Studebaker Corp. com	75½	77	136½	137	—5½
Studebaker Corp. pfd	99	101	107¼	111	+ ¼
United Motors Corp	..	..	73	74	—5¼
U. S. Rubber Co. com	64	66	53¼	53¼	—2⅞
U. S. Rubber Co. 1st pfd	106½	108	109	109½	— ⅝
White Motor Co. (new)	103	108	56	56½	—3¼
Willys-Overland Co. (new)	129	130	275	276	—29
Willys-Overland Co. pfd	103	105	108½	109½	—4

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	36	..	+ ½
Chalmers Motor Co. com	92	96	..	190	..
Chalmers Motor Co. pfd	95½	98½	..	105	..
Continental Motor Co. com	175	190	38	39	—3¾
Continental Motor Co. pfd	..	86	9¾	10¼	+ ¼
Ford Motor Co. of Canada	1000	..	380	400	..
General Motors Co. com	151	155	475	545	+5
General Motors Co. pfd	101	103	113	116	—2
Maxwell Motor Co. com	43	45	85	87½	— ½
Maxwell Motor Co. 1st pfd	86½	88½	88	90½	+1
Maxwell Motor Co. 2d pfd	37	39	58	61	+1½
Packard Motor Car Co. com	103	..	..	225	..
Packard Motor Car Co. pfd	96¼	99	102	104	+1
Paige-Detroit Motor Car Co	..	..	..	†56	..
*W. K. Prudden Co	19½	21	42½	44	+1½
*Reo Motor Car Co	..	32½	31¼	32	—12¾
*Reo Motor Truck Co	14½	15⅛	..	37¼	..
Studebaker Corp. com	76	77½	138	140	—2½
Studebaker Corp. pfd	100	102	101	..	—8
C. M. Hall Lamp Co	..	..	..	34	..

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	..	26	..	40	..
Kelsey Wheel Co	200	..	..	350	..
Regal Motor Car Co. pfd	..	25	1	..	..

*Par value $10; all others $100. †Ex-dividend.

Resta Wins from De Palma

His Peugeot Establishes New 10, 24 and 50 Mile Speedway Records at Chicago

CHICAGO, ILL., June 18—Dario Resta in his Peugeot defended his title of speedway champion to-day by defeating Ralph DePalma in his Mercedes and besides, established new American records for 10, 24 and 50 miles. Setting a terrific pace, he captured all three heats, though the margin of lead in his favor was never large.

There was a popular feeling at last Sunday's race that DePalma's Mercedes was as fast as Resta's Peugeot and the expression was current that Resta's winning was more the result of luck than of speed or superior speedway generalship. It was to settle this that the speedway hung up a price of $5,000 for a match race between Resta and DePalma and it was agreed to run three heats—one of 10, one of 24 and one of 50 miles—the winner of two heats to take the entire purse and the loser to get nothing. Besides the $5,000 a trophy was also hung up for the winner of the day's contests.

De Palma Gets Pole

In the first heat of 50 miles DePalma won the pole position in a toss-up, but Resta jumped into the lead on the first lap and held it through the second, maintaining a speed of better than 100 m.p.h. although DePalma was close on his heels all of the time, and in the 5th mile, Resta was forced to stop at the pits to tighten a loose spark plug wire and DePalma took the lead. At the end of 28 miles, the same spark plug wire on Resta's Peugeot loosened and he stopped at the pits 53.6 sec. while DePalma put on more speed and by the time Resta got away from the pits was nearly two laps in the lead. He held the lead then until the end of the 42nd mile when Resta again took the lead, Ralph's speed having dropped appreciably each lap after the 28th mile. As Resta passed Ralph, the Mercedes was hitting on two, but the race was too near over to permit of DePalma stopping and changing plugs and he kept on finishing 21 sec. behind Resta.

Resta Made Two Stops

Resta made two stops and DePalma one and the trouble for each one came soon after passing the pits so that some of these laps were turned as low as 55 m.p.h., and this cut down the general average materially so that Resta's average speed for the 50 miles was only 96 m.p.h., or 2½ m.p.h. slower than his average for the 300 miles a week ago.

The lap by lap summary of the 50-mile heat follows:

Miles	Leader	Lap time	Lap M.P.H.
2	Resta	1:11 3/5	101
4	Resta	1:12	100
6	DePalma	1:12	100
8	DePalma	1:12 1/5	99 3/4
10	DePalma	1:13 2/5	98 1/4
12	DePalma	1:10 4/5	101 1/2
14	DePalma	1:09 1/5	103
16	DePalma	1:09 4/5	103
18	DePalma	1:09	104
20	DePalma	1:08 3/5	105
22	DePalma	1:09 3/5	103
24	DePalma	1:09	104 1/4
26	DePalma	1:08 4/5	104
28	DePalma	1:09 4/5	103
30	DePalma	1:16 2/5	94 1/4
32	DePalma	1:22 4/5	87
34	DePalma	1:25 1/5	84 3/4
36	DePalma	1:35 4/5	75
38	DePalma	2:10	55 1/4
40	DePalma	1:19	91
42	DePalma	1:10 3/5	101
44	Resta	1:09 2/5	103 3/4
46	Resta	1:12 3/5	99 3/4
48	Resta	1:12	100
50	Resta	1:23	87

Resta Takes Second Heat

After a 20 min. intermission the next heat of 24 miles was started, Resta winning the pole on a toss. DePalma had spark plug trouble on the preliminary lap and the heat was held 10 min. for DePalma to go to the pits. He came around the track to the starting line and the Mercedes seemed to be in good shape for competition. Ralph took the lead in the first lap setting a pace of 102 m.p.h., but Resta's spurt in the next lap carried him to the front, his pace being 106.5 m.p.h. DePalma never crossed the starting line in the lead except on the first lap but was very close and his speed was terrific. In the third lap Resta held to 105 m.p.h., then a 104 for two laps, then a 102 for the sixth lap and from then on he gave the Peugeot an open throttle and built up his speed so that his average for the ninth lap was 107 m.p.h. and at this point DePalma and Resta were both even in the back stretch, but on the next lap Resta's average was 109 m.p.h., while his average for the eleventh and twelfth laps combined was 109.75 m.p.h. His total time for 24 miles was 13:42.6 and his average 105.1 m.p.h. DePalma's time was 13:45.8 and his speed 104.5 m.p.h.

The lap by lap of the 24 mile race follows:

Miles	Leader	Lap time	Lap M.P.H.
2	DePalma	1:10 3/5	102
4	Resta	1:07 3/5	106 1/2
6	Resta	1:07 2/5	106
8	Resta	1:09	104
10	Resta	1:10	103
12	Resta	1:11 1/5	102
14	Resta	1:10 2/5	102 1/2
16	Resta	1:09 4/5	103
18	Resta	1:07	107
20	Resta	1:06	108
22	Resta	1:06	109
24	Resta	1:06 3/5	108

By winning the two heats in succession, Resta pulled down the $5,000 purse and cup, but inasmuch as three heats were scheduled the third was made an exhibition drive and Resta finished less than three car lengths ahead of DePalma, the former's time for the 10 miles being 5:51.2, an average of 102.5 m.p.h. Had not the first lap been rather slow—92.5 m.p.h.—the average for 10 miles would have been considerably higher since the speed for the second lap was 102; for the third 103; for the fourth 108 and for the fifth 104 m.p.h. DePalma led for 6 miles of the 10-mile exhibition but Resta's turn of the track in 106.4 in the fourth lap brought him to the front in which position he finished.

Immediately after the 50-mile event, Resta offered DePalma a set of plugs which Ralph refused rather than have the impression become current that he was aided by Resta in case he, DePalma, should win the next heat.

In taking the 50-mile heat in 31:57.4 Resta broke the 50-mile mark of 88.87 m.p.h., set by Christiaens at Indianapolis in 1914. Both drivers averaged 101 m.p.h. in the 10-mile event, the best previous record for this distance having been established by George Robertson in a Simplex at Los Angeles in 1910, when he drove 90.99 m.p.h.

Stutz Features Newark's Night Track Race Meet

NEWARK, N. J., June 17.—J. W. Dickinson, in a 110-hp. Stutz, featured tonight's race meet in this city on the ½-mile dirt track at Olympic Park. The meet was held by the Olympic Park Automobile Racing Assn., under the direction of T. B. Shoemaker, former secretary of the A. A. A. contest board.

In the ½-mile time trials, Dickinson bettered the former track record by negotiating the distance in 37 2/5 sec. An Adams Special, driven by G. W. Adams, won the 3-mile event for cars of 300 cu. in. and under, the time being 4:16 4/5. Dickinson won the next 3-mile event, his time being 4:13 3/5. He also won the 5-mile free-for-all in 6:46, with G. T. Theobald's Mercedes a close second.

The Australian pursuit race of 10 miles was featured by a close race between the Stutz and the Mercedes, so close in fact that a special match race between the two cars was run off and won by the Stutz.

In a time trial, the twelve-cylinder Sunbeam, imported by the Packard company for experimental purposes and recently bought by G. W. Adams of Brooklyn, caught fire and was saved from serious damage by quick work on the part of the driver.

Record-Breaking Chalmers Remy-Ignition Equipped

NEW YORK CITY, June 17—Due to a misunderstanding, it was stated in THE AUTOMOBILE for June 8, that the Chalmers Six-30, which broke the Chicago to New York record, was equipped with Atwater Kent ignition, whereas Remy ignition is standard equipment on this model.

S. A. E. Standards Divisions Report Progress

(*Continued from page* 1117)

mitted to the Cleveland meeting of the standards committee in April, 1916. The committee again considered that a test should not be accepted without further elaboration, so that many other qualities should be tested simultaneously with the fuel economy. At present, therefore, the Research Division is elaborating a similar scheme for testing acceleration and for determining certain other facts in connection with car performance. The object of this work is briefly summed up as follows:

We do not at present know exactly what constitutes a really scientific test. It has been the practice both here and in Europe to test one thing at a time. We all know that wonderful fuel economy can be attained if acceleration is neglected; that marvelous power at high speed is available by neglecting economy and low speed operation, and so on throughout the range. The formidable task before the Research Division is to consider all these things, forgetting nothing, and to find some test which will cover the whole series at once. The outlook is bright but a good many more meetings will probably require to be held before conclusive action can be taken by the society.

Springs

The Springs Division presented a very full report indeed at the January meeting and since then has been engaged upon matters of detail. Concerning spring clips, which it was thought would be readily amenable to standardization, unexpected difficulties have been encountered.

Truck Standards

The Truck Standards Division commenced the year with a number of subjects before it, of which several have been dropped. The division has also just been entirely reorganized simultaneously with the creation of a new division to be known as the Tire and Rim Standards Division. A very large part of the time of the Truck Standards Division has been given to matters in connection with solid tires and, at its last meeting, considerable progress was made toward obtaining a series of tire capacity tables to which all tire manufacturers would give their assent. Owing to changes in the pneumatic tire rim situation, it is believed that there is a good chance of obtaining agreement on this subject, which was previously considered by the Pleasure Car Wheels Division disbanded at the beginning of the present year. The Tire and Rim Standards Division will therefore take over all the tire subjects until recently for the Truck Standards Division. The latter have as their objective, standardization of the location of motor truck controls. The need for similar positions for gearshift and break levers, or pedals, etc., has been emphasized enormously by the Mexican campaign as well as by the European war. It is also believed that standardization of controls would tend to reduce the number of accidents in the ordinary commercial use of trucks. This is not a matter for averaging up existing practice so much as the question has to be decided on its merits. A great deal of data is being collected and action may be expected shortly

With respect to the reorganization of the Truck Standards Division, it may be explained that this is in part owing to the creation of the military transport committee of the S. A. E. and to the great variety of debatable subjects discussed at the recent meetings of truck engineers organized by the S. A. E. at the request of and in order to assist the War College. The military transport committee will call upon any division of the standards committee for assistance in working out problems which will have to be considered. A great deal of this work will naturally fall upon the Truck Standards Division and it is therefore a good thing the program of the division is fairly open.

Better Engineering in New Regal Four

(*Continued from page* 1127)

made as direct as possible, and with a single opening in the side of the casting to which the Carter carbureter attaches, the passages lead by the shortest paths to the valve chambers, the valves themselves being of large diameter for an engine of this size. Around them plenty of water space has been provided by so designing the cored places that there is no possibility of these being obstructed in the casting.

The new Heinze electrical apparatus has been compactly and efficiently applied to this motor, the combined magneto and generator being located forward on the left, and the starting motor adjacent to the flywheel on the right, to which it connects through the automatically-operated Bendix drive. This cranks the engine at about 175 r.p.m., which is proof of its sturdiness. A pilot arrangement insures proper realignment and resetting of both these units, if they have to be removed for any reason. The coil and regulating switch are mounted on the back of the dash, and the electric system operates in conjunction with a 6-volt, 80-amp.-hr. storage battery.

Passing to a consideration of the new clutch used, this is of cone type, using a pressed-steel cone and having a self-aligning thrust ball bearing to take the thrust of the clutch spring. The spring adjustment is obtained by nuts back of this bearing, threaded to the shaft, the inner nut forming the shoulder against which the thrust bearing acts. This makes a simple construction that is easy to take care of. Another thrust bearing back of the spring takes the load imposed when the clutch is thrown out of engagement, and this is also very simply mounted, with a grease cup provided for lubrication. Gears and shafts in the gearset, the case of which bolts to the flywheel housing, are constructed of nickel steel, and the mainshaft runs on ball bearings, with plain bearings for the jackshaft. To make removal of the gearbox a comparatively simple matter, the clutch throwout lever has been designed to swing down forward enough to allow the front part of the housing to clear.

Continuing back, the drive passes through a specially-designed universal that is of rugged construction made with yokes forged on the ends of the shafts, these yokes at right angles and having machined pins that fit into the two halves of a steel ring. To take it apart the steel outer ring halves have only to be unbolted.

A torsion tube incloses the driveshaft, hinging to a bracket on the rear of the gearcase by means of a yoke, the arms of which are designed to be strong, yet are of sufficient flexibility to take care of any strains that may be momentarily imposed upon them without damage. The axle is three-quarter floating, and uses Hyatts and New Departure bearings. Spiral-bevel gears are fitted, and afford a ratio of 4¼ to 1. Attached to the final drive assembly are the brake equalizers and the operating rods that parallel the axle tubes to the drums, which are 10 in. in diameter and have a face width of 1¾ in.

Much thought has been given the rear cantilever spring suspension to get away from any side sway that might tear out the spring brackets. The rear pair are 40 in. long and mounted under the frame rails, trunnioned at the center and shackled at the front, with a special mounting at the rear which prevents any axle shifting. The rear attachments are around the axle tubes, and the spring end goes below the axle. This makes a very strong attachment that gets away from a very objectionable feature of many cantilever spring applications.

The frame itself is new to Regal construction, in that it is designed primarily to follow the body line and give it good support, to have sufficient strength at the right places to take care of weaving strains and to forego any chances of breakage or bending. The section is 3½ in. deep, and the flanges have been so widened at the points of change in width that they are very strong. In addition, a substantial cross member is placed at the point where the front ends of the cantilever rear springs attach.

Five passengers are afforded comfortable accommodations in the body, which is given a straight slope from the radiator all the way back, this being the prevailing body fashion. The radiator sets the appearance off well by its sloping linc and being a pressing free from the core, is given a high enamel finish. A special point has been made of the fender fitting, to see that the fenders center the wheels as nearly as possible, a thing small in itself but large in its possibilities of increasing appearance. The doors fit snugly and have no moldings at the top; the instrument board is a hardwood panel and running boards are linoleum-covered. The wheelbase is 108 in.

Ninth Used Car Market Report Out

CHICAGO, ILL., June 20—The ninth edition of the National Used Car Market Report has been issued by the Chicago Automobile Trade Assn. From this edition, as not of much value, have been dropped:

Brush, Cameron, Cino, McIntyre, Parry, Rayfield, Richmond, Royal Tourist, Sampson, Vulcan, Warren-Detroit, Welch and Welch-Detroit. Otherwise the book is much the same as the eighth edition.

Added co-operating factories are: Detroit-Electric, Hudson, Hupmobile, Jeffery, Mitchell and Reo. Added co-operating associations are: Columbus Automobile Trade Association, Columbus, Ohio; Tri-City Auto Trade Association, Davenport, Iowa, and Peoria Automobile Trade Association, Peoria, Ill. It is stated that the Boston dealers have lessened their activity in regard to the report, although the association is still listed in the book.

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Tune Up at Des Moines

DES MOINES, IOWA, June 17—Eddie Rickenbacher, captain of the Maxwell racing team, was the first race driver to arrive in Des Moines to start preliminary activities on the Des Moines speedway for the 150-mile sweepstakes on June 26. Mulford, De Palma, Henderson, Chandler, Christiaens, Galvin and other noted entries were not far behind and the speedway is now alive with the activities of preparation for the second annual speedway event. Ralph Mulford, who beat Ralph De Palma in a sensational finish for a distance of 300 miles here last year, will have the same task ahead of him again. Earl Cooper and his Stutz also were early arrivals to make proper preparation for the race. Fred Wagner, official starter of the American Automobile Assn., will give the men the word here. He is also negotiating with Resta to enter the local event. Elimination trials will be held on the 4 days preceding the race and several drivers will attempt to set a new record for the 25 mile distance. Rickenbacher, although an Iowa man, has never before competed in a speedway race in Des Moines and local fans are enthusiastic over the prospect of seeing him in action. Entries in the Des Moines race to date are: Earl Cooper, Stutz; Ralph Mulford, Hudson; Ed Rickenbacher, Maxwell; Eddie O'Donnell, Duesenberg; Josef Christiaens, Sunbeam; Frank Galvin, Sunbeam; Bill Chandler, Crawford; Wilbur d'Alene, Duesenberg; Tom Milton, Duesenberg; Pete Henderson, Maxwell; Dave Lewis, Crawford; W. J. Barndollar, Clergy. The program of race day will include a 50-mile free-for-all in addition to the championship race of 150 miles.

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Pathfinder 12 to Cross Continent on High Gear

SAN DIEGO, CAL., June 17—The Pathfinder which blazed the first transcontinental trail started on its tenth transcontinental trip from the San Diego Exposition to-day. The car will travel over the Lincoln Highway, blazing the trail for the Pathfinder twelve, which is to leave the San Diego Exposition grounds July 3, on a run over the Lincoln Highway with the car sealed in high gear under supervision of the A. A. A.

If successful, the Pathfinder will be the first car to make the transcontinental high gear run.

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Elgin Arrangements Completed

ELGIN, ILL., June 17—The Elgin national road race will be run over the Elgin course on Aug. 19. Final arrangements for financing the event were completed in a conference between representatives of the Elgin Road Race Association, and the Chicago Automobile Club. Prizes aggregating $8,000 will be hung up. Ralph DePalma, twice winner of the Elgin National trophy, is a sure entrant, and boosters of the event are confident that Dario Resta, winner of the Indianapolis and Chicago speedway events, will be among the contenders. Entry blanks will be sent out immediately.

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Fifth Avenue Bus Adopts Moline-Knight

NEW YORK CITY, June 17.—The Fifth Avenue Coach Co., this city, will standardize the Moline-Knight engines for its new equipment exclusively. The company has been experimenting with various types of Knight motors, running over a period of years. All the new equipment will be Moline-Knight motored, and the company's plans are so laid out that production of this equipment will start in July. It now has a few of these machines running.

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Apco Opens Prize Contest

PROVIDENCE, R. I., June 16.—A series of cash prizes is being offered by the Auto Parts Co., this city, maker of the Apco line of specialties for the Ford car, for the best short sales suggestion, story, joke, poem, photograph, shop kink, etc., containing the name of Ford. The first prize is $5, the second $3 and the third $2. There are fifteen $1 prizes. The only restrictions are that the name Ford is used and the copy written on one side of the paper.

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Wolfe Pathfinder District Mgr.

INDIANAPOLIS, IND., June 16—Richard Wolfe has been appointed a district manager of the Pathfinder Co., this city.

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Bay State A. A. on Outing

BOSTON, MASS., June 19—The annual outing of the Bay State A. A., which comprises the prominent motor and accessory dealers in Boston, ended last night when they motored back from Lake Spofford, N. H. after a 3-day trip. There were about 200 men and women present and they went in fifty cars.

Factory Miscellany

Inter-State to Add—The Inter-State Motor Co., Muncie, Ind., is planning an addition to its plant.

Dennsen Motor to Build—The Dennsen Motor Co., Cleveland, Ohio, will build a plant at Coltman Road and East 123d Street.

To Make Trucks—J. B. Barsdale, 618 Tower Avenue, Superior, Wis., is planning to build a $50,000 plant for the manufacture of commercial vehicles.

Gordon Parts to Build—The Chamber of Commerce, Muskegon, Mich., will erect a factory for the L. O. Gordon Co., maker of automobile parts, to cost about $10,000.

Continental Motor to Add—The Continental Motor Co., Detroit, Mich., has granted a permit for the addition to its plant at 3001 East Jefferson Street to cost about $104,000.

Covert to Add—The Covert Motor Vehicle Co., Lockport, N. Y., will add to its present plant a three-story and basement factory, 100 by 130 ft., of steel, concrete and brick, to cost $40,000.

Tube Co. to Build in Louisville—The Compressed Inner Tube Co., producing a solid rubber device for use inside automobile tires, will build a factory in Louisville, Ky., to manufacture this device.

Three New Buildings for Federal Rubber—Contracts for three new factory buildings for manufacturing, shipping and storehouse purposes have been let by the Federal Rubber Co., Cudahy, Wis. These buildings will be fireproof.

Fulton Tractor's Plant—The Fulton Tractor Co. has taken over a plant in Anderson, Ind., in which it will make farm tractors and motors. This is a new company, organized with $300,000 capital.

Pearce Tire Plant Progressing—Excellent progress is being made on the construction of the plant of the Pearce Tire & Rubber Co., Ashtabula, Ohio. It is expected that the building will be completed by Aug. 1.

Champion Equipment Makes First Shipment—The Champion Automobile Equipment Co., Wabash, Ind., made its first shipment of asbestos fabric recently to Fort Madison, Iowa, where it will be used in the manufacture of automobile tires.

To Make Gage—The Badger Crafts Shops, Sheboygan, Wis., has brought out a new type of gasoline gage designed especially for Ford cars and made to substitute for the tank filler cap. The indicator is graduated in gallons in etched letters of such size that they are easily legible, even at night. The apparatus consists of a hollow brass float which is fitted to a spiral upright that turns the indicator on the dial as the gasoline supply is raised or diminished. The gage is protected by a disk of plate glass ⅛ in. thick.

Curtis Plant Taken by Wagner—The Curtis Truck & Forging Co., Decatur, Ill., has sold its plant on North Woodford Street to A. W. Wagner of Terre Haute, Ind., who will open a malleable iron foundry for the manufacture of iron castings for automobiles. The plant will have a capacity of 45 tons daily. Wagner has been engaged in similar industries in Milwaukee and Racine, Wis., and for the past 11 years in Terre Haute. D. E. Willard will be vice-president and Irving Sibley secretary-treasurer of a new company to be formed, with Mr. Wagner as president. Willard and Sibley have been connected with the Allith-Prouty Co. of Danville, Ill. The Decatur plant will be enlarged and improved to the extent of $20,000. It will be ready for operation about Aug. 1.

Canadian Ford Shipments Large—It requires from twenty to thirty freight cars each day to handle the Ford company's shipments in Ford, Ont. As the average train is composed of from twenty to thirty cars, the Ford company's shipments average a trainload of cars a day.

The largest day's shipment so far this season was 314 cars. As most freight cars will only hold five Ford cars (a few of the larger freight cars hold seven), and many carloads go out containing three Ford cars, if the average number is placed at five cars, then it required sixty-three freight cars, or two whole trainloads, to transport this one day's shipment.

The Automobile Calendar

ASSOCIATIONS

July 2-6—Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

June 22-23—Chicago, Interclub Reliability Run, Chicago Automobile Club.
June 26 — Des Moines, Iowa, Speedway Race, Price Speedway Co.
June 28 — Des Moines, Iowa, Speedway Free-for-All, 300-Mile Race.
July—La Grande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300-Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 4—Newark, N. J., Track Race, Olympic Park, Auto Racing Assn.
July 4—Visalia, Cal., Road Race, Tulare Co. Auto Club.
July 4—Spokane, Coeur d'Alene, Track Race, Reigel-Hiller Co.*
July 4—Benton Harbor, Mich., Track Race, F. E. Fitzsimmons.
July 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
July — Burlington, Iowa, 100-Mile Track Race, Tri-State Fair.
July 15—Portland, Ore., Track Race, Northwest Auto Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7 — Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo, Mich., Track Races, Kalamazoo, Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis., Fall Show, Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Baush Machine Opens Detroit Office—The Baush Machine Tool Co., Springfield, Mass., has opened a permanent office in the Dime Bank Building, Detroit. W. Wetsel will be in charge.

N. Y. Marmon Moves—The Nordyke & Marmon Co. last week occupied a new building at 42 and 44 West Sixty-second Street, New York City. The building occupies a plot 65 by 100 ft. It is fireproof and five stories high.

Rives Pedal Pad's New Distributers—The George H. Rives Mfg. Co., New York City, manufacturer of the Rives Never-Slip adjustable automobile pedal pads, has established distributers throughout the country and also in Buenos Aires, Argentina, and Montevideo and Rio Janeiro, Brazil, South America. The company's offices are in the Woolworth Building, New York City, and its factory is at 171 Fulton Street, Brooklyn, N. Y.

Gorey Buys Chalmers Motors—J. C. Gorey & Co., 354 West Fiftieth Street, New York City, have bought over sixty Chalmers motors of the latest type and furnish all or any parts to fit Chalmers cars from 1907 to 1915.

Iowa News Items—The Fisk Tire & Rubber Co. has leased the northeast corner of Thirteenth and Locust Streets, Des Moines, as a site for a new branch house which is to be built there immediately at a cost of $30,000. The Des Moines branch will serve the entire State of Iowa.

A new business block now being constructed at Fifteenth and Locust Streets, Des Moines, will provide a new home for three service stations. These are the Diamond Tire & Supply Co., the Stewart-Warner Co., and the B. & B. Battery Co.

One of the biggest shipments of automobiles ever received in Des Moines was a recent trainload of Chevrolets. The train consisted of thirty-eight cars fully loaded with the Chevrolets. Because box cars were not available the automobiles were shipped on flat cars and covered with canvas. The trainload of Chevrolets made an impressive parade through the city.

Hudson N. Y. Service Building—The Hudson Motor Car Co. of New York plans to build a three-story garage and service building on a site it has purchased on West End Avenue between Sixty-eighth and Sixty-ninth Streets. It will house 600 cars. Ramps will be used instead of elevators and the aisles will be 18 ft. wide.

Packard Opens Accessories Dept. in L. I. City—The Packard Motor Car Co. of New York has opened a branch of its accessories department in Long Island City. A full line of tires, tubes, tire covers and other emergency stock will be carried at all times. The new branch is located in its service station at Thompson Avenue and Hill Street.

Cranston Succeeds Smith—J. P. Cranston has succeeded Gordon Smith as sales manager of the Vim Motor Truck Co., Philadelphia, Pa. Mr. Smith has gone to New York City, where he has taken a similar position in the Manhattan Motors Corp., Vim distributer.

Lolley Joins Timken—W. H. Lolley, formerly connected with the Simms Magneto Co. and the Remy Electric Co., has joined the selling force of the Timken Roller Bearing Co., Canton, Ohio, and will now represent the Timken company throughout the East.

Kansas City Items—The Rice-Sturtevant Motor Co., recently appointed distributer of the Elcar for Kansas and parts of Missouri and Oklahoma, has already established a few agencies.

R. R. Tenney, assistant office manager since February in the Kansas City distributing headquarters of the Maxwell, is now acting as distributing office manager.

Sewell Wheel Opens Baltimore Branch—The Sewell Cushion Wheel Co., Detroit, has opened a branch at 301 Continental Building, Baltimore, Md., and O. H. Jones has been appointed manager of the branch.

Columbus News Items—Plans are being prepared for an additional office building for the John W. Brown Mfg. Co., located on Marion Road near Columbus, maker of automobile lamps and parts.

E. F. Loeffler, one of the pioneers in the tire business in Columbus, has been made manager of the tire department of the Justus & Parker Co., local agent for the Swinehart tire.

The Hill Sales Co., Front and State Streets, has been made agent for seven counties in central Ohio for the products of the Automatic Carburetor Regulator Co., Detroit.

The Standard Motor Car Co., North Fourth Street, central Ohio agent for the Hudson and Milburn, has completed extensive changes to its salesroom. The service station is located at Third and Chestnut Streets.

The Double Tread Tire Co. has opened a retail store at 142 North Fourth Street.

The Columbus Cadillac Co.'s direct factory branch will complete its new building at Broad and Sixth Streets, to be used as a salesroom and service station, about Dec. 1. The structure will be 60 by 187 ft., two stories.

Omaha Retail News—H. P. Neble & Son, who have for many years been connected with Apperson sales in Omaha, have purchased the Omaha Apperson branch and assumed charge. Their territory includes Nebraska, western Iowa and the Black Hills district.

W. S. Barker, distributer of the Dixie Flyer, has opened salesrooms at 2107 Farnam Street.

The Overland Omaha Co. has leased the quarters of the Ford Motor Sales Co. and will take possession when the latter firm moves to the Ford branch factory building now nearing completion at Sixteenth and Cuming Streets.

Wadsworth Body to Build—The Wadsworth Mfg. Co., Detroit, will build a two-story factory, 95 by 350 ft., costing $60,000.

St. Louis Items—W. H. Anderson, for several years agent in St. Louis for the Kelly-Springfield trucks, has joined the local Locomobile Co. to take charge of the sales of Ricker trucks.

Ben Edwards, battery expert of the Willard plant, has arrived here to take charge of the service department of the Battery Service Co., which handles the Willard line.

The Reliable Auto Tire Co., 3117 Locust Street, has added a service department.

Sam Broadbent has been made sales manager for the Frye Motor Car Co. of St. Louis. Mr. Broadbent has been in the printing business in St. Louis for 27 years, and for 14 years was secretary of the Lambert-Deacon-Hull Printing Co.

F. J. Walsh, St. Louis, has been named sales manager of the M. & N. Auto Equipment Co. of that city, distributer of Olson Unit. Mr. Walsh comes from the Riefling Carriage & Auto Co.

Henry Hotze & Son, St. Louis, have been appointed agents in this territory for the Pilot car. The executive offices are at 219 Chestnut Street, the service station being on Magnolia Avenue near Grand Street.

The Moon Motor Car Co. announces the opening of an air system for finishing its cars. R. L. Cleveland, superintendent of the finishing plant, says that, in addition to other advantages, the plant will give the needed increased capacity.

The AUTOMOBILE

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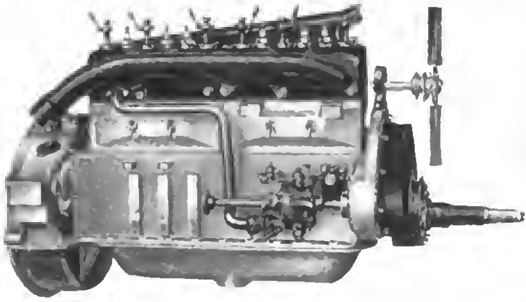


Growing by Leaps and Bounds

It looks as if 1917 was going to to be a "complete equipment" year in the real sense of the word.

We judge this from the large quantity of Stewart Tire Pumps which have been and continue to be ordered.

Only a few days ago we booked the largest single order ever placed for pumps.

Each week our pump business grows larger and larger.

The survival of the fittest is the explanation.

If you want the best pump—get the Stewart.

"No car is better than its accessories"

The Stewart-Warner Speedometer Corporation, Chicago, Illinois, U. S. A.

Vol. XXXIV New York—Thursday, June 29, 1916—Chicago No. 26

A few of the many thousands of automobiles wrecked in war. All of these machines are capable of being repaired

Rejuvenating Wrecked Cars

French General Clearing Hospital Behind Lines Utilizes Every Part for Practical Purposes

By W. F. Bradley

"THERE must be a tremendous amount of automobile junk piling up behind the armies in France." Doubtless this is a surmise shared by many who have reflected vaguely on the destructiveness of war, but have had no opportunity of examining the methods employed to repair the inevitable loss of equipment.

A collection of radiators from all factories

This opportunity to examine the methods adopted in order to prevent the wastage of automobile material and keep the mechanical transportation service of the army working on the most economical lines came with an invitation of the French War Department to visit its huge centralized repair depot. First aid in automobile breakdowns is given by the traveling workshops attached to each convoy or group. More serious cases are dealt with by the general repair shop—a few miles behind the lines. The first-aid gang can deal with only a limited amount of work of a comparatively simple nature. Theoretically the army workshop can tackle any kind of a job; but when these shops have to be established in barns, under canvas covers on some market place; when they are in danger of being shelled by the enemy, and when they are obliged to maintain a certain degree of mobility, they are apt to be submerged and incapable of carrying out the work intrusted to them either rapidly or economically.

1—These motors have been taken out of condemned chassis. After cleaning they will go to the stores to be used again

2—A corner of the armored car repair department at French central motor depot behind the lines

3—No driver is allowed to throw away a tire or a tube, for in this central workshop provision has been made for repairing hundreds a day and returning them for service

Thus, back of the army workshops the French War Department has established its general clearing hospital. This unique establishment receives the whole of the overflow from the repair shops in the field. Cars and trucks which have been battered by shell fire, vehicles which can no longer be efficiently kept in repair, old models for which spare parts are not easily obtainable, the whole of the automobile wreckage of the battlefields, flows into this central establishment. This organization may be compared to the big hospitals which receive all the human wreckage of warfare. The automobile hospital, however, does not admit of a crematorium in the background, for under the wonderfully efficient system evolved by the French no vehicle, nor any wreckage of a vehicle, can ever be considered valueless.

80,000 Vehicles at Front

Along the French front there may be some 80,000 automobiles of all kinds. This figure does not claim to be accurate, but it is sufficiently near the truth to give an impression of the vast organization dealt with. The overflow and the hopelessly incurables from this vast army are brought in by rail to the central repair depot at the rate of about seventy or eighty per week, and about 60 per cent of these are capable of being rebuilt into perfect automobiles fit for service in the fields.

When this organization was decided on the war had already been in progress a considerable period and there had accumulated several thousand battered remains of motor vehicles of all makes, from all countries, of all ages—having only one feature in common, their inability to run. The law of the survival of the fittest decreed that these first wrecks should be the least valuable of the automobiles of France. They comprised old models which had been doing useful if not very efficient work in various corners of France when the net of the requisition agent swept them up; they were thrown pell-mell into the army, and the army a few months later threw out their cracked and rusty bones.

The officers placed in charge of the central repair depot had to decide what should be done with this old-world wreckage and also with the more modern material which came in from day to day with only slightly varying regularity. It is an invariable rule in the French automobile service that no war-worn cars shall be thrown on the market and that not an ounce of metal nor a plank of wood shall pass into civilian hands. This rule has been strictly adhered to and will continue to be adhered to, to the disappointment of those bargain hunters who are hoping to secure war-worn vehicles for an old song and to the foiling of the man who habitually presides over the junk heap. Speculators can make no money out of this branch of the French army.

Automobile Dissection as an Art

As each batch of wrecked vehicles comes in, a group of expert officers examines them and decides whether the vehicle shall undergo repairs or whether it shall be dismembered. In the former case it is towed or carried away to the repair shops to be dealt with in a manner which will be described later. If dismemberment is the order, the vehicle goes into the temporary cemetery and is dealt with in proper order. These French officers have developed automobile dissection into a fine art; there is not an ounce of material on an automobile which is incapable of being used in some efficient manner. First of all the carbureter and magneto—if these two auxiliaries still remain—are taken off and sent to the stores. A special gang strips off the body, and while one man puts the horsehair into a sack another takes the cloth or the leather, another rips off the sheet metal panels and still another pounces on all the woodwork. The man who is interested in seat stuffings knows the difference between horsehair and the many substitutes which pass under that general term—and he has a special sack for the real thing and another receptacle for the imitation. The same with upholstery and leathers. Real leather from a $3,000 touring car is not stored with the imitation from a $500 runabout. It takes no longer to classify them than to group them, and the saving on quantities is enormous.

The same system applies to the chassis. When the motor is taken out of the frame it is carried across to the cleaning

1—A fine stock of wood obtained from dismembered trucks and omnibuses. This can be used for repair work, shack building, etc.

2—The breakdown gang dissecting an old-time Berliet army truck. The men waste no time in taking the old machines apart but the work is done without breakage of parts.

3—A typical example of how automobiles are wrecked in warfare

shops. It may be found that this unit is in perfect condition, in which case it is cleaned and sent to the stores. It may be that the wreckage is so complete only one connecting-rod can go into service again, in which case that single rod goes into the stores. The gearbox, the rear axle, the steering mechanism, the brakes, all pass under the same examination. If a gearbox, for instance, is unfit for further service, it is not thrown into the junk heap and allowed to lie there. Its shafts are taken out, its ball bearings are separated, its gears, if of B. N. D., or other high-grade steel, are not thrown into the heap with cheap mild steels; the aluminum casting is not flung in with the cast iron.

A Card Index System

The card index system has been applied to this work in a very systematic manner. When a vehicle comes in it is given a number and classified according to its make, model, and year. All the parts saved out of this vehicle and sent to the stores for possible future service are noted on the back of the card. These parts vary considerably: they may be a complete motor, a complete transmission, a complete rear axle, or only a crankshaft, a set of connecting-rods, or a couple of cylinders. But whatever they may be, they are recorded.

How the System Works

As an example of how this system works, let us suppose the repair depot receives a Peugeot XZ model, 1912 type in good condition with the exception of a big hole in the cylinder waterjacket. The officer in charge of records looks up his dockets of Peugeot XZ 1912 models and finds that he has in the storehouse a set of cylinders saved from a previous wreck. He makes out an order for these to be delivered to the repair shop and records their departure from the stores. From time to time repairs will be given out to the factory having originally built the car, and it is the army which will provide the replacements to be used in that car. As European factories are generally working on munitions, the factory stock of spare parts is often low, and in many cases it would be necessary to make parts specially but for this complete system of classifying all parts taken out of condemned chassis. There are numerous cases also of old models still fit for service, but for which spares cannot be obtained owing to the factory being in the hands of the enemy, the firm having disappeared, or other causes. In these instances the army stock allows a good vehicle to be repaired. A particular instance noted during my visit was several Mercedes-Daimler trucks captured from the enemy or picked up on the battlefield. Several of these had been put into service entirely owing to the fact that spares had been secured from disassembled Mercedes-Daimlers. It is estimated that the French army is saving $5,000 a day on its spare parts bill alone by reason of the intelligent application of this system.

1000 War-Worn Cars

The big open-air garage in which considerably more than 1000 war-worn cars are awaiting treatment is one of the most picturesque sights in connection with the war. There is such a variety that it needs a life-long connection with the automobile industry of two continents to identify them without reference to the maker's nameplate. Every possible cause has helped to bring them to this common meeting place. Some are merely worn out from hard service; there are cases of collision, fire, water, high explosive shells, machine gun and rifle fire. A modern-looking gray Panhard limousine appeared to have little the matter with it—its tires were intact and its body carried only the scratches which come of hard service. But when the rear door was opened a silent tragedy was revealed, for a shell had burst inside and the blood of brave men had dried on the floor and seats of that once elegant limousine.

No Young Men

All the men connected with this depot are beyond the fighting age. The only one who could lay claim to youthfulness was the officer who had evolved the card index system. For years before the war he had been a salesman in Paris and London automobile showrooms and had been selected for this post on account of his organizing ability and his intimate

How rubber tires are received from the front

knowledge of the features of all makes of cars. In the various departments were to be found engineers, foremen and testers from the leading French automobile factories—men whose age or constitution would not allow them to undertake the rough work of the trenches, but who were capable of an honest day's labor.

Everywhere Economy

The system of economy was spread to the tools with which the men worked. Tubular chassis built by Renault about 1900, constituted excellent floats for moving material about the yard when stripped of all their organs but the steering gear. Wheelbarrows with a ball-bearing motorcycle wheel and a body made out of a truck's side panels cost practically nothing to produce and were more satisfactory than the usual article delivered by the stores. The rough sheds which serve as offices and will have to be pulled down when the war is over, had windows taken from derelict hotel omnibuses. Chain-driven truck rear axles and springs, of which scores could be saved from the wreckage, were almost ideal for field kitchens.

A Central Repair Shop

With this system in proper working order, a considerable amount of material is accumulated which cannot be used again in the rebuilding of automobiles. These comprise stocks of aluminum, copper, brass, sheet steel, high-grade steels, mild steel, etc., all of which are sold to the foundries working exclusively for the war department. The state monopolizes metals and eliminates private speculation.

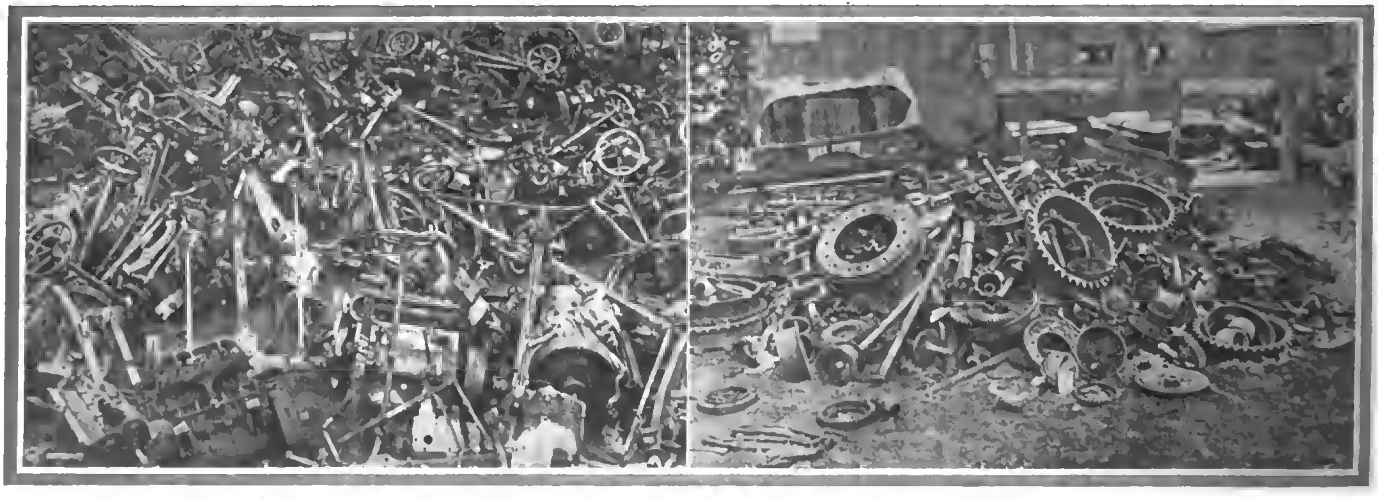
In conjunction with the central receiving and dissecting department is a central repair shop. When this work was begun the repair shop officers were given a wholesale wine merchant's storehouses and yards and told to make the best of it. Within a few months those empty buildings and deserted yards had been transformed into well-equipped shops filled with all kinds of automobiles undergoing or waiting repair. Technically this central repair department only differs from civilian repairshops by reason of its size and the variety of work undertaken. Thus, in addition to the usual divisions dealing with motors, gearsets, rear axles, etc., each of these is sub-divided according to makes. Men who have had experience of American motors, for instance, being kept on that class of work as much as possible, while Knight motor specialists are kept busy on sleeve-valve engines. The range of work covers everything from a heavy 60-hp. four-wheel-drive tractor to a light-weight motorcycle, while the individual repairs may be the changing of a steering gear or the complete reconstruction of chassis and body. Under such conditions a cast iron system is not possible of application, yet the general arrangement is wonderfully orderly and economical. At one end of the building the chassis are dismounted and frame, sheet metal and radiator repairs are carried out. The various units are passed into the engine, gearbox and rear axle departments and assembly carried out on the usual factory lines. Spares are obtainable from the stock of dismembered cars, by an order on the central supply stores, from the home factory, or in exceptional cases the parts may be made in the shops.

Road-Test Department

The road test department is similar to that of the big factories, for every chassis after assembly must go on the road to be passed by the tester. The authorities have at their disposal a remarkably good class of men for this work: several racing mechanics who had been through the whole series of Gordon Bennett events were noted among them, and the officers pointed out testers from such factories as Brasier, Panhard, and Delaunay-Belleville. After the road tests the chassis pass to the body shops, where they are completed, given a final road test, and then returned to the receiving yard from which they are redistributed to the army as required.

Repairing Tires

In the early stages of the war tire economy was considered a matter of no importance. Drivers of touring cars, having neither time nor means of repair, left their punctured tubes and casings by the roadside, and put in a claim for new ones, which claim was never refused. Now all that is changed. Every worn casing and every punctured tube must be returned to the depot from which the driver works. This depot



Left—This may look like junk, but every unit has been passed for service after cleaning and slight repairs. Right—Only high-grade steels are allowed to enter this group sends its damaged tires to the central repair department, and here, in a specially equipped shop, tubes and casings are made almost as good as new. Repaired and tested tubes are packed in boxes marked in big figures with their dimensions, and repaired casings are wrapped in the same way as new tires and labeled with maker's name and size. These repaired casings and tubes are given out to the army as required, the output after only a few months working of this department being several hundred a day.

Presses for Truck Tires

A similar method has been adopted for truck tires. Hydraulic presses are maintained with all the armies on the front, and the staffs in charge of these presses periodically return all the worn-out bandages to the central repair depot. Here machinery has been erected for paring all the rubber from the metal base, this worn rubber being sold from time to time as sufficient stocks accumulate.

So complete and thorough is this system that instead of wreckage being piled up, the automobiles of France are being rejuvenated and the end of the war will find that country with a smaller proportion of old-timers than it possessed at the outbreak of hostilities. Month after month the least valuable trucks and cars are disassembled and their parts sent to the melting pot. Old vehicles which might be good enough for individual service over well-paved city streets are of no use to the army and consequently are not allowed to exist. Only thoroughly sound automobiles are of any value in warfare. It is possible to state that, so far as France is concerned, the end of the war will find the country with a better and more modern automobile fleet than the beginning. Further, this change will have been made without loss to the nation.

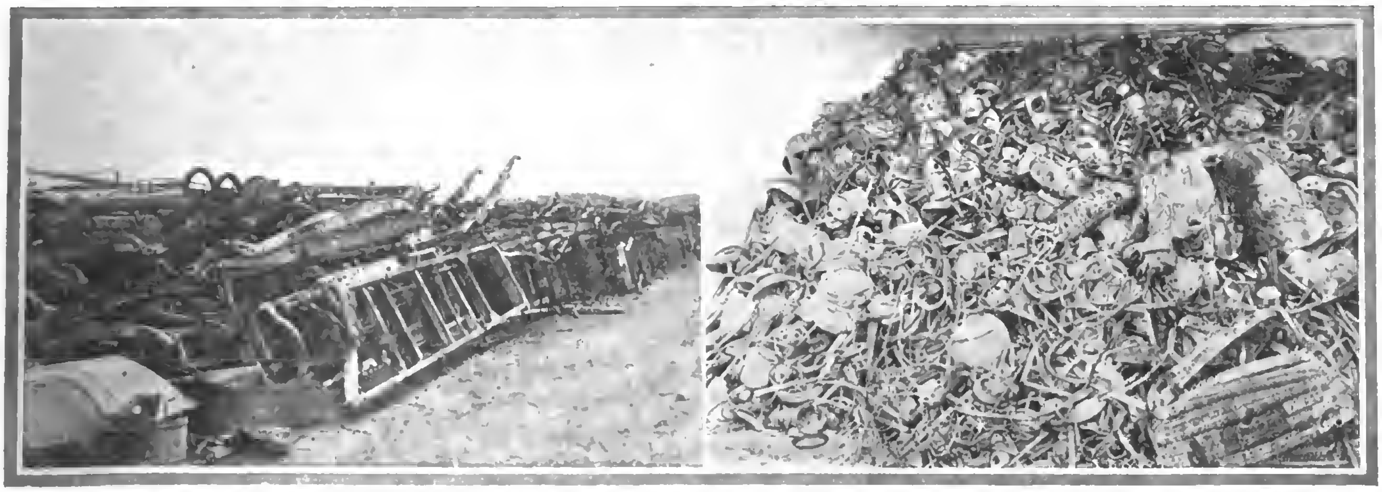
Mobile Repair Shops

The mobile repair shops, which have already been described in THE AUTOMOBILE on previous occasions, have been found very valuable for quick repair work of all kinds, one of their special advantages being that they can be moved to any new position within an hour after an order has been received to the effect that such a change is necessary. Each tool is mounted on a special trailer truck and two or three of these trailers are made up into a train drawn by an automobile or a motor truck and this arrangement gives the shops a wide range of action. While they have to be capable of keeping pace with the body of the main army whenever an advance or retreat is under way, these shops do not have to operate absolutely in the open. In fact, they have been found most effective for all-around work when operated at an average distance of 25 miles from the front and at this range it is generally possible to find buildings of a type which can be readily converted for repair shop purposes. Abandoned factories, street car stations, barns or a farmhouse with a large courtyard are found very convenient for the establishment of repair depots. In fact, such extremes as a village schoolhouse and a slaughter house have been selected as places suitable for this sort of work, while a factory with electric power is looked upon as ideal.


A captured Mercedes-Daimler truck which will return to the front when it has received a couple of cylinders and a piston

The equipment of the automobile repair shops usually comprises lathes, drilling machines, grinding machines, a case-hardening plant, and all the smaller tools required for general repair work. Electricity is used for driving the machinery, a gasoline engine and dynamo carried on a trailer being provided for this purpose.

There is more repair work to handle under war conditions as found on the frontier in the north of France than is the case in civil service. But on some parts of the front the percentage of scrapped automobiles and trucks is only slightly higher than in times of peace. The more dangerous conditions, however, and the fact that drivers cannot be selected with as great care in such circumstances, go a long way toward making up the increase in repair work over normal conditions which is found at the shops. Still, it is surprising how hard it is to put a motor vehicle entirely out of running order by bullet and shell fire. The bodies of the machines are frequently wrecked by shells, but it requires a direct hit or very heavy shell fire to render a chassis unfit for further service. It is a simple matter to replace the body work and even trucks which have been under direct fire to such an extent that they had to be abandoned have been towed to a repair shop and put into serviceable condition once more.


Left—These frame members are about to be sawn up and sent to the melting pot. Right—A collection of valuable junk which after going through the melting pot will be made into munitions

Radiator Design a Neglected Factor

Lack of Appreciation by Car Engineer Makes Difficulties for Radiator Manufacturer—Pros and Cons of Various Designs

ORDINARILY, when the car designer gets to the point of determining the size and type of radiator he wants to fit to the car, he gives the radiator maker the dimensions of the front end of the frame and car, indicates the shape desired and provides the radiator maker with such other data about the car and engine as will enable the latter to fix upon the amount of cooling area and general construction of the radiator. If the radiator maker is not able to give sufficient cooling with the limitations imposed, he usually comes back at the car designer and such alterations and changes are generally made as will allow of the proper size and cooling possibilities. Thus, as a general thing, the average car engineer pays little attention to the matter of radiators and depends upon the builder of that part for a proper type to suit his car.

One reason for this lack of consideration of the radiator problem by the car engineer is that each different make of radiator has some differences over every other type. Due to variations in the methods of making tubular and cellular cores, and to other differences in methods of building them up, it is hard to find any formula or data which will work satisfactorily for more than one make of radiator. Each radiator producer has determined through long experiment and test with his particular construction just what it will do per unit of area and thickness and, as this varies for each make, the car engineer could only design the radiator after determining which particular core construction he was going to use.

The Engineer's Part

It does seem, however, that the engineer should have a better understanding of the general radiator problem and of considerations that affect this all-important cooling member, for even though he does leave it to the producer of the radiator to determine the size and type to be fitted to meet the conditions, he could better design the parts that govern its size and shape to give greater opportunity to make it more efficient. Oftentimes some slight change in the front shape could be made to allow a much better radiator shape or size, and this usually could be done without in any way sacrificing the good looks or construction of the car in general. Perhaps the car designer might lay out the contour of the hood and body all unconscious of the fact that he was imposing some heavy limitations upon the radiator, whereas some slight differences in this would make a big difference in the radiator effectiveness if he but knew what they are.

For instance, the placing of the louvres in the sides of the hood and the position of these are important considerations. The width of the radiator, governed by the contour of body and hood, plays a part in the cooling efficiency. Whether or not there is a clear air passage back of the engine is another point influencing the cooling results. Others are the height of the car, the size of the engine, kind and type of ignition, carburetion, fan design and operation, fan location, water jackets of the engine, and a great many other things. Having more or less control over many of these, the car designer, as has been said, can always have an eye upon the health of the cooling system and the radiator if he knows what effect each has.

Take the question of louvres in the hood. It almost goes without saying that the more there are the better the cooling, yet a great many cars have only a very few, while others have none at all. They do not detract from the appearance and therefore they should be used. Besides, these vents should be brought as high as possible on the sides of the hood so that no hot pockets can form at the top of the engine under the hood. The hot air goes up in the engine compartment just as it does in a room, hence vents in the part of the bonnet that is directly above the engine are an excellent thing, although very seldom found.

Price an Important Factor

The personal equation also enters into radiator design to a large extent in that what one man considers adequate cooling will not suit another. That is, the engineering department of one factory may be satisfied, for commercial reasons, with a radiator that will keep the water from boiling up to a certain point, although this same relative efficiency might not be at all satisfactory to another car builder who wished to have a more adequate cooling system. The price at which a car sells also has much to do with it, for the owner of a low-priced car does not object to the engine getting hot under conditions in which the driver of a higher-priced vehicle might think he had a right to expect the engine to keep reasonably cool.

As a general thing the popular high, narrow shape of radiator that is being fitted to a great many cars now is a more efficient shape than the older form with its greater width in proportion to height. One reason for this is the fact that a fan of moderate diameter extends the entire width of the core, cooling the entire flow of water as it passes down, as contrasted with the wider radiator which is too broad to allow the fan to extend its entire width unless the fan is of a diameter that in the average case would be too great to be accommodated in the space available. This is shown by the diagrams in Fig. 1. It will be seen that with the wide radiator at *B* some of the water at the sides does not get the effect of the fan, while at *A* all the water is given the benefit, although the fan is of the same size in both cases. Then, too, the high and narrow radiator gives a greater head and a greater distance for the water to pass from the top to the bottom, thus causing this water to be cooler when it again reaches the inlet pipe to the cylinder jackets.

In determining the type of radiator to use, the engineer is always confronted with the question of price. While it is generally accepted that the most efficient type of cooling unit on the market is the cellular radiator, nevertheless there are some very efficient tubular varieties whose builders claim almost as much cooling efficiency for them as for the cellular. The tubular core has a much smaller amount of seams that must be proof against water leakage than is the case with the cellular, but the tubular form is generally bulky. Being less costly than the cellular and in some forms giving an excellent account of itself, the tubular has seen wide use. Therefore, it is first necessary for the engineer to choose the type that presents the least number of possibilities for leakage with the best compromise with price and efficiency.

The thickness of the metal used in the core also has a bearing upon the efficiency, although for mechanical reasons it cannot be as thin as it should be for greatest radiation quality. Generally speaking, the amount of heat radiated varies inversely with the metal thickness, this fact forcing the compromise just mentioned. Copper is the best metal to use in the core construction, but brass finds a very extensive place because of its being stronger so as to add to the mechanical rigidity of the built-up core. Where possible, however, in tubular types, copper tubes should be used in preference to any other. Some makers used copper in the forming of the cells of their cellular types with most excellent results. The use of any other metals in the radiator makeup should be discouraged due to chances for corrosion and rust. Some of the fittings are made of malleable iron in certain of the radiators on the market, but brass is better. If iron is used, it should be well tinned to prevent the destructive rust. Most good radiators have brass or copper tanks at top and bottom, also. Due to the unusual condition of brass being even more costly than copper at the present time, many radiators at the moment are being made with copper tanks instead of brass, but this is even better than brass, although under normal conditions it would be a more expensive construction. Copper is also easier to form, resulting in less wear on the dies.

There is some difference of opinion among radiator makers as to the advisability of making the core and shell separate, assembling them with bolts instead of soldering shell to core as an integral part. Some hold that the bolting of the core into a shell relieves the more delicate part of the strains that are set up by the frame, while others are of the view that such construction does not give as substantial a radiator unit, it after all being a question of solidly mounting the core so that vibration will not have a chance to work on the core.

Soldered-in Core Is More Rigid

There can be no doubt that the securely soldered-in core is more rigid as a whole, and that if the shell is of sufficient strength, any frame weaving will not have any very deleterious effect upon the core, but there is one strong point in favor of the separate shell. That is the matter of enamelling, for with the separate shell it is possible to give it as high a bake as is given any other metal part, this resulting in a more lasting enamel finish than can be obtained where the shell is integral with the core. In the latter construction the whole thing has to go in the baking oven, and the baking temperature must be kept down to prevent melting the solder. Ordinarily the solder will commence to melt at about 250 deg. Fahr., hence the baking temperature must be kept well below that amount to allow for any possibility of the temperature being higher in certain sections of the oven. This means that the enamel used has to be a low-baking variety, which is softer and not nearly so durable as that which is baked on at higher heat.

The matter of the size of the upper tank is an important consideration, more particularly where thermo-syphon cooling is employed. The depth of this tank for the pump-circulation system varies somewhat; with the average about 3 to 3½ in. so as to afford sufficient water to always keep the top of the tubes or cells covered. It being one of the requisites of a thermo-syphon radiator that there be sufficient head of water covering the tubes or cells, the tank in this case must be even larger, and they are usually extended back with considerable overhang to increase the quantity of water for the purpose. Tanks are frequently 5 in. deep, but there is a limit to the amount they can be allowed to extend back, due to the troubles in adequately supporting them, there being considerable weight when filled with water. Probably about 4 in. is the maximum amount they should extend back for good practice.

A well designed radiator core does not rely upon the solder to do more than act as an effective seal to the seams against water leakage. Solder is a very weak material and cannot be relied upon as a strength factor, hence the seams should be so formed that they hold together firmly due to their inherent construction, the soldering merely being for the purpose of making watertight joints. Most modern radiators are built with this idea in view, and there is much less trouble through seam leakage than there used to be several years ago before the radiator problem had been given such extensive thought.

There are a great many lesser details in actual radiator design that are important, but are given little thought save by the radiator makers themselves. One of the first of these is the matter of disposition of baffle plates or similar pieces within the tanks so that the water will be distributed properly throughout the core with no excessive amount flowing through one section. Usually the water enters the radiator upper tank at the center, and there must be internal webs or plates that will insure an equal amount flowing down throughout the extent of the core bank. At the bottom, the outlet is usually at one side, which is also a point requiring provision for equal drainage from all parts. It is not a difficult matter to insure this equal distribution, but, of course, the more elaborate the provision for it, the more the cost, although this is not out of proportion to the very advantageous results obtained.

Refinement that is especially appreciated by the car driver is the method of threading the filler cap and filler tube now practised by a great many. What is referred to is the cutting of the cap threads on the inside, which prevents damage to them in case the cap is dropped. It also has the advantage that the filler tube threads are outside, which obviates any possibility of hurting these through the use of funnels, etc. Yet, the writer was surprised to note only recently a new car brought out with the tube and cap threads in the opposite relation on its new shape of radiator; that is, filler threads were inside and cap threads outside.

Although it is hard to find any very logical reason for it, there is a growing prejudice against the V-radiator. Many are of the belief that it is not so efficient. Certainly it does not admit of as great core rigidity, and there seems to be some difficulty to give the water equal distribution. As a tendency, it seems to be giving way to the high and narrow type, but whether this is merely because of a change in car fashion or to real mechanical superiority of the latter is difficult to determine.

Although the radiator of to-day is a very effective unit, it still admits of a great deal of refinement and improvement, and radiator makers and car engineers should get closer together on this very important matter. As a general thing, the radiator engineer knows most about the subject of cooling, what the causes of inefficient engine cooling are, and what factors make for the best all-around efficiency.

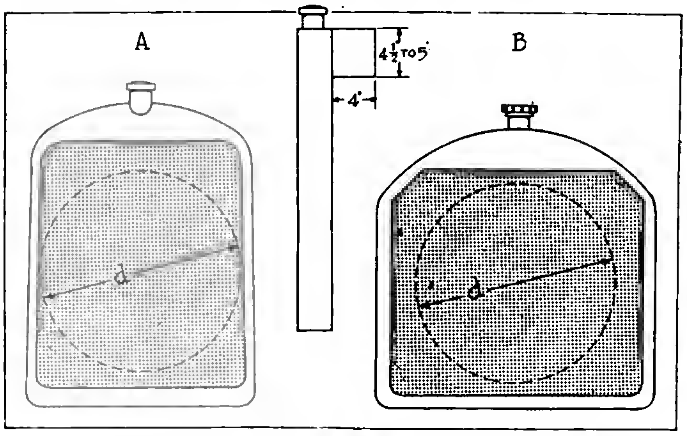
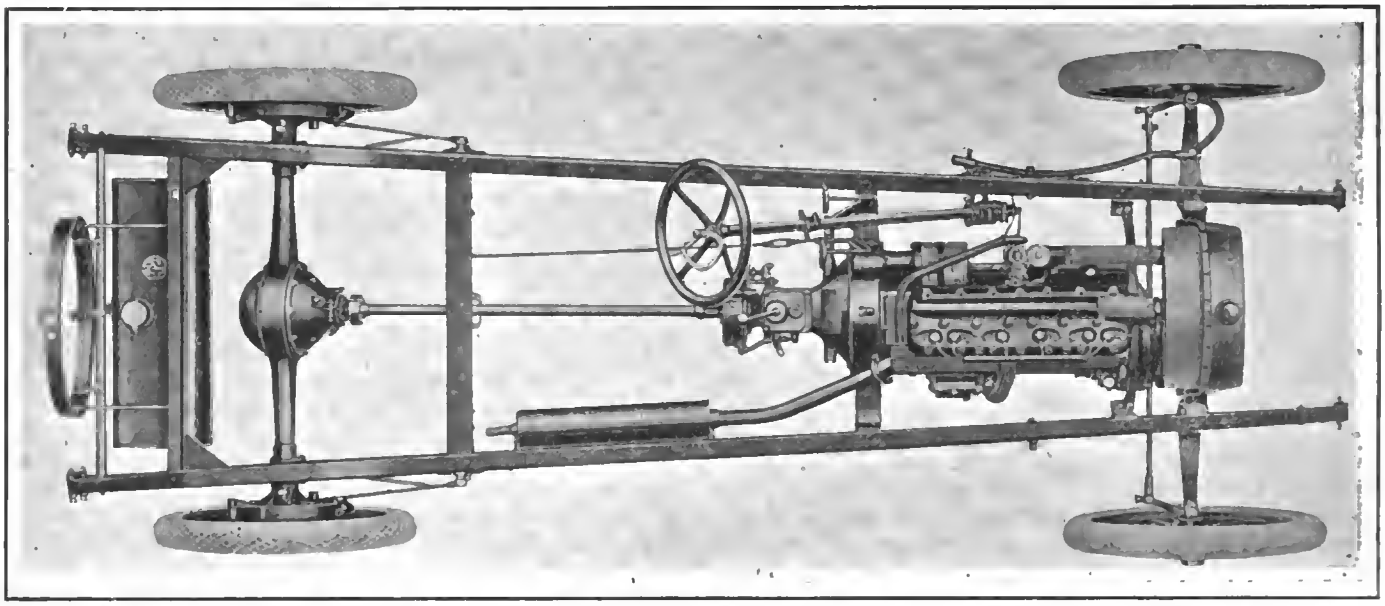


Fig. 1—Diagrams to show advantage of narrow radiator as regards fan diameter. Fan has same diameter in both cases, but it extends entire width of case in case A and leaves some space on either side of B

Fig. 2—Center—Size of upper tank for thermo-syphon should not be less than 4½ in. deep, nor extend back over 4 in.



Plan of Liberty chassis, showing the six-cylinder unit power plant, mounting of Delco electric units and straight taper frame

Colonial Body Lines in New Liberty Six

Five-Passenger Touring Car To Sell at $1,095—Other Models To Follow—Standard Units Make Up Assembly—Transmission Emergency Brake a Feature

ALL speculation as to the design and appearance of the Liberty car is now dispelled by the coming of the car itself. The Liberty is to be manufactured in large quantity by the Liberty Motor Car Co., Detroit, Mich., one of the newcomers of last Fall, which is headed by Percy Owen, formerly prominent in the field as sales manager of the Chalmers company and later connected with the Saxon concern. Things have been moving rapidly since Mr. Owen organized his new company, and not only are the first cars on the road, but within a very short time the first production models will be coming through.

Standard Units Used

The Liberty might be considered as new in body and general design, though its parts are mostly known to the motorwise. It has a six-cylinder Continental engine, Delco electric equipment, Timken axles, Borg & Beck clutch, Detroit Gear & Machine Co. gearset, Rayfield carbureter and Stewart vacuum fuel feed, among other features. At present only a five-passenger touring model is to be supplied, and this is to sell for $1,095.

Built on a wheelbase of 115 in., the Liberty has sharper angles and straighter lines than are usually to be found in the body shapes of the day, but these have been blended into what might be a colonial tendency, the various curves being carefully proportioned to produce a harmonious effect. There is no bulge at the sides of the cowl, and simplicity at the front is brought out by the sharp edges of the rather high and narrow radiator, these being carried back by both the hood and the cowl. In addition, the car is hung low, and has a lengthy appearance, as shown in the illustrations.

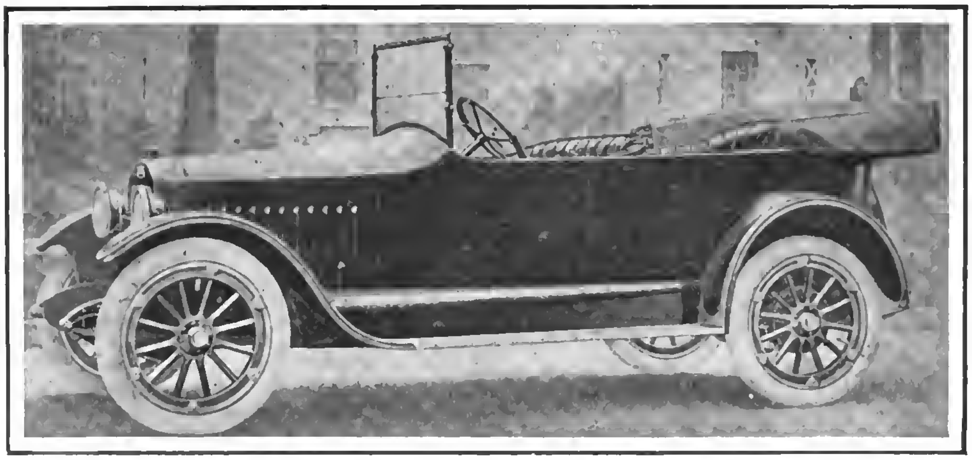
Front view of new Liberty six

In addition to this unique body design, there is another point that immediately becomes evident upon examination of the chassis—the extreme simplicity of the mechanism. By using the Hotchkiss type of drive through the springs, and by placing the emergency brake system forward on the transmission, a point that will be touched upon more in detail later, it has been possible to produce a chassis that is about the acme of simplicity. No rods of any kind nor other complications are to be found back of the power plant, with the exception of the one rod which controls the foot brakes on the rear wheel drums. An idea of this can be gained from a glance at the plan view of the chassis.

Cooling Is by Thermo-Syphon

The six-cylinder motor has a bore of 3⅛ and a stroke of 4½ in., which dimensions give a formula rating of 23.4 hp. with a displacement of 207.1 cu. in., making it evident that there is plenty of power for the chassis, which is really very light. This power plant follows usual Continental six-cylinder practice, with the single exception that the cooling system is of the thermo-syphon type instead of being by a pump. In changing to this simplified method of cooling, specially-designed waterjackets were formed and rather unusual precautions taken against any restrictions in the water passages due to core sand, core wires, fins or other foreign matter.

Built with the head detachable and the upper portion of the crankcase in unit with the cylinder block, a very rigid and substantial construction results. Being integral with the bear-



Liberty six-cylinder, five-passenger touring car which sells for $1,095. This car has a wheelbase of 115 in., the motor is 3⅓ by 4½ in., and 32 by 4-in. tires are used. Other features are the single dry-plate clutch, transmission emergency brake and reserve gasoline supply

ings that carry the crankshaft, there is no possibility of misalignment between the cylinders and the crankshaft—a feature that is conducive to smooth running and absence of vibration. There are three main bearings for both camshaft and crankshaft, and the moving parts are balanced accurately, pistons and their assemblies being of equal weight throughout.

Cast integral with the head is the large water outlet connection, and on the right are the valves and exhaust manifold as well as the generator and fan drive. The carbureter and starting motor are the main units on the left, the former bolting directly to the cylinder casting high up, with distribution of the incoming gas through cored passages within the casting to the intake ports on the other side. This feature not only makes a simpler motor, but assists in gas vaporization, due to the cylinder heat around the passages. Valves are completely inclosed by two pressed steel cover plates.

Oiling by Force Feed and Splash

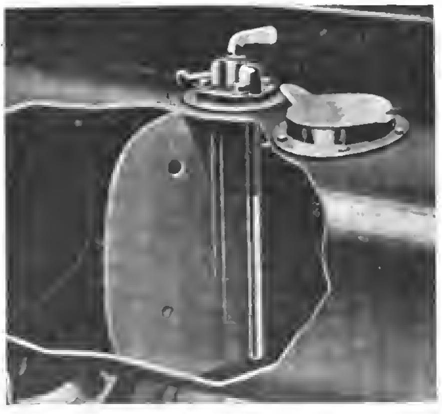
In line with standard Continental design, the lubrication system is a combination force-feed and splash arrangement, whereby the oil is forced through copper tubes direct to the main bearings and the timing gears by a horizontal plunger pump driven by an eccentric on the camshaft. This lubricant then drains back into the oil pan and maintains the splash troughs under the connecting-rods at a constant level. There is an oil pressure gage on the instrument board and a filler gage on the side of the crankcase.

Liberty is among the first to be fitted with the new two-unit Delco starting, lighting and ignition system, in which the ignition distributer and coil are in unit with the generator, the whole being driven by a horizontal shaft on the right, and the starting motor is attached on the opposite side close to the flywheel housing. Starter drive is through the Bendix automatic shifting mechanism, which meshes a pinion with the flywheel gear when the starting current is switched on by a pedal, and automatically demeshes when the engine gets under way and the speed of the flywheel exceeds that of the starter driving shaft. In connection with the control of the ignition distributer, a detail worthy of mention is the use of a flexible wire cable to turn the distributer on the principle of an antenous release. This does away with a complicated set of levers and rods ordinarily employed to actuate the distributer from the lower end of the steering column, especially when the distributer is on the opposite side as in this case.

Single Dry Plate Clutch

Clutch and gearset are in unit with the motor, and they are arranged to go together very compactly. This is due in large part to the simple single-plate clutch. The plate runs dry and is held in engagement by a pressure of about 2500 lb., which is obtained by stepping up the force exerted by a 200-lb. spring by means of a series of levers. Thus it is practically an impossibility to have clutch slippage with such a large force holding the engagement, and at the same time a reducing linkage makes the throwout very light, it being possible to depress the clutch pedal with the forefinger. The driven plate is held in engagement between two wire-woven asbestos disks, and due to the clutch design, these can be used until entirely worn out with no detrimental results. Adjustment is only a matter of removing the clutch cover plate and shifting two bolts.

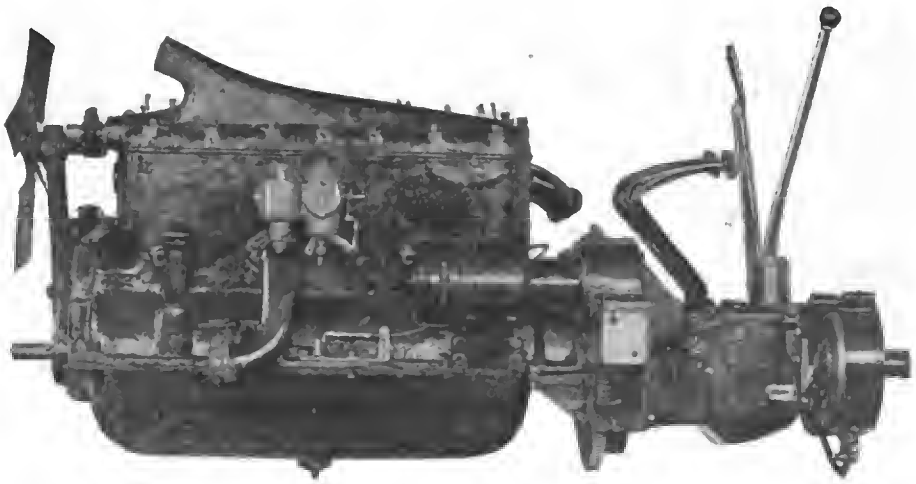
Roomy driver's compartment of new Liberty six



Partition forming 3-gal. reserve compartment in gasoline tank

A feature not often found on American cars is the emergency brake on the transmission shaft. This is just back of the gearbox and ahead of the front universal joint, bringing it about as close as it could possibly be to the brake lever. The brake consists simply of a drum on the shaft, with an external contracting band around it, this band carried by a yoke attached to the gearbox. The arm of the brake lever attaches directly to the brake rod, greatly simplifying the control. This type of brake, used extensively on foreign cars, simplifies the rear wheel system and obtains the added leverage of the rear axle gear reduction which multiplies the braking effectiveness and requires less effort to stop the car. Further, both rear wheels get an equal retardation, there is less chance for brake road rattling and by bringing the brake forward, adjustment is merely a matter of lifting the floorboard. The emergency drum is 8 in. in diameter by 2½ in. wide, giving a braking surface of 63 sq. in. The service brake drums on the rear wheels have external contracting bands, and are controlled in the conventional way, with the equalizer placed under the intermediate cross member of the frame. These drums are 12 in. in diameter by 2 in. wide.

Having incorporated most of the mechanism with the power plant, even to bringing the emergency brake for-



Intake side of unit power plant used in Liberty six, showing high carbureter mounting

ward, it is evident that the rest of the chassis admits of marked simplicity. The driveshaft, fitted with a universal at each end, is a tubular member that is light in appearance yet amply strong for its work. It conveys the power to a Timken semi-floating axle that has a pressed-steel housing with axle tubes that are swaged and electrically-welded to the housing. The driving gears are of spiral-bevel form, and a two-pinion differential is fitted. The whole mechanism is carried on Timken roller bearings; two back of the drive pinion, one either side of the ring gear and one at each wheel. The standard gear ratio is 4 11/16 to 1.

In order to take the drive and torque, as is required of them where the Hotchkiss drive system is employed, the rear springs are of ample size, being 50 in. long by 2 in. wide, with the master leaves plenty large to care for their additional duties. These springs go directly under the frame rails to give good support, and are semi-elliptic. The rear end of the frame rails are bent down to take the end of the springs, which go under the axle tubes. Thus the springs are almost flat normally and efficient spring action is obtained, while at the same time the body is hung low. The front springs are also of the flat type and measure 38 in. long by 1¾ in. wide.

Straight Taper Frame

Special mention should be made of the frame, which is not only of a deep channel to form a rigid ground work for the body and running gear, but is a straight taper from front to rear. This allows of a short turning radius of 20 ft., and at the same time makes a substantial support for the body along its entire length. The channel is 5 in. deep, has a width of 2¼ in. and is made from ⅛ in. metal.

Special attention has been paid the detail refinements that mean much for the convenience of the car owner. At the sides of the windshield, for instance, it is often difficult to make the side curtains fit snugly against rain or wind. To take care of this, rubber strips have been provided here as well as at the bottom of the shield, effectively sealing the compartment when the curtains are up. Then the door curtains are made to swing with the doors, making entrance and egress free without damage to the curtains.

Unusual Gasoline Tank

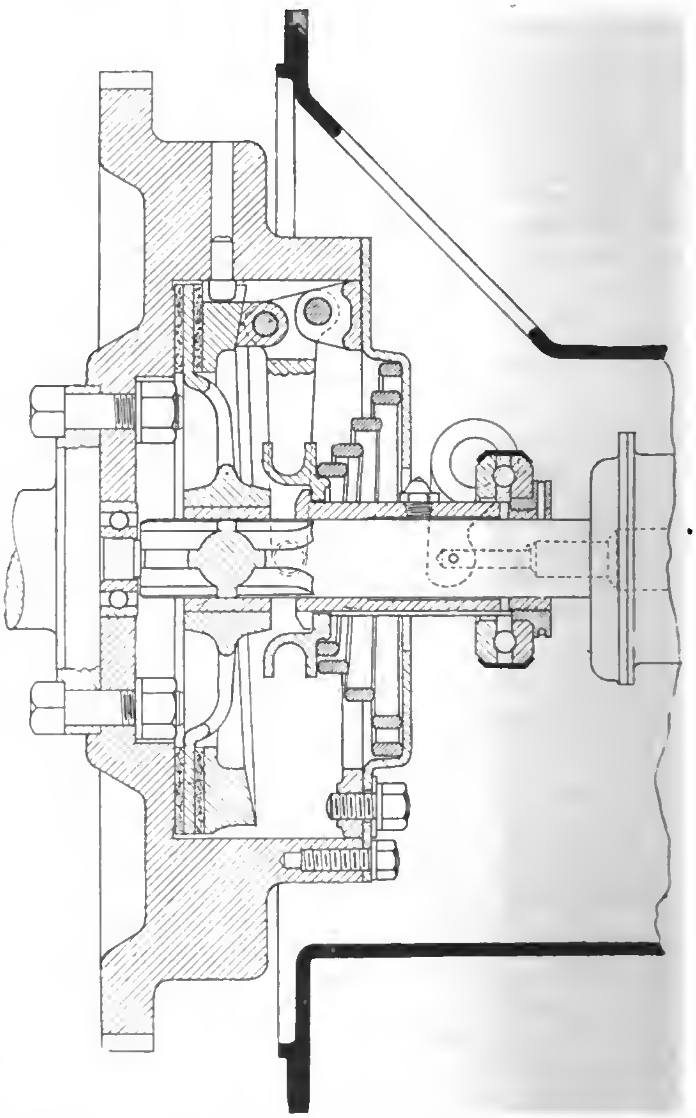
Another feature is the specially-designed gasoline tank at the rear of the chassis. It incorporates a reserve compartment that holds 3 gal., this being formed by means of a dividing wall perforated by two ½-in. holes located well up toward the top of the partition. When the main tank is filled to the height of these holes, gasoline flows in to fill the reserve compartment, and two tubes, one on either side of the partition terminating in a three-way cock and leading to the main gasoline line, constitute the simple control. Normally fuel is drawn from the main tank, but should this become empty, the control cock is turned and the reserve supply becomes available.

Other Bodies Planned

Grease cups on the spring shackles and at other chassis points have been discarded in favor of oil cups. As an example of the installation of these cups, all shackle bolts are drilled and two small wicks are inserted, the bolt being slightly flattened along the line of these wicks. It is explained that the cups are easily filled with oil, and that it has been found that lubrication is more satisfactory this way than where grease cups are used.

In addition to the five-passenger touring car, the Liberty company expects to build on the same chassis a number of open and closed type bodies. Among these is a close-coupled four-passenger open roadster, besides which there will be a town car that is promised to be of elaborate finish.

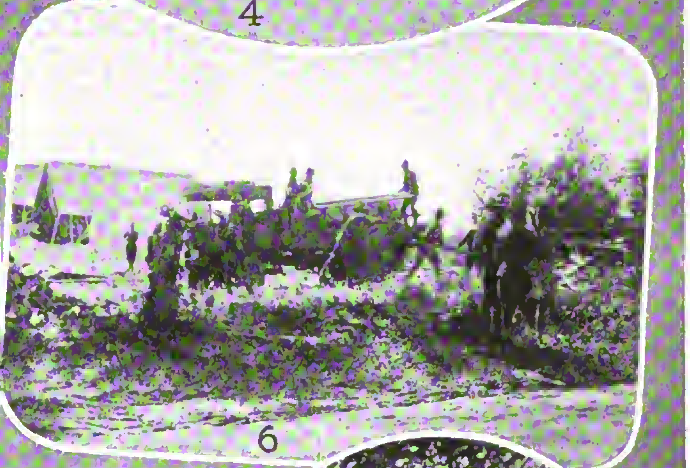
Tires are 32 by 4 in., non-skid in the rear.



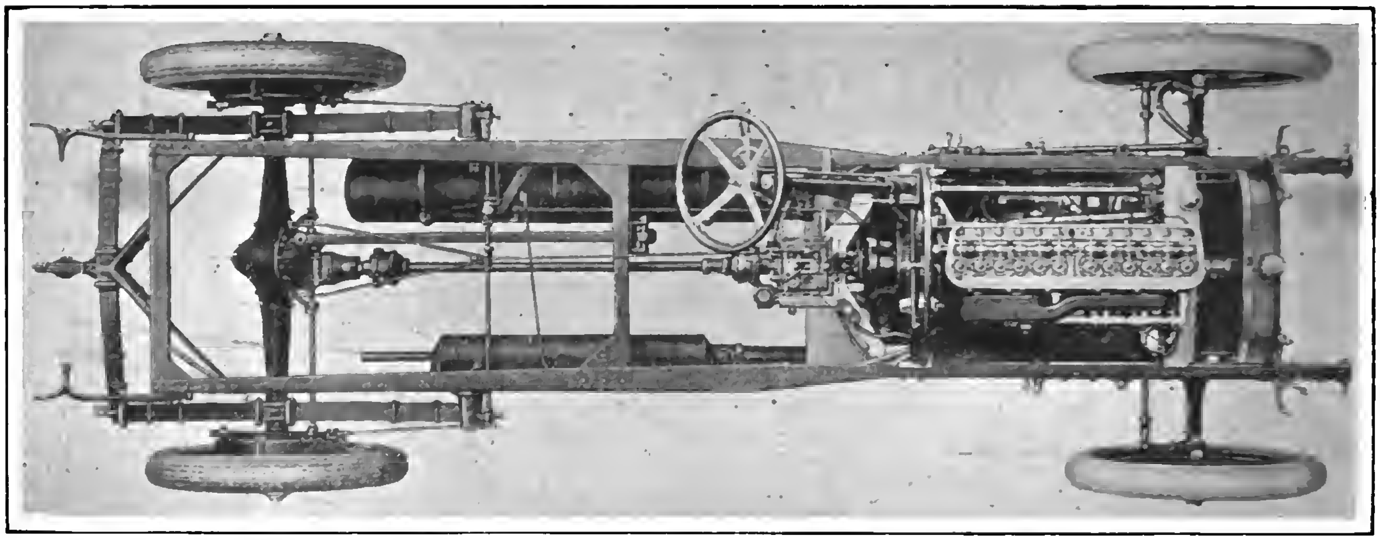
Section of simple single plate clutch used in Liberty six. The plate is held in engagement by a pressure of about 2500 lb., being stepped-up through a series of levers from a 200-lb. spring. Thus the action is soft and the effect large

Trucks Aid Militia Mobilization

Serve in Many Capacities at Camp Whitman



1—*Unloading pipes for water supply from 5-ton Saurer*
2—*White 1½-ton truck and army wagon as trailer coming into camp*
3—*Garford 3-tonner with army wagon on way to Camp Whitman from supply station at Peekskill*
4—*Garford 3-tonner owned by W. F. Chambers & Sons of Peekskill and hired for hauling at Camp Whitman*
5—*22nd Engineers strengthening a bridge*
6—*Unloading sanitary equipment from Garford 3-tonner*
7—*White 1½-tonner arriving at Camp Whitman with army wagon as trailer after 2-hr. trip from Peekskill*
8—*White 1½-tonner used in telephone service along the route to Camp Whitman*



Plan view of 1917 Dorris six chassis, showing overhead valves, unit power plant, platform rear spring and tire carrier brackets. Note the cylindrical gasoline tank mounted beside the left frame member

Dorris Oiling System Now Force Feed

Better Body Design and Racing Type Radiator Improve Appearance of 1917 Model—Top Has Also Been Re-Designed—Few Changes in Chassis Construction—Price Is Continued at $2,475

AN entirely new car in looks, the Dorris model IB-Six for 1917 has a new body of better lines and a radiator which is a distinct departure from the former type. The mechanical changes are few, in fact no radical alterations have been made except in the oiling system, which is now of the force-feed type. The price of $2,475 remains unchanged.

The fundamental construction of the Dorris car has not been changed in 11 years. Features of the design which have weathered the tests of time and are even at this date most up-to-date practice are: valve-in-the-head motor with valves actuating from one camshaft, unit power plant, multiple-disk clutch, Timken axles, platform rear spring and 22-in. fan-type flywheel. The car has a 128-in. wheelbase and is fitted with 36 by 4½-in. tires.

The 4 by 5-in. six-cylinder motor was introduced last year with practically the same elements of design as characterized the four. The oiling system for the 1917 model takes care of all motor bearings and the overhead rocker arm bearings from the pressure pump. Oil is forced to the wristpin bearings through a copper tube embodied in the crankshaft drop forging. The breather tube opens into the inclosed overhead valve compartment, utilizing what oil vapor is given off for a valve lubricant. Of course this is only an added source of oil supply as the rocker arms are hollow and oiled direct from the pressure pump.

An added feature in the oiling system which, although a very small item, is of unusual value to the car owner, is the petcock drain, in place of the usual pipe plug. This drain cock is easy to reach and permits the owner to drain his crankcase regularly without inconvenience. Dorris lays particular stress on this matter of cleaning out the crankcase, because of the poor grades of oil and gasoline now on the market.

Radiator of Racing Style

The new body is of striking originality. The radiator is patterned after that used on the Peugeot racing cars. Both the front and the back seats will comfortably carry three people. Body refinements are noticeable throughout. As another step towards simplicity and accessibility, an aluminum dash is fitted which is made a part of the chassis itself. All electrical wiring is carried on this dash and none of the fittings have to be disturbed when occasion demands that the body be removed.

The one-man top has been redesigned, with a view to creat-

Dorris six-cylinder touring car for 1917 which sells for $2,475 ing a conformity between the body lines and the top itself, with striking results. Although the height of the top is sufficient to give clear vision to the occupants of both seats and allow entry with but very little stooping, the design has been so worked out that the extra height is not noticeable.

Curtain Refinements

The Dorris idea of perfecting every item, no matter how small, is evident in the construction of the side curtains. Irons are provided which fit to the back of each door attached by the aid of thumb screws. The curtains fasten solidly to the top and body on one end and slide over these irons on the other, making an assembly which permits opening and closing the doors without unfastening the curtains. A flap is provided over the rear window of the top which can be let down during night driving when the glare of street lights throws a reflection through the rear window onto the windshield, hindering the vision of the driver.

Although the Dorris chassis design has been refined rather than changed for a number of years a résumé of the principal characteristics will show how thoroughly modern each unit is. The crankshaft is suspended on seven bearings, eliminating any possibility of a sprung crankshaft or a vibrating crankshaft. The camshaft is carried on the same number of bearings, and, according to the factory, this construction is invaluable in a large six to maintain rigid cams and thus establish perfect timing under any conditions.

Valves Easily Removable

Each valve is set in a cage which is readily removable with the aid of a wrench. The push rods, which float between springs on the upper and lower end, are actuated from the camshaft by the means of rollers. The assembly which contains the rollers is kept from revolving by the aid of steel pins sliding up and down in slots within a brass shell. Perfect action without noise and maximum reduction of wear are claimed for this design.

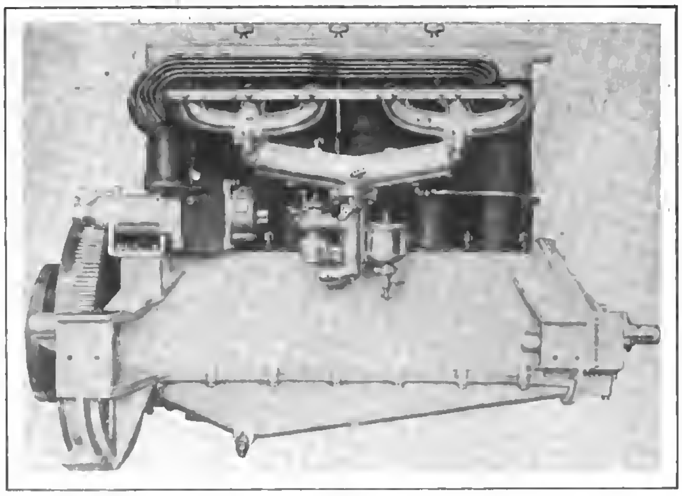
Although the power plant is a unit with the motor it is not inclosed in a housing integral with the motor as is usual practice. The reason for this is that the large flywheel contains fan blades which assist in the motor cooling and carry the heat away from the front seat floorboards. To enable the air to circulate from this fan, the gearset is fastened to the motor with arms which are a part of an aluminum casting.

The gear train drive of the starter has been discontinued and the Bendix system is used in its place. The two-unit Westinghouse starting and lighting system and Bosch magneto ignition are continued without material change except in the starter drive as mentioned above, and the routing of wires from the new aluminum dash described previously.

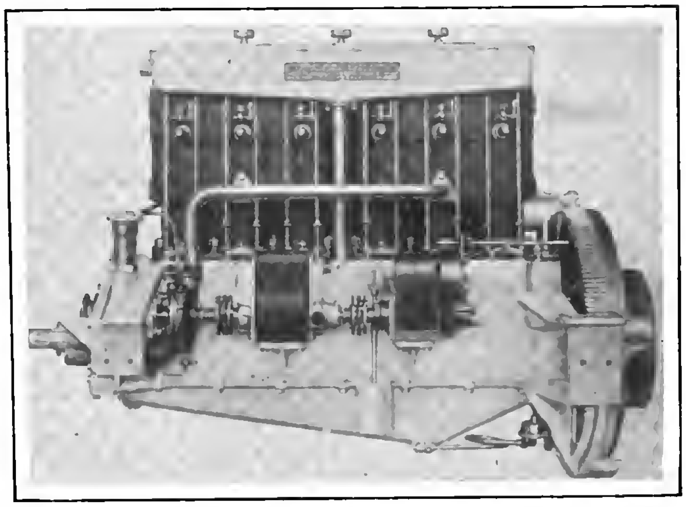
Dorris has long been an advocate of platform spring suspension. The new car is carried on exceptionally large springs, the rear side members being 50 in. long and 2½ in. wide, with eight leaves; the cross spring is 40 in. long by 2½ in. wide, with eight leaves, and the front springs are 42 in. long by 2½ in. wide with ten leaves.

For the rear axle a Timken product is again used with spiral bevel drive and 2½ in. wide brakes of large diameter. The torque is taken care of through a forged torsion bar suspended between the rear axle and a bracket on the center cross frame member.

A peculiar little detail that seems to make for convenience and better distribution of weight is the use of a pressed steel cylindrical gasoline tank located next to the left side member of the frame. This placing enables a filler and a gasoline gage to be arranged so that they stand almost flush with the front floorboard; the gage can be seen at any time by glancing downward, and the filler is accessible by merely opening the side door. A Stewart vacuum feed is employed for raising the fuel to the carbureter.



Right side of 1917 Dorris six-cylinder motor, showing arrangement of intake and exhaust manifolds and mounting of carbureter



Left side of the motor, showing the mounting of the ignition and lighting units. Note the inclosed overhead valve mechanism

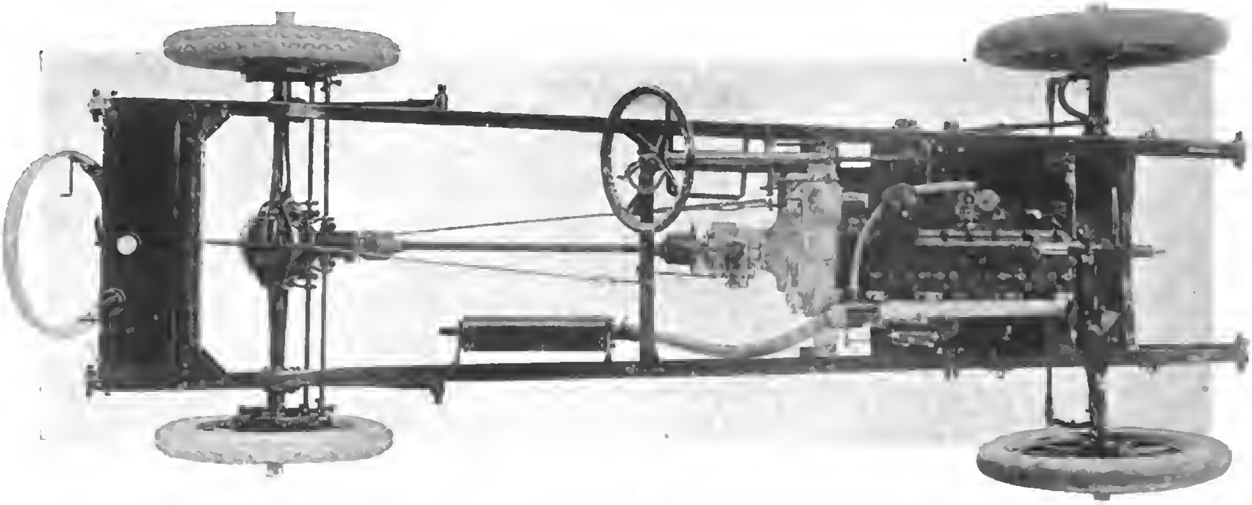
Every part of the car but the body and axles is Dorris built. The gearset retains the feature incorporating a locking device by means of which the gears cannot possibly be shifted until the clutch is released, and there is no possibility of more than one gear being engaged at a time.

The equipment of the new car is complete, including Stewart tire pump and horn.

Spending $22,605 for Shop Economy

FORD, ONT., June 24—Big economies sometimes cost considerable money. This was illustrated at the factory of the Ford Motor Car Co., this city, where the rearrangement of the machine shop cost $22,605. Four hundred new machines costing $325,000 were installed in the new machine shop opened recently, the floorspace being increased by over 2 acres. The progressive assembly system demanded that 1300 heavy machines be moved to new locations, so that successive operations might be performed on adjacent machines. To move these, Ford pony cars of the type used to haul material from one part of the factory to another were brought into service. These were attached to one, two and three and even four machines, which were dragged along the floor of the factory. In some cases the hauling was for almost the entire length of the machine shop. 705 ft. Labor and materials for putting in the new machines cost $13,375, and the expense of removing the old ones was $9,230.

Two-Unit Electric System in New Moons



Chassis of the 6-66 model Moon for 1917. Note the clean design and general simplicity of the assembly

Two Sixes Are Continued for 1917 as Models 6-66 and 6-43—Automatic Spark Advance Used—Four-Passenger Roadster Added for Larger Chassis

IN accordance with its plans to adhere strictly to the construction of high-grade six-cylinder cars, the Moon Motor Car Co., St. Louis, Mo., will continue its two 1916 chassis for the coming year. The model 6-40 is continued with but few changes as the model 6-66 and the car of later design known as the 6-30 in the 1916 production will be continued as the model 6-43. The price of each has been increased. The larger car which was listed last year at $1,475 now sells for $100 more and the small six has been increased in price from $1,195 to $1,250.

Two-Unit Electric System

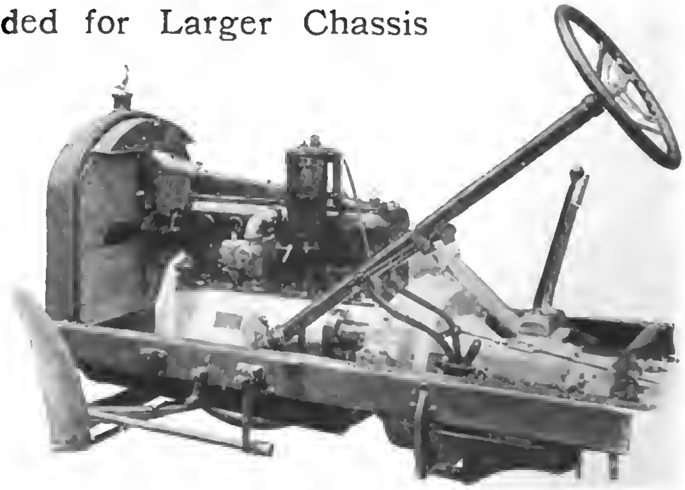
The most noticeable change in both chassis is in the electrical system, a two-unit outfit being used in place of the single starting and generator equipment of the 1916 models. The new Delco-Moon two-unit system embodies an automatic spark advance and a new switch with an ammeter in connection.

The bodies have also been refined and the 6-66 touring now has the tonneau cowl. The tops of the bodies have been tumbled in, creating a marked streamline effect. Acting upon the great demand for four-passenger roadsters, the larger six is offered with an unusually attractive body of this type at the same price as the touring car. A light six can be had in a three-passenger roadster at the same price as the five-passenger touring car.

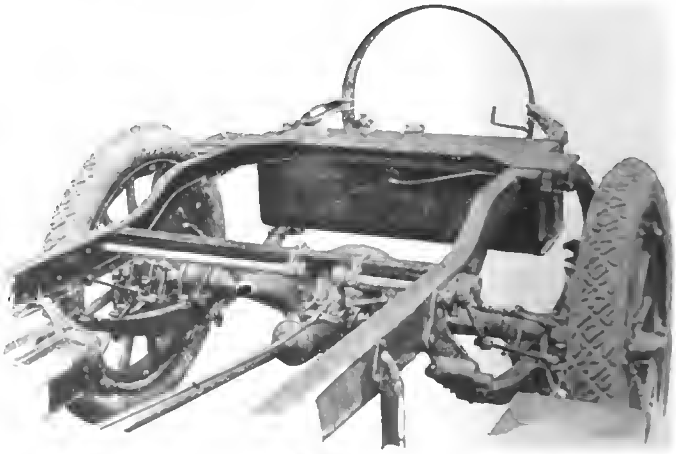
The two models are mechanically similar, the difference being principally in the size of the parts. Continental motors are used of 3¼ by 5¼ and 3¼ by 4½ cylinder dimensions fitted with Delco cranking, lighting and ignition units and the Stewart vacuum feed system. The clutch is disk in unit with the motor, the gearset a three-speed selective type and drive is by a hollow shaft to a floating axle. Timken axles are used, front and rear.

Bendix Drive Used

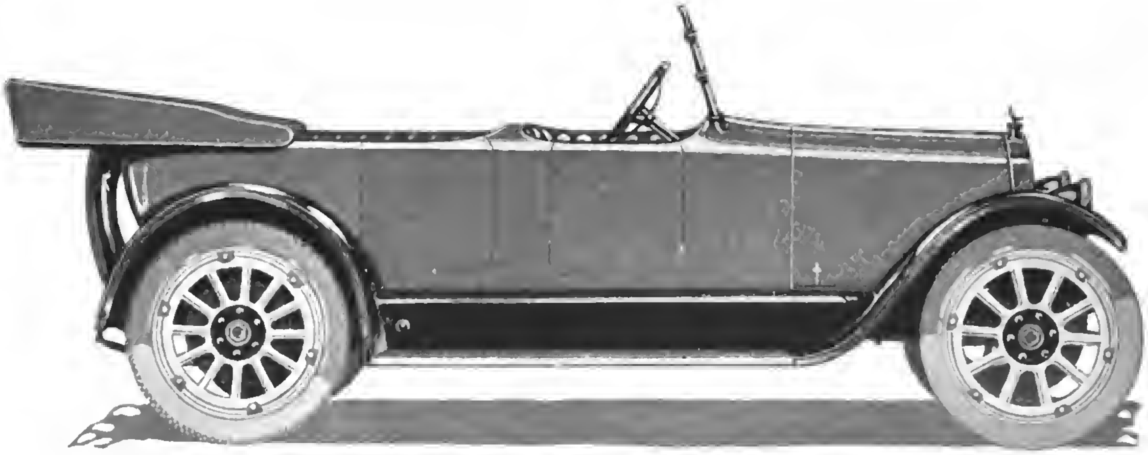
The adoption of the double unit Delco system is accompanied by the use of a Bendix system of drive on the starting motor which is now bolted to the left side of the crankcase.



Intake side of the power plant of the Moon 6-43 model for 1917. Note the absence of complications and the general accessibility. The carbureter is mounted high and the Stewart vacuum fuel feed tank is close beside it. Note the flexible exhaust pipe



Rear construction of the new Moon chassis, showing the rear springs slung under the axle, Hotchkiss drive being used. Note the strong brake linkage and the gasoline tank supports which are integral with the frame



Moon 6-66 touring car which has a tonneau cowl and slanting windshield. Ncte the smooth body lines

The generator is still located on the right side of the motor and is driven from the water pump shaft. On the right side also is the exhaust manifold which has attached a flexible tube instead of the non-flexible type commonly used for carrying off gases. The oiling system in both motors is the same combination splash and force feed as used in other large Continental power plants.

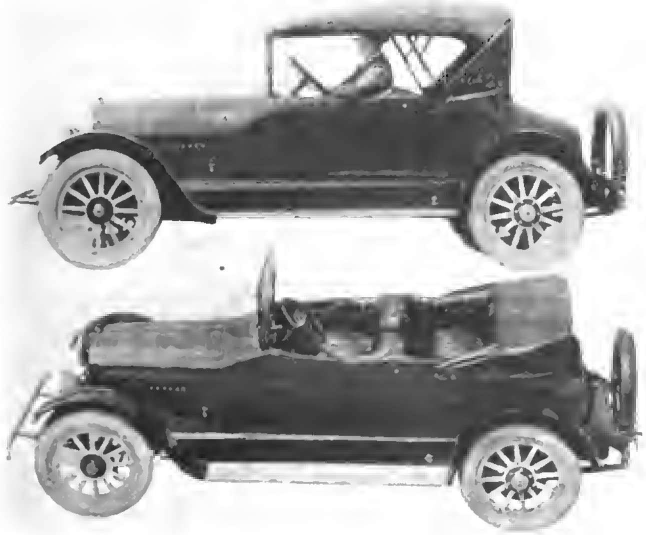
Hotchkiss Drive Employcd

The drive from the motor is conducted to the rear axle through the Hotchkiss principle, double universals and a floating axle being used. Moon engineers have carefully worked out the framing design to take care of the Hotchkiss drive. The frame is of bottle-necked shape in front to enable a short turning radius and is constructed in the rear to form an integral support for the gasoline tank and tire irons.

Although accessibility has been a big factor in the design of the chassis throughout the same careful attention has been given the deslgn of the bodies and the kind and location of the equipment. The touring car tonneaus are unusually large with wide doors having concealed hinges and locks. Both front doors open wide, permitting the driver to enter from either side. Upholstery is of genuine leather, stuffed with curled hair. A slanting windshield has been incorporated to enhance the speedy lines of the cars and a Stewart tire pump and Warner speedometer, driven from a gear which constitutes the flange on the front universal, are standard equipment on both models.

Tires Larger on Big Six

Tire sizes have been increased on the big six. The 6-66 is equipped with 35 by 4½ in place of 34 by 4 tires and the 6-43 carries 34 by 4, the same size as last year. The wheelbase of the larger car, model 6-66, is 125 in., while that of the 6-43 model is 118 in.



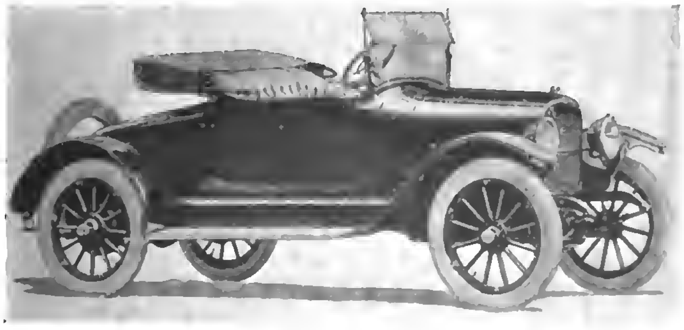
The new Cole eight-cylinder four-passenger Tuxedo roadster

Cole Adds Four-Passenger Tuxedo Roadster Model

CONCENTRATION on the production of one chassis enables the Cole Motor Car Co., Indianapolis, Ind., to offer a wider variety of body styles than heretofore. Distinctive among the new types is the four-passenger Tuxedo roadster mounted on the eight-cylinder Cole chassis. This new model is practically a small touring car, built for four passengers but with sufficient room for traveling accouterment.

Ample Storage Space

The Tuxedo model has a divided center cowl and a rear deck which contains a roomy baggage compartment accessible by tilting the back of the rear seat forward a few inches, furnishing an air, dust and waterproof compartment. There is also a special alcove in the back of the front seats which makes possible additional knee room and foot comfort for those riding in the rear seat. Vanity pockets on the sides of the car afford convenient repositories for veils, goggles and other traveling equipment.



Allen 37 four-cylinder 1917 roadster selling at $795

Allen Brings Out New Roadster

A NEW two-passenger roadster has been brought out by the Allen Motor Car Co., Fostoria, Ohio, selling at $795 f.o.b. the factory. It is mounted on the standard Allen chassis fitted with a 3¾ by 4 in. four-cylinder block unit power plant. The 112-in. wheelbase and 55-in. rear springs insure easy riding qualities, the seats being carefully proportioned and fitted with deep cushions. There is a big waterproof rear deck compartment and the body and wheels are finished in olive green with radiator, hood, fenders and running gear in black enamel.

King 8 on 2-Weeks' Endurance Run

The New York City police had a field day at the speedway but the King eight kept on its way

SHEEPSHEAD BAY, N. Y., June 27—Running steadily, day and night, and circling the board track at a speed of more than 30 m.p.h., the King model E stock car, which started upon its non-motor-stop run on Thursday, June 15, has now completed over 9000 miles of its journey. The motor has never been stopped for a second since the test started, and when it comes to its close on Thursday, June 29, it will have run continuously for 2 weeks.

This test is designed to show the dependability of the car under conditions which are similar to those of actual use by an owner, but more severe as far as average speed is concerned and as far as continued running has its influence. In the 2 weeks of continuous motor running the car will have traveled a distance equivalent to that given in 2 years of service by the ordinary owner. At the end of the first week of travel nearly 6000 miles had been covered or as much as the average car owner will drive in 1 year, and this without a single stop of the motor. Since the car started on its journey at 12.14 on June 15, the crankshaft has not stopped revolving.

In carrying out this test the King company has established a headquarters on the speedway, having moved a corps of drivers and mechanics to the spot and also provided quarters for the American Automobile Assn. officials, under whose direction the test is carried on. The committee in charge is made up of F. E. Edwards, chairman, J. Edward Schipper, Harry A. Tarantous and Fred Elsner. The drivers each take the wheel for 5 hr. at a stretch and have 10 hr. rest between periods. The mechanics are also riding under similar conditions, the same mechanic always being with each driver. The drivers are men from the experimental and testing departments of the King factory in Detroit, and the car is one taken from the regular production in the factory and has been certified as standard stock throughout.

The entire equipment of the car is also stock, even to such small details as the voltage of the lamps, etc. The car is being driven at a speed of very close to 30 m.p.h., the average being somewhat higher than that as it passed the 9000-mile mark.

The whole distance has not been covered on the board speedway, as the car was driven 200 miles over the roads of Long Island during the morning and afternoon of Saturday, June 24. During this time the car was off the track for 9 hr. continuously and was put through touring conditions of hilly country and variable road conditions before returning to the track and continuing its circuit around the same bowl which has staged the Astor cup races and other races.

While the official figures have not yet been checked over and announced by the A. A. A. officials, it is expected that the gasoline and oil consumption of the car will be very low in spite of the 30-m.p.h. speed and the difficult weather conditions such as continuous rain, thunder storms, varying temperatures and humidity, etc. The windshield is up, and besides the driver and mechanic in the front seat, the tonneau of the car is ballasted with sand bags to represent a passenger load. The top is in place but is carried in its down or closed position and an extra tire and rim is carried on the rear so that throughout from one end to the other the entire car is in the same condition as it would be placed on the road by the ordinary owner.

At the conclusion of the test the engine will be torn down and rechecked for the information of the A. A. A. and also for engineering inspection by the King company. During the course of the run there has been no decrease in power of the engine, but, as a matter of fact, while on the track the car has been driven with the hand throttle, and for the same throttle opening higher speeds have been made than with the

Official send-off of the King eight on its 2-weeks' run by Starter Wagner original setting. The tire equipment of the car is exactly the same as stock with Firestone plain tread in front and Firestone non-skids in the rear. The extra tire carried is a Firestone non-skid. The gear ratio is also standard, and while traveling the lamps are carried lit for a large percentage of the time, giving the lighting system as rigid a test as the other parts of the car.

The car making the run has a 3 by 5-in. V motor with a formula rating of 28.8 hp. and a piston displacement of 282.7 cu. in. The motor is cast in blocks of two and is made by the King company. Lubrication is by pressure; Atwater Kent ignition is used; a Ball carbureter with a hot air pipe and vacuum feed is also used. A Ward Leonard starting and lighting system is another feature. Other features include: plate clutch; spiral bevel drive; the car is driven through the springs; has floating rear axle and 33 by 4-in. tires.


Replenishing the supplies of the non-stop-motor King eight

A New Demountable Rim Patent

Hydraulic Pressed Steel Co. Secures Rights on Wood Wheel Rim and Also on New Steel Wheel

TWO new demountable rim constructions which are claimed not to infringe the Perlman patent have been granted by the U. S. Patent Office to O. A. Parker, manager of the wheel department of the Hydraulic Pressed Steel Co., Cleveland, Ohio. The company states that it assumes from the granting of these patents that the essential feature of the Perlman patent is the use of a single nut or similar device which operates a wedge holding the rim both laterally and radially. In the new patents the rim is secured radially by one set of attachments and laterally by another. Further, it is claimed that these individual attachments are of great value in that they prevent the rim from being misplaced. Since neither the radial nor the lateral attachments have a wedging action and simply exert straight pressure, it is possible to tighten one completely before passing on to the next. There is no need to tighten the various securing nuts progressively.

The Wood Wheel Rim

The nature of the invention is shown clearly in the accompanying illustrations. Taking the wood wheel first, this has a felloe band with a flange, which is not coned but merely stands square to the wheel. On one side of the demountable rim, beside the valve hole, there are some dowel pins which take the drive. Opposite the dowel pins several bolts or set screws are threaded radially through the felloe. Close to these radial bolts are two or three transverse bolts by means of which small tongues of steel are drawn against the outer edge of the detachable rim, so pressing it laterally against the flange at the back of the felloe band. To attach the rim the valve dowel pins are hooked into the holes provided for them and the rim is then pushed on the wheel. The lateral clips can then be tightened, pressing the rim back against the shoulder on the felloe band and a few turns of the radial bolts will then complete the locking.

The Steel Wheel Construction

The steel wheel operates on much the same principle and is based upon the already well-known Parker steel wheel. In this case there is no felloe band, the rim attaching to the ends of the spokes. These spokes are provided alternately with radial locking bolts and lateral clips, the detail being shown very clearly in the illustration.

It is claimed that the new rims are lighter than the majority of demountable patterns and that they have a manufacturing advantage in that no hot-rolled parts are required, the rims being rolled up from ordinary sheet. It is announced by the Hydraulic Pressed Steel Co. that it will be in a position to commence deliveries on a large scale almost immediately.

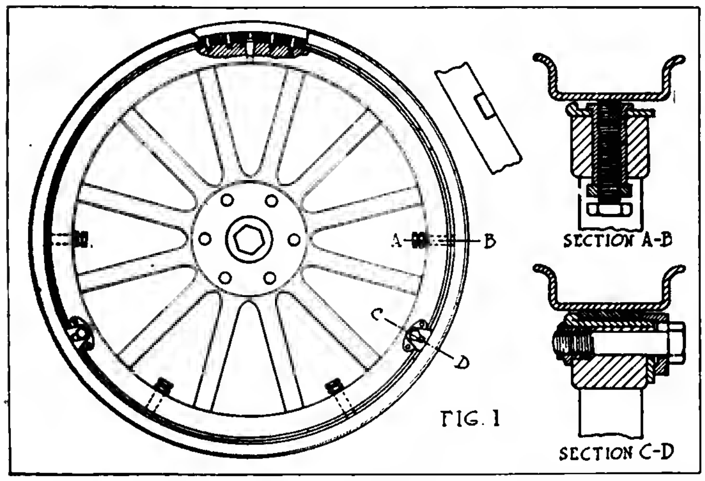


Fig. 1—Elements of Parker patent on demountable rim construction.

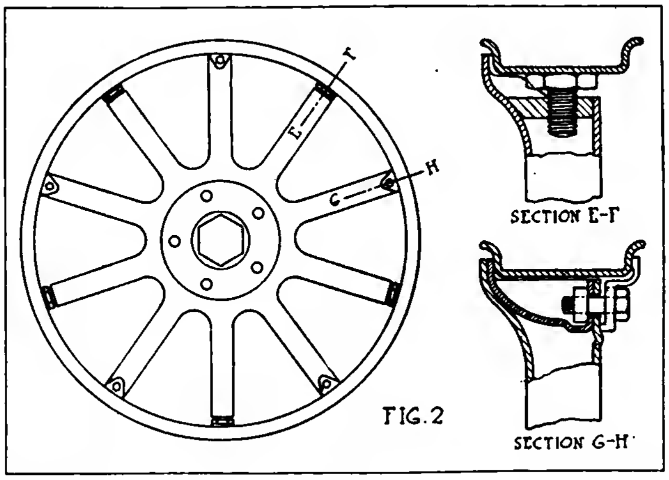


Fig. 2—Improved design of the Parker steel wheel recently patented

Street Sweeper with Brush Encased to Produce Auxiliary Suction

WHAT may be considered the most up-to-date type of road sweeper is manufactured by Clayton & Co., Ltd., in Grosvenor Road, S. W., under the name of the "Hill's Patent Motor Vacuum Road Cleanser," but it is not really operated on the principle of a vacuum sweeper, having in common with this type mainly that it carries away the sweepings. Some illustrations and a cursory description accompany this statement in *The Commercial Motor* (London) of May 11 and serve as authority for the following:

The machine is built with a "Karrier" motor truck chassis supplying the vehicle features, and its powerful Tylor motor drives the rotary brush sweeper as well as the vehicle. The brush is contained within a steel casing and can be expanded by ingenious means—partly explained below—so as always to scrape the side of the casing and at the same time exert sufficient pressure on the road to remove all loose dirt and dust. The sweepings are carried around by the brush and thrown off by centrifugality through an opening above it leading into a receiver tank of 75 cubic feet capacity, this volume of sweepings representing an average weight of 3 tons.

Above the receiver there is placed a water tank of 100 gallons capacity, whose contents are sprayed in front of the brush, to obviate as much as possible the rising of the dust. A small pump driven from the vehicle motor adds force to the spray and helps to secure against clogging of the nozzles.

As the weight of the vehicle when nearly full is very considerable (apparently about 7 tons), and the work of driving the brush is added, the Tylor motor is necessarily of large dimensions, with 5-inch bore and 6-inch stroke. It is mounted under the driver's seat. The propulsive transmission from the gearbox, which is bolted up to the motor, takes place by means of a pair of bevels to a long shaft carried in a casing at the right-hand side of the chassis, and this drive-shaft conveys the power by worm and worm-wheel to a differential and cross-shafts situated a short distance in front of the rear road wheels. From the cross-shafts to the wheels the final transmission is by chains.

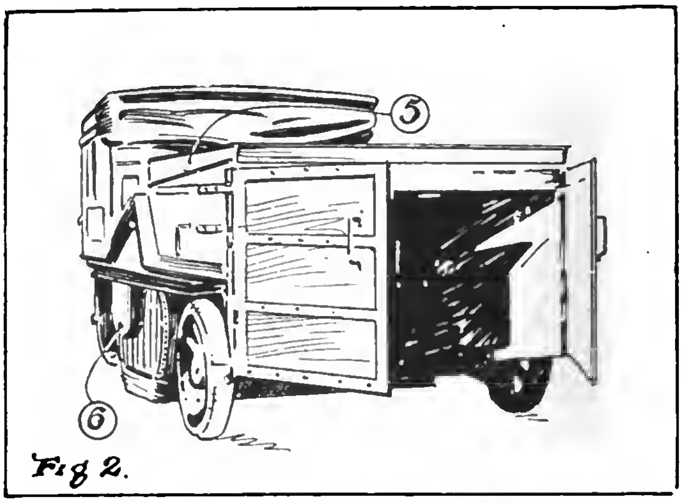


Fig 2.

Fig. 2—Rear and left-side view, with discharge doors of refuse tank open. 5—Location of 100-gallon water tank. 6—Casing for chain operating the brush

The brush is driven from the front end of the motor through a clutch which is operated by a separate control lever. It is entirely independent of the propulsion mechanism of the vehicle. It is 4 feet in diameter and 7 feet long, extending so far to the sides that the edges of the pavement can be swept as well as the middle of the road. Each of the 20 smaller brushes of which it is composed is slung in the outer ends of a pair of levers which are here carried by nuts on a shaft with right and left-hand screwthread. By revolving this shaft the diameter of the whole brush can be altered at will to take up wear, keeping it always 4 feet in diameter until the bristles are quite worn down. Revolving at high speed, the brush sets up a considerable draft within one side of its casing, and this action, intending to collect dust by suction, accounts for the name of the machine.

Figs. 1, 2 and 3 show the general appearance and give the location of details by reference numerals.

[The adjustment of the brush appears to depend on a parallelogram action of the pairs of radiating levers supporting the individual brushes in conjunction with some provision for maintaining the side reach of the brush constant. Suction is probably assisted by the high circumferential speed of the brush, which is operated with the driving movement, not against it.]

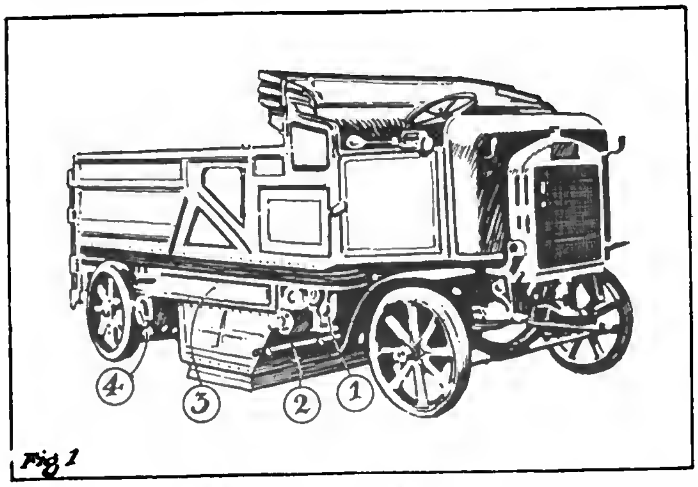


Fig 1

Fig. 1—Three-quarter right front view of Hill's Vacuum Road Cleanser. 1—Three-speed and reverse gearbox for transversely mounted motor under driver's seat. 2—Pipes for spraying water in front of brush. 3—Casing for main driving shaft. 4—Worm and worm-wheel with jackshaft and differential

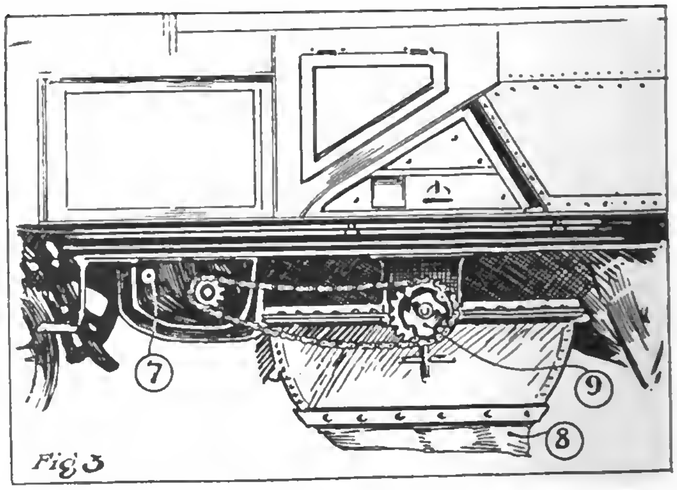


Fig 3

Fig. 3—Left side view, front portion. 7—End of motor shaft, with starting clutch. 8—Leather flaps reaching to the ground to confine sweepings. 9—Chain for driving the brush; casing removed; to adjust brush diameter for wear, long-handled spanner is applied in 4 holes in rear sprocket to turn shaft

Constant-Mesh Gears for New Buses

Paris Renews Omnibus Service with Chassis of Changed Design and New Streamline Bodies—Wood Wheels to Go

New Paris omnibuses have streamline effect with unbroken roof and scuttle dash

PARIS, JUNE 6—Twenty-two months after withdrawal on account of the war, the Paris motorbus service has been partially re-established with a single route served by thirteen buses running on a five-minute schedule. The established line is over the main boulevards from the Madeleine to the Bastille.

Interest attaches to these buses by reason of the good service they have performed in the war, and the modifications which have been carried out on the new models as the result of war experience. It was an old-standing arrangement that in case of mobilization the whole of the motor buses of Paris should be equipped with special meat-carrying bodies or with lighter bodies for the transportation of troops. The parts necessary to modify the buses were kept in stock, so that within 48 hr. the Paris motorbuses were transferred from civilian to war service.

Several attempts have been made by the bus company to re-establish its service, but on every occasion the vehicles were requisitioned by the army as soon as completed. It may be taken that the army now has sufficient supplies, for the last batch of thirteen has been allowed to go on the streets, an assurance having been given that they will not be taken over by the military. There is no intention of resuming the whole of the Paris service while the military situation remains as at present. Before the war Paris got its motorbuses from the De Dion Bouton and the Schneider factories, the bus company making most of its own bodies and its own road wheels. Lately the company has shown a desire to build its own vehicles, although being dependent on the De Dion Bouton and other factories for many components. There is an impression that the company will eventually follow the example of London and build entirely in their own shops.

The single decker type of bus, carrying thirty-five passengers, with driver placed above the engine, has been maintained as the most suitable for Paris conditions. The engines of the new buses are built by the De Dion Bouton Company, and are four-cylinder L-head type, cast separately, of 4.3 by 5.9-in. bore and stroke. There is nothing very distinctive in the design except that, unlike the majority of French trucks, they are governor controlled. Cooling is by thermo-syphon, but instead of the De Dion Bouton radiator the Solex type is used. This is a circular tube radiator with centrifugal fan discharging hot air laterally.

Originally the Paris motorbuses ran on a 50 per cent mixture of benzol and alcohol, but immediately before the war were using benzol only. Now, owing to the commandeering of benzol supplies, they are using gasoline in a modified Zenith carbureter. Lubrication of the engine is by De Dion pressure system to the five main bearings and to the connecting rods.

The entire power plant is carried on an elongated U-subframe 3-point suspended to the main frame and about a couple of inches below this latter. The underpan has been abolished and no attempt has been made to fill up space between main and subframes. As the magneto is driven by a cross-shaft across the front of the engine it appears to be in a rather exposed position, but on city service no trouble is experienced from this cause. The De Dion Bouton type of plate clutch is used.

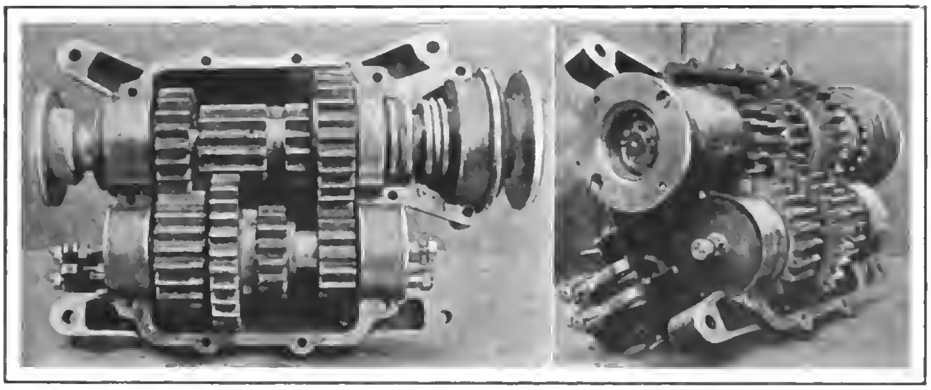
Has Constant Mesh Gears

Before the war practical tests were carried out with various types of gearboxes. These proved the superiority of a patented type of gearset known as the Dux in which the gearwheels are in constant mesh and engagement for each combination is obtained by internal gears. The sliding member on the engine shaft incorporates in itself two gears which mesh with first and second gears on the layshaft. The faces of these teeth are long enough to allow of their being moved in both directions to clutch with the internal teeth of the members for obtaining the third and the direct drive without allowing the gears on the layshaft to come out of mesh. Gear changing is easy; also, all the forward gears engaging with internal teeth which are close to their supporting bearing, there is no bending moment in either the main or the layshaft and the gears remain silent. Both three and four speeds have been used. The former are sufficient for city work, while the fourth gear has been found preferable for army service. Rear axle construction has undergone no change, this being of the internal gear type incorporating Hotchkiss drive through semi-elliptic springs having a face width of 6 in. Rearwheel brakes are formed of hard wood blocks on the internal gear drum. Foot brake is external contracting type with cast-iron ribbed shoes.

Weed Out Wood Wheels

As the result of war experience the Paris Bus Co. has decided on the use of cast steel in place of wood wheels. A few of these latter have gone into service, but this is only to use up stock. The war department will no longer take wood wheels and the company has also concluded that the cast steel type is preferable for city work. Both front and rear wheels have eight spokes, and are fitted with single band tires in front and twins at the rear.

Before the war there was considerable complaint about the mud-flinging propensities of Paris buses. To remedy this evil a public competition was held, with a view to finding some more efficient guard than the square leather splasher suspended from the hub-cap of each wheel. This competition proved the value of a rubber ring, with a face depth of about 2 in. and the same diameter as the tire, attached to the wheel with a gap of about a couple of inches between it and



New gearset with constant mesh pinions adopted by Paris Omnibus Co.

the tire. The device, which has been patented, has been adopted by the company for all its vehicles. The improved method of fitting it is to have the steel rim sufficiently wide to receive the rubber ring with the necessary gap between it and the tire. This device is indestructible and cuts down about 75 per cent of splashing.

There has been a certain attempt at streamline forms in the new bodies. Instead of the dash being vertical, it is of the cowl type, giving the driver the maximum amount of protection. The roof is domed and forms an unbroken surface from the driver's cab to the end of the rear platform. Side windows are bigger and interior fittings are lighter. Acetylene lighting from gas contained in cylinders has been abolished in favor of electricity.

A glance at the accompanying illustration discloses, on the whole, lines and proportions which are bolder and more pleasing than any seen before in omnibus design.

Conflict with Previous Report on Paris Omnibus Construction

On the authority of *Engineering* of London it was stated in a recent article on Paris omnibuses that the two types of chassis, the Schneider and the De Dion-Bouton, which had been gradually developed before the war, and have been found very serviceable during the war, were to be reproduced in all their essential features for the resumption of omnibus service in Paris, and brief illustrated descriptions of these features were therefore presented, deriving their interest largely from the unusual indorsement implied in the re-adoption of them without material changes. But now comes Mr. Bradley, the competent and well-known correspondent of THE AUTOMOBILE in France, and calls attention —in the foregoing account—to some very important changes in the new series of De Dion-Bouton omnibuses which are finally to replace the old ones in the new city service, and the information seems to imply, moreover, that these omnibuses of changed design will largely replace the Schneider omnibuses, which were before in decided majority.

Sharp competition between the Schneider and the De Dion companies, or complete absorption of the large Schneider works in military matters, would seem to be at the bottom of the discrepancies in the reports, but Mr. Bradley's version is doubtless the correct one, as well as more in accordance with what would be expected of the progressive Paris omnibus company, which has never shown any inclination before to rest on its oars. The new change-gear, in which clash is avoided by means of internal-gear clutch pinions with wide-faced teeth, which maintain continuous mesh independently of gear changes, is a departure more than ordinarily significant, the new arrangement demanding much less skill of drivers than the older construction.

The change from wood to cast steel wheels is also nothing more than could be expected, since the same tendency is observed even in this country where the supply of suitable wood is much more dependable.

Cylinder Scores Filled With Nickel

IN order to avoid the necessity for reboring or regrinding cylinders, which are slightly scored by loose pistons or loose wrist pins, a new process is coming into use. The scores in the cylinders are filled with a nickel alloy which is smoothed down to the inner wall of the cylinder and is permanently welded in place. In working with this composition not enough heat is applied to warp the cylinder walls and therefore the necessity for reboring and regrinding is eliminated. The Wilkes-Barre Welding Co. of Wilkes-Barre, Pa., are making a specialty of this work, the cost of which is not high. By the same method repairs can be made on complicated breaks in crankcases, cylinders and housings, if these are made of cast iron, steel or aluminum.

Validity of Mortgage on Dealers' Cars

WHEN a company sells automobiles to a dealer and takes notes secured by a chattel mortgage, the mortgage is not valid in Texas if the automobiles are to be exposed for sale by the dealer in the ordinary course of his business.

The agent of a certain make of automobiles at Houston, Texas, gave a written order for six automobiles and agreed to pay $9,651 for them. Thereafter an ordinary chattel mortgage was given covering the purchased cars. Some time later the dealer sold one of the cars to a man who re-sold it. The company finally had a writ of sequestration issued and the car was seized.

The court held that the company had no right to seize the car under the chattel mortgage, as it had not reserved title to the cars and that, as it had been contemplated they would be exposed for sale by the dealer in the ordinary course of his business, the agreement was invalid. The car owner was therefore allowed $850 as damages against the company for the car which had been taken from him.—(*Case vs. Lipper*, 181 *S. W.* (*Texas*) 236).

Accident Liability Voided

Where an automobile insurance policy issued to a manufacturer of automobiles requires notice to be given of all accidents, the fact that the superintendent of the company, after investigating the report of an accident made to them by an attorney, believed that no accident occurred and failed to notify the insurance company, will not excuse the failure of the automobile company to give the required notice.

Suit was brought by an automobile manufacturer against an insurance company under an automobile liability policy and also for the amount of damages paid by the manufacturer in satisfaction of a judgment against it for personal injuries.

The accident out of which the claim arose occurred as the result of a horse driven by a woman becoming frightened at one of the manufacturer's automobiles which was being tested. Judgment was recovered against the manufacturer on the claim and reimbursement was refused by the insurance company.

The court relieved the insurance company from liability.

Paragraphs on Current Topics

By Marius C. Krarup

Motto: Radical Thought, Conservative Action

Considering that profits are mostly spent in making life more picturesque and interesting for the maker of them, there would seem to be a shorter road to final results in occasionally going in for an unproved side issue in the routine of manufacture and taking a sporty view of the possibilities for profit. But the stockholders' expectations stand in the way of thus humanizing success and getting its rewards before retirement, in the form of new sensations and achievements, and for this reason the participation of the automobile industry in aviation—now so widely expected—and in the improvement of agricultural motor tools and implements must probably take place entirely through new corporations under a predominating personal control. One-man power is apparently still indispensable to make business a picturesque occupation.

* * *

Since one still hears the question asked whether it is expensive to run an automobile, it is not yet too late to answer it with another question: Does it cost something to travel, or have your family travel, about 3000 miles every month at an average speed of 30 m.p.h. and to blow your friends and neighbors to sumptuous suppers at the road houses? Answer: With six up, about 8 cents per mile; suppers *ad lib.* By reducing speed to 15 m.p.h. no gasoline is saved, but the mile comes down to about 4 cents and the friends get scarcer, the meals plainer. The six persons, more or less, lose theoretically 100 hours per month, which may be profit or loss, according to their habits. In real life, however, they lose 1500 miles and gain the cost of them, while seeing more, exercising more and making more new friends with cars of their own.

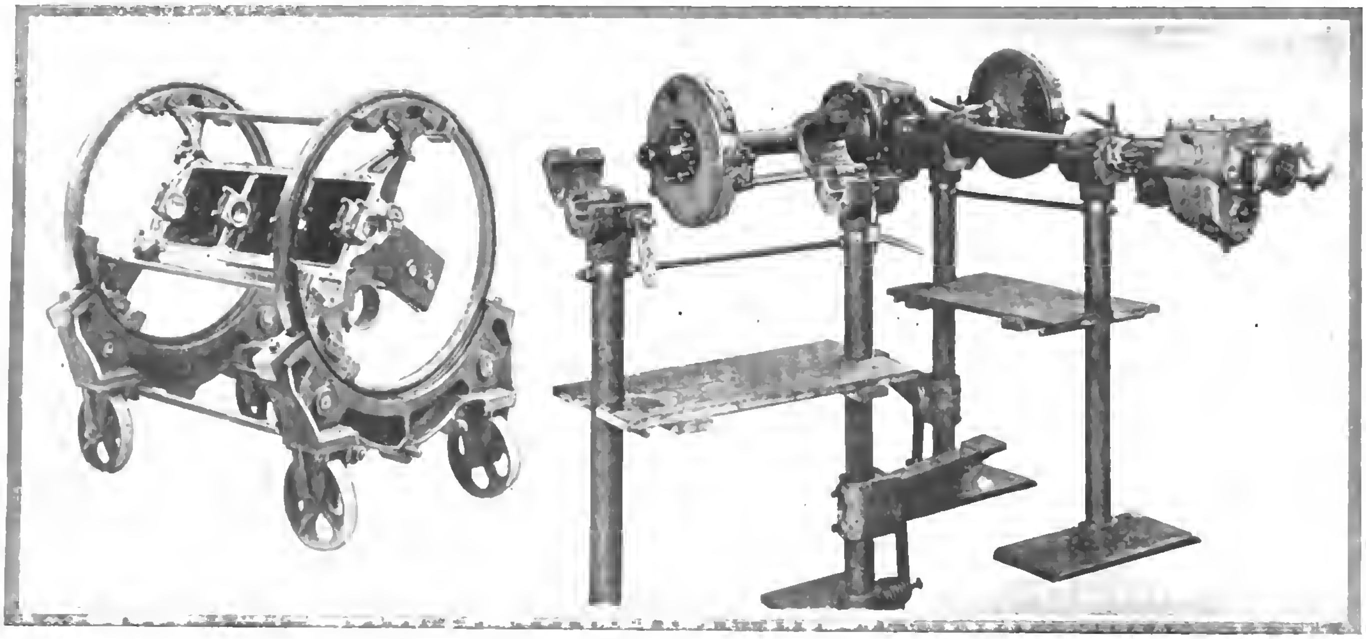
* * *

A sensitive paragrapher finds it disgustingly snobbish to advertise that "Success Rides in Closed Cars." But he underrates the ad-writer's shrewdness and philanthropy. The real parvenus are not numerous enough to bother with. The dart is aimed at the multitudes who need a hint to help success along. It conveys a business-like suggestion for their benefit. And were it snobbery, how and in what category should deliberate and professional snobbery be classified, having a laugh up its own sleeve? Whatever be the ethics of it, the sentiments of an ad-writer must be vicarious and tolerant, like those of a constitutional monarch, an actor or of any other victim of civilization who "represents" somebody or something.

* * *

Willis A. Gibbons writes on "Skin Friction of Various Surfaces in Air" in *Aerial Age* of June 26. Nap on cloth causes considerable additional friction, but a smooth surface, such as that of tinfoil, does not in all cases mean a reduction of it. These test results, contemplated with some imagination as to what they may ultimately signify, are perhaps as worthy of attention as the projected Aerial Derby—the "proposed aviation classic," as Secretary of the Navy Josephus Daniels terms it, with generous anticipation.

Facilities in Assembling of Marmon Cars



A special engine stand (at the left in the illustration) and a special rear system stand are used in the assembling of Marmon 34 cars.

The engine stand is constructed of gray iron castings and is mounted on four wheels so that it can be very readily moved. The engine can be turned in any position in the stand. The aluminum casting is first bolted into it and the other parts of the engine follow till the unit is complete.

The other illustration shows two rear system stands—one open and ready to receive the torque tube and the other with the rear system mounted and clamped in place. The arm extending from one of the uprights has a spring arrangement by which the center piece of the rear axle is held in line with both side housings for insertion of through bolts.

The FORVM

ADVANTAGES OF TWO-CYCLE ENGINE COMPARED WITH FOUR-CYCLE—EXPERIMENTS ON TAXICABS SHOW DIFFERENTIAL TO BE NECESSARY

Two-Cycle Superior to Four-Cycle in Performance

By Chas. E. Duryea
Consulting Engineer

HAVING spent much time and money experimenting with two-cycle engines and knowing by actual results that the two-cycle can be very satisfactory on all points and compare favorably with the four-cycle, I dislike to remain quiet when incorrect views concerning the two-cycle engine are expressed. If the man who thinks the two-cycle cannot handle its charges for lack of time will extend his exhaust ports well around the cylinder he will find he need not open so early as does the four-cycle exhaust valve and that he can run with fair power up to 3000 r.p.m. or over. Nor is there a high heat flow to the cooling jacket. On the contrary, the two-cycle lets its hot gases get out quickly and cool gases enter and absorb the flash of heat before it gets far into the wall. A two-cycle will cool easier than a four-cycle on this account. That a two-cycle is not efficient at full power is largely true but automobile engines seldom work at full power and at part power the two-cycle is more efficient than the other because of the constant compression.

Crank bearings can easily be fitted with stuffing boxes if one is really anxious to hold the crankcase compression. Having but about one-fifth the number of parts that the four-cycle has, we may add many and still have much advantage. But this is not necessary. Splendid two-cycles can be made with very little complication.

Flexibility and Two-Cycle Engines

That they are not flexible is another fallacy. First define flexibility. If we mean that motor is most flexible which develops least power at 300 r.p.m. and most power at 3000 r.p.m. then the four-cycle is winner, but that is not my definition. For automobile use I need a motor which will pull like a mule at 300 r.p.m. and yet be able to speed along over perfect roads at 3000 r.p.m.; and that is just where the two-cycle shines. It takes full charges at low speeds and develops surprising power for mud, sand and hills where power is needed and where one does not like to use the low gear. Perhaps it is wasteful of fuel at such times. So well does it run and so hard does it pull we can afford to overlook this fault. Bad roads do not occur often, we think.

Cooling Ability Not Limiting Factor

That the cooling ability is the limiting factor either is not true, or is misstated. Air-cooled two-cycles can be made as easily as can air-cooled four-cycles. Nor is there any difference in the fuel needs. Or if there is it is in favor of the two-cycle which carries several charges in the crankcase where they are warmed and fully vaporized before passing to the cylinder. I have used crankcases so hot that low test cylinder oil vaporized. Almost any grade of fuel could be used in such an engine after it warmed up.

Every advantage is in favor of the two-cycle. It is cheaper, simpler, lighter, gives double the number of impulses, has constant compression and therefore higher efficiency, except when forced to the point of crowding its new charge out with the old, is more compact, less noisy and has much less internal friction. Many folks think it will not idle, but if one will shut off the fuel or sparks so that half the strokes are idle ones as in the four-cycle it idles even better than the four-cycle. But with every one pushing the four-cycle, the two-cycle like air cooling has a hard time to find buyers. There were almost as many new automobile buyers last year as old users. Can you blame them if in their inexperience they followed the crowd and bought the oldest and best known kinds, even if not so good? But men who know better things should not remain silent.

Taxicab Experiments Show Differential a Necessity

By L. P. Prosson

I HAVE been reading with great interest the different articles published in THE AUTOMOBILE of the possibilities of eliminating the differential in motor vehicles and as I have had quite a little experience along this line I take this opportunity to bring forth the results of my experiments.

In 1913, when I was mechanical superintendent of the Yellow Taxicab Co., I conceived the idea that it was possible to operate a vehicle without a differential and selected two good running cabs, removed the differential, locked the axles in the housings and put them in actual service.

The first day out the drivers complained that the cabs were very hard to steer and that the brakes were binding when going around corners, that the motors were laboring hard through traffic and that they preferred to go around the block instead of turning in the street.

Of course, we immediately knew the trouble, but as we wanted to carry the test further we insisted on keeping the cars in service. We told the drivers that the steering and brakes were in good condition, but they continued to report the same trouble.

After a couple of weeks' running, with many complaints, one of the cabs had a live axle broken and a few days later the same trouble occurred to the other cab. I also kept a very accurate record of the tire wear and gasoline consumption and found both to be excessive.

The result of my experiment was a failure, and I was convinced that it was impossible to operate a vehicle properly and economically without a differential and I also found that it was detrimental to the whole car.

The only time that we could operate these cabs with any degree of satisfaction was on rainy days on account of the wheel slippage being accomplished more easily.

The History of the Pneumatic Tire—8

Great Activity in the Tire Field in Both Europe and America in Early 90's—Jeffery Clincher Tire Patent Invalidated — Many and Varied Types

The History of the American Automobile Industry—35

By David Beecroft

THE A. Strauss cushion tire brought out in 1891, as briefly described in THE AUTOMOBILE for June 22, resembled the Duryea of 4 years earlier, in that the central cavity was of some size, while the open base was comparatively narrow, and not, as in the arched tires, wider at the open base than at any portion of the cavity. It differed from the Duryea, however, in that it fitted a crescent or arc-shaped rim, whereas the Duryea rim had in-turned edges and no other fastening, just as did the later clincher rim.

Much Activity in Early '90s

A very considerable activity existed on both sides of the Atlantic at this time. Of course, the patent record follows the actual work of the inventor by some months, representing the time required in the United States Patent Office. Illustrations of a variety of English designs were printed in American bicycle publications early in 1891. The Columbia and Union tires were brought out about this time while several of Jeffery's devices began to attract attention. His patent issued in June, 1891, shows a casing having metal hooks along its edges and actually hooking into the edges of a rim shaped to receive these hooks. The tire of January, 1892, however, omits the hooks but provides beads which are forced into the overhanging edges of the rim by a stiff base which can be lifted in the center to draw the beads closer together and remove the tire. This tire did not have the open base so desirable in a double tube tire and it was not found easy, by the various inventors, to produce a tire having a base rigid cross-wise and yet flexible enough to be lifted in the center and forced down again in order that the tire might be loosened or locked in place.

Jeffery Patent Invalidated

Jeffery's patent of 1896 shows the more common form of clincher tire and became the accepted type of that kind. The Jeffery patents were supported in the courts for some years and were believed to hold the tire in place by hook action of the bead in its engagement with the edge of the rim. As a matter of fact, this was not what proved to be the holding feature, and the patent was finally invalidated in the courts.

The feverish activity in the eary '90s among tire inventors brought out a surprising number of forms. One of these, by Welch, an Englishman, was adopted by the Dunlop makers in England and was independently developed and patented in this country by Brown & Stillman in 1892. This form used a rim deep in the center but shallow at the sides, forming supports for the edges of the tire casing, which edges each contained an endless wire. To apply the tire, the wired edge was pushed into the center of the rim and thus a sufficient slack gained to bring the last portion over the extreme top of the rim edge, after which the wired edge was brought out against the rim edge, the air tube inserted and the other edge of the tire applied in the same manner. Once in place, the tire could not get off unless the wire broke, but could easily be removed by reversing the process. This form of tire is largely used in automobile work to-day, and is called the straight side tire to distinguish it from the beaded side or clincher type rims with a removable side ring displacing the original type with depressed center.

Stretching Fabric Weakened Tire

Since the endless wires of this straight side tire hold the tire to the rim, and since the shape of the rim prevents the base from spreading, the holding function of the fabric is performed by the cross-wise threads of the fabric rather than by the lengthwise threads. It is impossible to make a constrictive open tire where threads are broken. In the constrictive tire the reverse was true. In order to insure the tire remaining on the rim, the fabric had to be stretched in such a manner that, when inflated, the tire would shorten, and this shortening effect caused great strain lengthwise on the fabric. This strain was objectionable from two standpoints: it tended to cause the tire to burst more quickly because it was already under considerable tension, and passing over an obstacle, threw more strain on the already strained fabric. Second, this fabric, already taut, could not stretch and yield enough to swallow the obstacle, so the wheel is necessarily lifted, which strains both the tire and the mechanism, and is uncomfortable for the passengers. With the wire-edged tire, the fabric could be rather long for a given rim size, and therefore loose and free to yield longitudinally. It therefore could pass over an obstacle without lifting the wheel or straining the fabric so much.

The Rostrum

Would Build Roads Like Railways

EDITOR THE AUTOMOBILE:—The number of automobiles is steadily increasing and likewise the number of accidents, but over 80 per cent of all accidents are the direct result of easily preventable causes. Many preventable accidents can only be prevented by the adoption of a broad and comprehensive system of road operation similar to railroad traffic operation, in which a definite responsibility is recognized as residing in the corporation, state, or town, as well as the automobilist.

In the congested parts of our large cities the traffic is directed by the police and by signs on one-way streets and in the country a few roads, notably State roads, have inadequately posted warning signs and directions, but all through the great number of our country roads there are no warnings whatever to apprise a motorist that he is approaching a dangerous curve, cross road, bridge or other perilous place.

Up to this time the responsibility for nearly all automobile accidents has been laid at the door of the operator of the machine, which is unjust. It is no more right to hold automobile drivers down to 20 or 25 miles an hour in open places than it would be to hold passenger trains down to that limit of speed, if all things were equal as they should be.

A Comparison of Conditions

This brings me to a comparison of the conditions of railway and automobile traffic. Railroad trains travel on a right of way granted them by the State and the State requires them to erect and maintain suitable and safe bridges, viaducts, railroad and wagon road crossings, signs, signals, fences, turnouts, switches, gates or tell-tale bells, flagmen, etc.

Automobiles travel on public roads that also belong to the State, county or town, but with the exception of a few very inadequate signs on some roads, giving warning of dangerous curves, railroad crossings and schools, there are no safeguards erected, no signals or signal lights, no tell-tale bells at hidden crossings, no flagmen or gates except those provided by the railroads where their line is crossed by the carriage road and none whatever where any of the innumerable country roads cross each other.

From early times the law has held the city, town, country or state liable for damages resulting from defects in the roadway, bridges, viaducts, etc., just as it holds the railroads liable for similar defects and in the case of the railroads it includes lack of proper gates, signals, flagmen, etc.

Proper Equipment Required

The proper equipment to meet the requirements of present-day traffic on our common road truck lines or principal state roads would consist of nearly all the appliances in use on railroads, in the line of signals, sign boards, flagmen and tell-tale bells, besides other safety devices not applicable to railroads, owing to the difference in the construction and operation of the two roads.

Take for instance a heavily traveled main road between two large cities much used by automobiles. All the roads crossing or branching from this road, where a clear view is obstructed, should have tell-tale bells set up at such crossings or junctions, automatically constructed to be electrically rung as on railroads, by the passing of any vehicle over the main roads, bearing always in mind that an automobile may very likely have a velocity equal to an ordinary express train.

It would be perfectly practical to arrange this by having a transverse steel bar set across the roadway in the hard surface of the roadbed, which the wheels of any vehicle would depress sufficiently to make an electrical connection and so ring the bell at the crossing or junction when a quarter or half a mile away.

Double Track All Curves

Another safeguard that is imperatively demanded is to double-track every road used by automobiles at all curves where the view is at all obstructed by fences, buildings, or shrubbery. This should be done by building a stout, low fence, longitudinally in the middle of the road around such curves, thus confining the traffic to the right-hand track in both directions and so preventing collisions. This fence should be provided with large signs at each end, directing all vehicles to take the right-hand track, and with red lanterns at night.

The same precautions should be taken at all small hillocks over which the road may run, where the grade is so high as to cut off the sight of an automobile or other carriage on the further side of the rise.

I have several times barely escaped a smash-up in both of such places, for, while you may be keeping close to the right-hand side of the road, the other driver may very likely not do so.

A most reprehensible method of earth road construction, quite common in many places in the rural districts, especially in the West, should no longer be tolerated. This is the practice of using road scrapers to plow up the soft mud and grass roots from the sides of ditches and depositing it in a high ridge in the center of the roadway. I have seen and ridden over roads that were built in this manner, that were crowned as much as four feet in the center and so narrow and steep that the gearboxes plowed a furrow in the top when straddling the center and with such steep sides that it was impossible to turn out when meeting a team without tipping over or going into the ditch.

The construction of such a road should be deemed a misdemeanor. A consideration of these matters forces the logical conclusion that our main arteries of automobile travel should be treated like railroads, for the safety of travel and should be equally well protected as far as is possible, and the state, county or town owning the road should be legally liable for all accidents occasioned by dereliction in their duty to the traveling public, even as a railroad is so held.

Chardon, Ohio. J. FRANCIS LE BARON.

Installing Ammeter on Oldsmobile

Editor THE AUTOMOBILE:—I have a 1915 Model 42 Oldsmobile and wish to install an ammeter. Will you kindly tell me how to do this?

2—Will you please publish a wiring diagram of the electric system on this car?

New York City. R. W. DE V.

—To install an ammeter on a 1915 Oldsmobile the instrument should be mounted at a convenient place on the dash instrument board, and the wire running from the No. 1 post on the switch should be cut and the cut ends of the wire should be connected to each of the connecting posts on the ammeter.

2—Wiring diagram of 1915 Oldsmobile 42, appears in Fig. 1.

Operation of Dual Exhaust System

Editor THE AUTOMOBILE:—How does a dual exhaust operate?

2—Is rain water better than hard water for use in a radiator?

3—In lubricating the spring leaves, how far can they be spread before danger of breakage?

4—Describe the operation of burning carbon out of cylinders.

West La Fayette, Ind. A. H. R.

—You are probably thinking of the design of exhaust manifold fitted to a few four-cylinder engines. In these the four exhaust ports are connected alternately to a pair of pipes which are often integral in a single casting. The two passages become one at the point where the exhaust pipe is attached. The idea is that if cylinder No. 1 has just exhausted and cylinder No. 3 is the next in order it is an advantage to prevent the exhaust from No. 1 from interfering in any way with the exhaust from No. 3. If No. 3 exhaust passes into a separate passage the effect of the exhaust from No. 1 passing down the exhaust pipe may actually exert a suction on the exhaust from No. 3, whereas with the ordinary manifold it can create a back pressure. Thus a dual exhaust consists of dividing the manifold so that the four cylinders exhaust alternately first into one passage in the manifold and then into the other. The same system is sometimes used on six-cylinder motors, using an exhaust pipe for each block of three cylinders.

2—Yes, because containing no lime it can throw down no deposit in the cylinder or in the radiator.

3—To lubricate spring leaves the car should be jacked up by the frame and not by the axle. Lifting the car by the frame will cause the spring to expand, and when the wheel is off the ground the weight of the axle will tend to pull the spring open. Under these conditions the leaves can be spread apart quite wide. Exactly how far apart it is safe to spread them depends upon the design of the spring and a great many other factors. The best way to lubricate the leaves is to use an old steel table knife which can be dipped in the grease and then rubbed between the leaves and you will find it is only necessary to spread the leaves a very small amount to allow the knife to be inserted. The less the leaves are spread the better it is for the spring.

4—The carbon which is deposited in the cylinders will not burn in air, but it will burn in pure oxygen gas. The operation of burning out cylinders is to direct a jet of oxygen gas into the cylinders. At the commencement of the operation a little ordinary gas is injected also. This burns in the oxygen and quickly heats the carbon to a point where it begins to burn by itself. The gas is then turned off and oxygen alone is fed, the carbon continuing to burn until it is entirely consumed. Directly the carbon is burned off the cylinder or piston, combustion ceases, so very little heat is generated.

Safety Fuse May Be Burned Out

EDITOR THE AUTOMOBILE:—Kindly publish information for model OB 2916 magneto and generator on a model R 1914 25-hp. Reo.

The ammeter, with the car running and lights out, shows 2 amp. discharge; with lights on it shows 6 amp. discharge. With the engine idle, ammeter is at zero. The brushes and commutator have both been cleaned without any satisfactory results.

Danbury, Conn. S. M. P.

—The difficulty can be located by ascertaining whether the safety fuse on the generator has burned out, also see that the terminals are securely fastened to the terminal posts as well as seeing to it that the terminals are securely fastened to the end of the cables.

This trouble is most likely to be found in the fuse or the

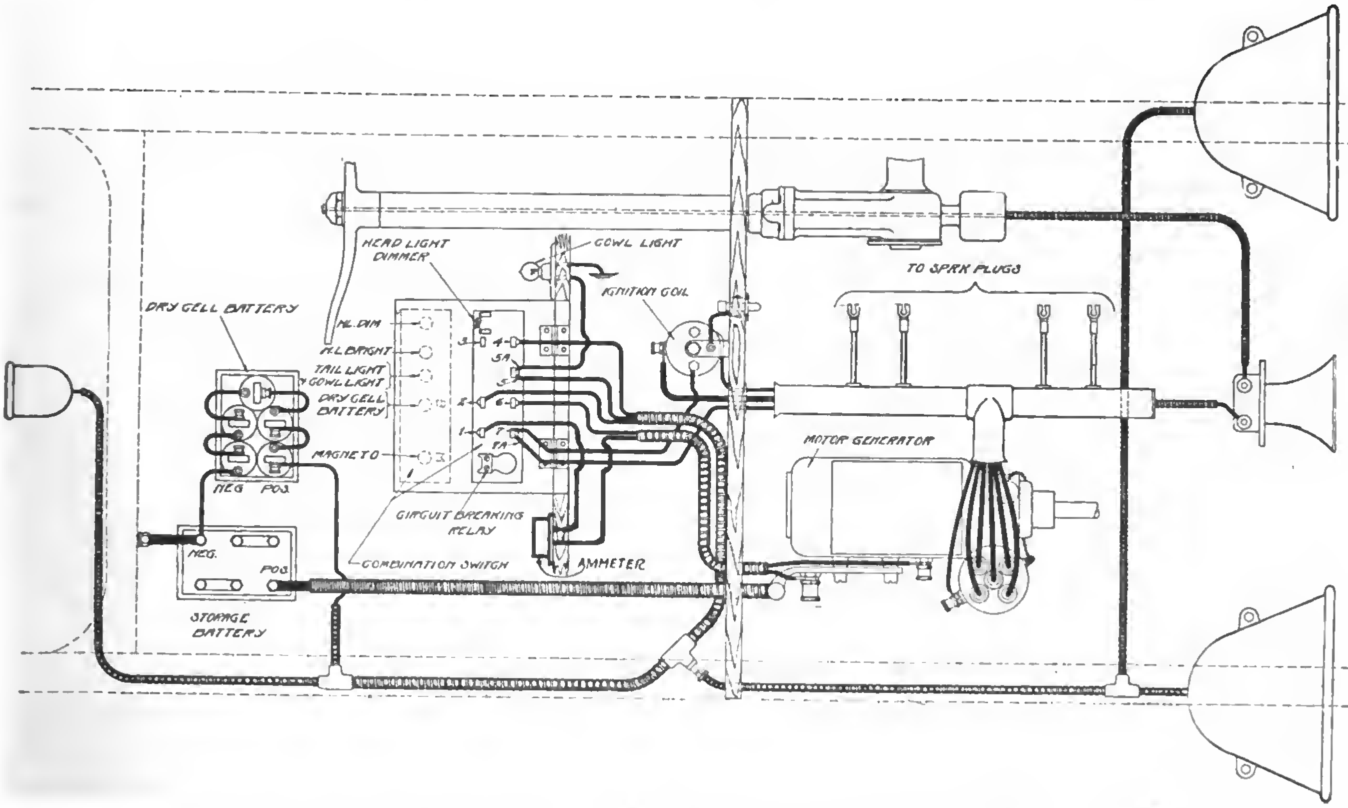


Fig. 1—Wiring diagram of electric system on 1915 model 42 Oldsmobile, showing where to install an ammeter

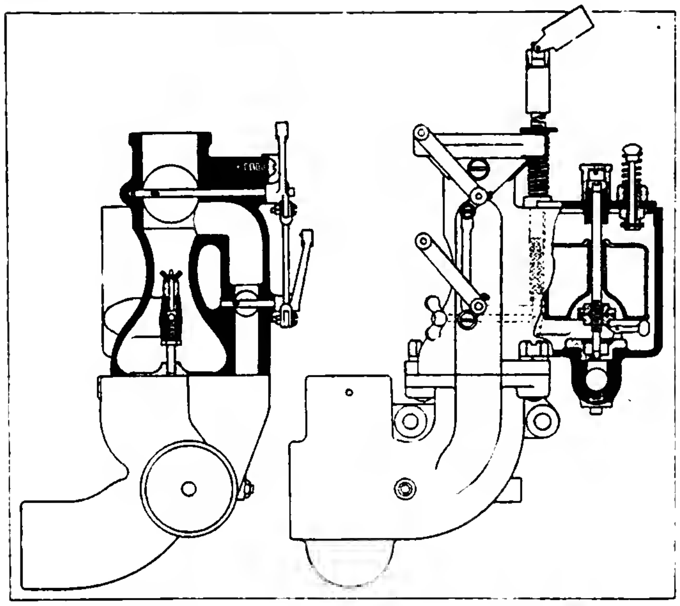


Fig. 2—Sectional views of carbureter used on Franklin

terminal being loose on the top of the generator or cable or at the brushes. It would also be well to inspect the armature for an open circuit and also the field circuit.

The 2-amp. discharge shows the amount consumed for ignition and the 6 amp. shows the consumption of lamps and ignition.

Description of Carbureter on Franklin

Editor THE AUTOMOBILE:—Kindly publish full description, including illustration, of the carbureter used on the Franklin car.

2—What weight would you give to the factors of carbureter design, air cooling and low bearing friction, influencing the remarkable economy developed by this machine?

3—Which is better practice, to make a hill on high at 12 m.p.h. requiring full throttle, or to go into second, making the same speed with a smaller throttle opening?

Miami, Ariz. W. W. J.

—Fig. 2 shows the carbureter used on the Franklin car. Its construction and principles of operation are evident from the illustration except that the needle valve control of the gasoline is carried to the dash where it may be adjusted to suit conditions as they arise.

2—Air cooling and a high over-all efficiency have more to do with the mileage obtained with the Franklin car than has the carbureter design. It is difficult to give any absolute figure of the relative effects of the three points mentioned.

3—It is better to go over a hill on high at 12 m.p.h. with wide open throttle if this condition maintains only momentarily. If the grade is long enough to require continuation of this condition for any length of time we believe the car will be better off by making the hill on second gear.

Locating Cause of Power Loss

EDITOR THE AUTOMOBILE:—Will you explain to me how to remedy loss of power in my 1915 Hupmobile? The cylinders all work fine and would pull any hill on high until about a week ago. Now I have to use second on the same hill that it would pull on high. On the level it runs as fast as ever.

Blackstone, Va. R. I. S.

—Check the adjustment of the valve tappets closely. See that you have at least 0.004 in. clearance between the valve tappets and the valve stems. See that the valves are seating perfectly and are not pitted or corroded. Test the compression of the motor by attaching the hand crank and rocking the motor against compression on each cylinder consecutively. Should you find one that is weaker than the other we would suggest that you immediately endeavor to locate the point of leakage. If you find that the compression is leaking past the piston rings, this, of course, can be remedied by the installation of new piston rings.

See that the motor is entirely free from carbon and that the spark plug electrodes are set 0.020 to 0.022 in. apart.

Be sure that the Atwater Kent header points are perfectly clean and are not pitted or corroded. See that they are adjusted to between 0.010 and 0.012 in. and that they meet squarely.

See that the carbureter and gasoline feed line are entirely clean and not obstructed in any way.

Ascertain that the clutch is not slipping and that the brakes are not dragging.

Information on Norwalk Underslung

EDITOR THE AUTOMOBILE:—Will you kindly publish a list of all Norwalk underslung type cars manufactured, showing model, number of cylinders, developed horsepower, and if possible, the bore, stroke, wheelbase, starting and lighting system and size of wheels.

Also please let me know about what date you figure engine No. 97 was built and where I may obtain parts for these cars. I understand that the reorganizers of the company are at present manufacturing practically the same type of car under a different name. Is this so? If so, what is the name of the company and where are they located?

New York City. W. A. T.

—Herewith is a list of all Norwalk underslung cars. All used six-cylinder engines.

		Bore	Stroke	W.B.			
Model	Hp.	In.	In.	In.	Start	Light	Wheels
1912-6	60	4	5	136	Elec.	Apple	40 x 4½
1913-A	50	3⅞	5	127	G. & D.	G. & D.	38 x 4½
1913-A Special.	60	4	5	131	G. & D.	G. & D.	40 x 4½
1914-1915 D....	60	4	5	131	Wsthse.	Wsthse.	38 x 4½
1915-C	70	4	5½	136	Wsthse.	Wsthse.	39 x 5

Abbreviations: Wsthse., Westinghouse; G. & D., Gray & Davis.

Engine No. 97 was built in 1912 model six, and parts can be obtained from the Norwalk Motor Car Co., Martinsburg, West Va., at the present time. The model C and D with minor improvements and refinements are being built, together with model F.

Making Gage for Gasoline Tank

EDITOR THE AUTOMOBILE:—I noticed in a recent issue of THE AUTOMOBILE an inquiry about the depth of gasoline for different amounts in a cylindrical tank. Wanting to make a gage for my fuel tank, I made the following tables coefficient for certain aliquot parts of tank capacity.

For 10 or 20 gal. tank		For 15 gal. tank	
1/20	0.19442	1/15	0.23677
2/20	0.31291	2/15	0.38205
3/20	0.41481	3/15	0.50808
4/20	0 50808	4/15	0.62488
5/20	0.59592	5/15	0.73500
6/20	0.68021	6/15	0.84213
7/20	0.76203	7/15	0.94766
8/20	0.84213		
9/20	0.92125		

Now, for example, let us consider the Ford tank which is 10 in. in diameter and holds 10 gal. very nearly. For each aliquot part of 10 gal. multiply the corresponding coefficient by one-half the diameter. This gives:

½ gal. depth	0.972 in.	3 gal. depth	3.401 in.
1 gal. depth	1.565 in.	3½ gal. depth	3.810 in.
1½ gal. depth	2.074 in.	4 gal. depth	4.211 in.
2 gal. depth	2.540 in.	4½ gal. depth	4.606 in.
2½ gal. depth	2.980 in.	5 gal. depth	5.000 in.

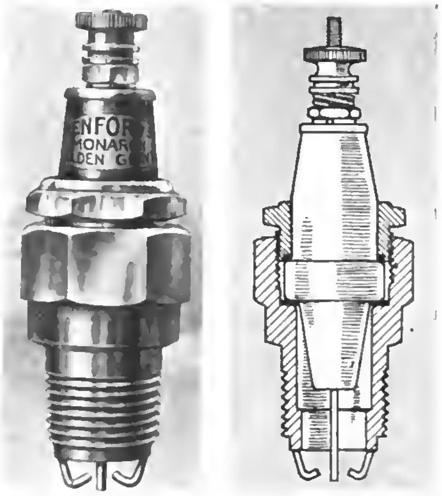
For a 15 gal. tank use the other table and multiply by one-half the diameter.

Port Clinton, Ohio. W. B.

ACCESSORIES

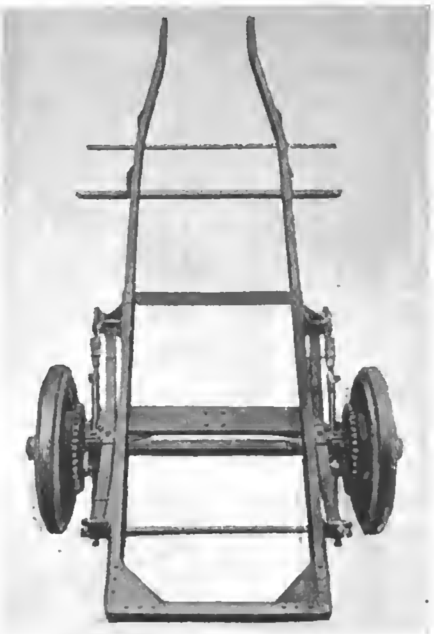
Golden Giant Spark Plug

THE manufacturer of this plug has combined the results of 14 years of experience in spark plug manufacture in the Golden Giant, which is illustrated herewith. Although the most striking exterior feature of the plug is that the shell is durably plated with 24-karat gold, there are a number of points in the interior which denote the serviceable design and excellent material and workmanship characterizing the construction. A special insulation called blue adamant is used in connection with copper asbestos gaskets made by a special process and a strongly built shell. The bushing is nickel. Electrodes are of pure nickel, insuring delivery of a spark under all conditions. The manufacturer guarantees each plug unconditionally, the guarantee stating that the plug may be returned to the factory at any time if found unsatisfactory and it will be repaired or replaced free of charge. The company co-operates with both dealers and jobbers with all sorts of dealers' helps, such as wall posters, size cards, display cartons, window cards and trims, etc. The plugs are made in all sizes and are packed in individual tin cartons. They sell for $1 each.—Benford Mfg. Co., Mt. Vernon, N. Y.


Exterior and section of Golden Giant spark plug, showing construction

Ralston Ford Attachment

To change a Ford into a satisfactory 1-ton truck a special frame, rear wheels, axle and springs are supplied, forming a complete unit which is attached as a rearward extension of the Ford frame. The Ford rear axle and wheels are removed; the rear axle is bolted to the frame extension, sprockets are attached in place of the wheels and chains are run to the sprockets on the new rear wheels. The front of the extension frame is attached to the Ford frame near the front; the rear end of the Ford is attached to a cross member of the extension frame. The greater part of the load is carried on the rear wheels, the front wheels carrying only their normal load. Weight of complete converted chassis, 1850 lb.; weight of attachment, 900 lb.; axle, 2 by 2½ in.; tires, 32 by 3½ solid; wheelbase, 124 in. Price, $350.—Curry & Rowe, San Francisco, Cal.


Ralston truck attachment for Fords

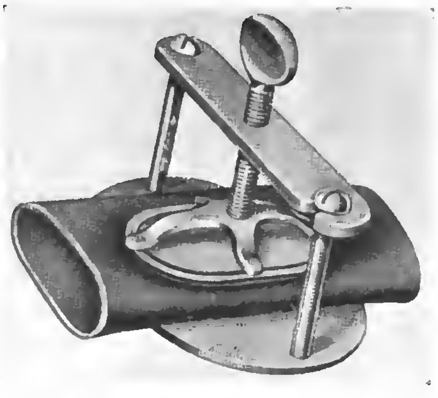
Chadwick & Trefethen Reamer

With this reamer the cylinders of Ford and Dodge Bros. motors can be refinished. It is of the shell type with taper slots fitted with eight blades of semi-high speed steel. Loosening the top nut and screwing up the bottom nut makes the reamer cut larger; there is an adjustment of ⅛ in. The shaft extending through the reamer, which is more than the length of a cylinder, has a taper guide which sets in the bottom of the cylinder, forcing the reamer to cut the cylinder perfectly straight. The makers state that the reamer will not chatter or buck. It is turned by means of a tap wrench 36 in. long, or it may be used in a drill-press; it is not intended for lathe use. Two men can ream a set of cylinders in 25 min. The reamer lists at $30.—Chadwick & Trefethen, Portsmouth, N. H.


Chadwick & Trefethen cylinder reamer

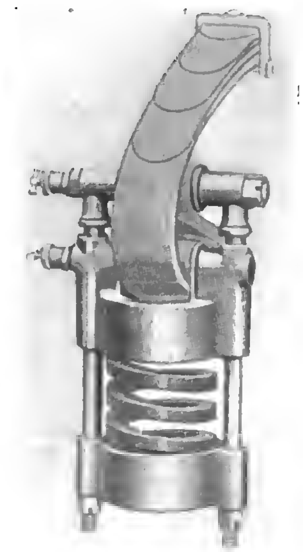
Safety Vulcanizer

This tube-patching vulcanizer consists of a circular plate, carrying rods which support a yoke through which a clamping screw is threaded. Horizontal arms on the end of the screw press the patch on the tube. A piece of prepared fuel is placed on the patch and ignited with a match. When the fuel has burned out the patch is vulcanized, the time required being 5 min. The outfit consists of the clamp and a dozen patches, together with the prepared fuel. Price, $1.50.—Safety Vulcanizer Co., Mason City, Iowa.

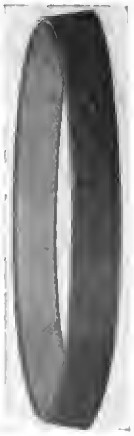

Safety vulcanizer for inner tubes

Alisco Shock Absorber

The Alisco shock absorber is of the auxiliary type and is easily adjustable to its load, being unusually well provided with means for guiding its movement. The device is of the open type. Connection between the upper and lower parts is by means of two steel rods; the upper ends are fast in the upper spring shackle fitting and the lower ends pass through the bottom casting and are held by nuts which can be tightened or loosened to provide the proper spring tension. The upper head slides on the rods, which thus constitute guides so widely spaced


Alisco shock absorber

Telescope apartment—It is a complete touring outfit, being practically an entire house on wheels



Leathertex clutch facing

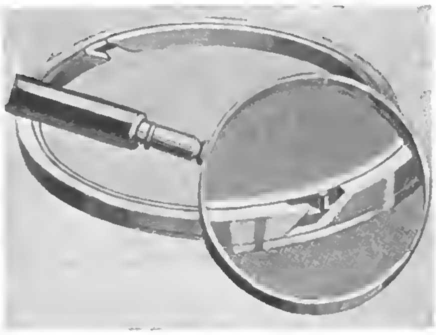
as to give adequate support. All the bearings are long and are provided with grease cups. Price, $18 per pair.—Allen Iron & Steel Co., New York City.

Telescope Apartment

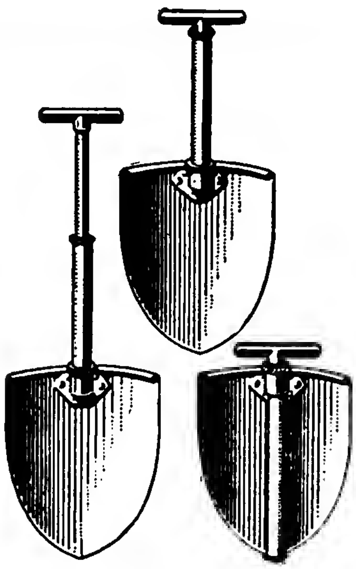
This touring apartment is a complete house on wheels. It is extremely light, however, and is designed particularly for Fords. It is box-like in shape with rounding sides and top and displaces the tonneau. There is a mattress on the floor of the compartment large enough to hold three people and when desired, this bed may be pulled back so that it extends out into the open and thus provides perfect ventilation on the hottest nights. There is a collapsible dressing-room which may also be used for shower baths. In cold weather it may be heated by a special heater attached to the exhaust which also furnishes hot water for bathing. Cooking utensils, food and a stove are carried in a cabinet on the left side. The side of the cabinet is hinged so that when it is opened it forms a table. The opposite side has several drawers which are used for storing clothing. These two cabinets slide laterally so that in the daytime they occupy part of the interior. At night they are pushed out so that this space may be used for sleeping. Price, $100.—Gustav de Bretteville, Seventh and Brannan Streets, San Francisco, Cal.

Ideal Tourist Shovel

This all-steel shovel has a telescoping handle and is particularly suitable for automobilists driving in rough country or camping. The blade is 6¾ by 8½-in., the length of the handle 16 in. and the weight 2 lb. After the handle is extended it is locked by turning two lock rings. It is nickel plated.—Ideal Mfg. Co., North Kansas City, Mo.



Sioux piston rings, showing joint



Ideal shovel with telescopic handle

Advance Overhead Fountain

The feature of this overhead washer is that it effects a saving of 50 per cent in the amount of water used because the water is automatically shut off as soon as the hose is released and turned on by pulling slightly on the hose. The washer consists of a horizontal arm carried in a swivel joint which is part of the ceiling bracket. When the arm is up the valve is closed and when it is down, it is opened. An adjustable counterweight on an extension of the arm makes it possible to quickly adjust the device so that the weight of the hose and the arm is slightly overbalanced by the counterweight. Price $35.—Advance Mfg. Co., Franklin, Pa.

Leathertex Clutch Facing

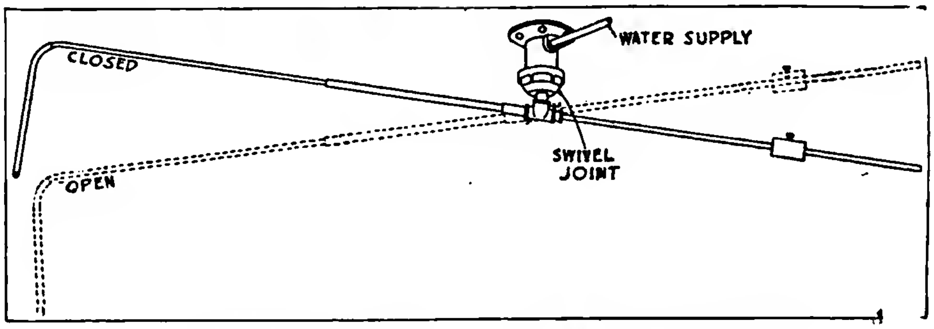
Leathertex cone clutch facings are designed to give greater durability and efficiency, being a combination of specially tanned leather and textile, the two being merged into one under 3000 lb. hydraulic pressure. The outer surface is leather and the inner surface fabric. A smooth, velvety action and unlimited wear are claimed. The company has had more than 50 years' experience in the manufacture of leather goods and guarantees that the facings will hold their shape and will not vary in thickness more than 1/100 in.—Hide, Leather & Belting Co., Indianapolis, Ind.

Sioux Piston Rings

The Sioux is a two-piece ring with joints at the opposite sides. A section of each ring is stepped, the two fitting together to form a rectangle. This construction provides a comparatively long and tortuous path for any gases which may try to leak through. Price, Ford, $1; 2¾ to 3½, $1.25; 3⅝ up, $1.50.—Albertson & Co., Sioux City, Iowa.

Garage Door Stay

A stay designed to hold garage doors open consists of a jointed angle-steel bar with brackets at each end. One bracket is screwed to the door and the other to the frame, both at the top. When the door is closed the stay is folded upon itself. When the door is opened the stay opens and when the folding joint is straightened out it locks in position, holding the door so that it cannot swing either way. To release the door a chain is pulled, throwing the joint off center. No mortising is necessary in applying. Chains are tinned and japanned. The set includes two stays with chains and rings and four chain guides.—Stanley Works, New Britain, Conn.



Advance overhead fountain which automatically shuts off the water

The AUTOMOBILE

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Chassis Quietness

NOT long ago it was usual for the engine of a car to be the greatest noise-producing part, but to-day there has been considerable change in this respect, and the slight sounds made by other portions are becoming more noticeable. At present, with good grade cars, the sounds made in running are mostly very small, that is the sounds produced by running parts such as gears or bearings. The constant mesh gears in the transmission are still a source of trouble, and the spiral bevel is not always absolutely silent, but a little care in inspection overcomes trouble on this score. Most of the noise to be heard in a good car is intermittent, arising from the body and from the various parts made of sheet metal.

The number of cars which can be driven over a rough road without squeaking or rattling is very small, and the tracing down of noise of this sort is very difficult, yet a trained observer could almost estimate the price of a car by being driven in it blindfold over a bit of rough road or street. Thus it is reasonable to assume that care for detail in assembly has much to do with the matter.

A body shell of sheet steel or aluminum can have either great strength or very little, great rigidity or great flexibility. We have not yet begun to study the body from a proper engineering viewpoint, we have little or no information as to the rigidity which should be desired. It seems rather remarkable that so little concentrated study should have been given to this part of a car, that the few bodies which will stay quiet and maintain their door fits, etc., after years of use, have not been studied closely by all manufacturers, and that the *durability* of the average body is not a little better: it easily could be.

Expanding S. A. E. Activities

AT the summer meeting of the Society it was made abundantly clear that there was much work to be done in connection with the standardization of aircraft parts, especially parts of aeronautical engines and the petty details of plane construction. It may, however, be pointed out that such standardization is hardly likely to follow along quite the same lines as the automobile standardizing work already done. For one thing, the aeroplane is a much more recent product and is much further from perfection; there is little about an aeroplane that follows convention, for in air machines "convention" changes every few weeks.

This being the case, any standardizing work that is undertaken will have to be of a highly scientific character, and any committee appointment to handle the subject will have to consider fundamental reasons all the time. They will practically never be called upon to compare existing practice and strike an average, which was the method adopted for establishing many of the earlier S. A. E. standards.

Probably the amount of responsibility resting upon the aeronautic standards committee will be extremely great, and its personnel will be studied with interest when it is completed. Probably it will be found that the automobile industry has a large representation as the amount of engine work being done by automobile manufacturers is greater than might be imagined.

Excess Capacity

WHATEVER may be the result of the Mexican situation, one thing is assured, and this is that the automobile industry is ready and able to supply the utmost needs of the army. Whether it be standard types of truck, or whether special adaptations are needed, supply will follow demand with practically no delay.

It is only possible to judge by rumor at present, but there seems good reason to imagine that the army has in mind the extensive use of automobiles for the transport of troops. In Europe the motor truck and the passenger car has been used for this purpose but, owing to the number of railroads there is seldom any need to send men far by road. On the Mexican border this is not the case. Railways are few and far between, and there are only three ways of moving troops; on foot, by horse traction and by automobile.

It is distinctly gratifying to reflect that the American army, did the need arise, could collect as large a fleet of motor vehicles in a week as was got together by the armies of Europe in 6 months.

King Passes 10,000 Mile Mark

Distance Covered Long Before Close of 2-Weeks' Record Endurance Run

SHEEPSHEAD BAY SPEEDWAY, NEW YORK, June 28—Without once stopping its motor since starting on its run at 12.14 p. m. on June 15, the eight-cylinder King Model E stock car had covered 10,000 miles at 12.18 to-day. The run will be continued until to-morrow noon when the car will have been running day and night for 2 weeks, being subjected in that time to far more severe tests than it would meet in over 2 years of actual use by an owner, the average speed for the entire run being well over 32 m.p.h. as the demonstration draws to a close. For details, see page 1164.

Weather conditions have been most trying throughout the test, thunderstorms, continued rain and rapid changes of temperature, from the chill of Winter to the heat of midsummer, combining to augment the difficulties encountered. In spite of this, however, the car is gradually pulling up its speed average, the lap times varying from 2 min., 50 sec. to 4 min., the average being between 3 min., 25 sec., and 3 min., 30 sec.

To-day representatives of the companies manufacturing the various units used in the King car are assembling at the Speedway to witness the conclusion of the test.

Delling to Leave Mercer

NEW YORK CITY, June 28—It is stated on good authority that Eric H. Delling, at present chief engineer and designer at the Mercer Automobile Co., Trenton, N. J., expects to sever his connections with that company and devote his time to the development of a new car which will probably bear his name. While nothing definite could be learned about the matter it is believed a company is forming to carry out Mr. Delling's ideas. If this information is correct the new car will be anticipated with a great deal of interest as Mr. Delling is recognized as one of the foremost engineers here and abroad.

Benjamin Is Ross Sales Manager

DETROIT, MICH., June 26—The Ross Automobile Co., this city, has appointed C. Arthur Benjamin, veteran automobile man, to the position of sales manager. Benjamin's career with the industry dates back to 1898 when he took the agency for the Stanley steamer at Syracuse, N. Y. In 1900 when the Stanley was taken over by the Locomobile company, he was made Southern sales representative. In 1902 he became salesmanager of the H. H. Franklin company, retaining this connection until 1906 when he became sales manager of the Babcock Electric company at Buffalo. Later he was connected with the Aerocar company, Detroit, and for 6 years following that handled the Packard in Syracuse, in 1913 becoming sales manager of the automobile department of the American Locomotive Co., now discontinued.

Humphrey Out of Chalmers

DETROIT, MICH., June 26—S. H. Humphrey, vice-president in charge of manufacturing of the Chalmers Motor Co., has resigned to take up similar duties with the Briscoe Motor Corp., Jackson, Mich. The Chalmers company has not yet appointed a successor.

Mr. Humphrey joined the Chalmers forces in April of last year, coming from the Hupp Motor Car Co., with which concern he had been connected for 2½ years. He has had a long and varied experience in his field of the industry. On first entering the Chalmers organization, he was works manager, being elected a vice-president during the early part of May of last year.

Walter Marmon Injured in Accident

NEW YORK CITY, June 26—Walter Marmon, president of the Nordyke & Marmon Co., Indianapolis, Ind., is fast recovering from a painful injury received in an accident in this city on June 17 when his car struck an L pillar on 6th Avenue, near 36th Street. Franklin Hall, a retired business man of Philadelphia and father-in-law of Mr. Marmon, died in the Polyclinic Hospital from injuries received in the accident. Mrs. Marmon escaped with slight bruises.

314 Continental Motors in 1 Day

MUSKEGON, MICH., June 24—The Continental Motors Co. established a new record at its local factory with a day's production of 314 engines one day recently. The average is 284 daily.

Schwartz Appointed Schavoir Rubber Co. Sales Manager

STAMFORD, CONN., June 22—A. J. Schwartz has been appointed general sales manager of the Schavoir Rubber Co., Stamford, his duties beginning June 26.

Mr. Schwartz leaves the Automobile Tire Co. of New York and was formerly connected with the Continental Caoutchouc Co., New York City.

The Schavoir company has recently trebled its capacity, and plans are now under way for a still greater extension. Mr. Schwartz for the present will be located at the Stamford plant, pending the opening of a New York office.

New Overland Four at $635

Model 75 B Is Continuation of Model 75—Has ¼-Inch Larger Bore

TOLEDO, OHIO, June 24—Announcement has just been made of a new series of the smaller four-cylinder Overland that was originally brought out last November as model 75. The new car is known as model 75 B, and is very little different from the previous series, except in the increase of the bore from 3⅛-in. to 3⅜-in., with the stroke remaining at 5 in. There are other engineering refinements of a minor character that add to the efficiency, however. The price of the new 75 B touring car of five-passenger capacity is $635, and the roadster costs $620. The previous series touring model was $615 and the roadster $595, and while the greater materials cost would be sufficient reason for a price increase of this amount, the increase of the engine power, together with the other refinements that have been made render the car well worth the additional figure.

There have been no alterations in design to speak of in the power plant, except those changes that have added to the power. The motor now develops 31.5 hp. at 1950 r.p.m. The body looks practically the same. and there are the same little conveniences such as the electrical control box on the steering column, one-man top, demountable rims, and all the fitments of the day.

This model Overland is built on a wheelbase of 104 in.; has cantilever rear springs; retains the characteristic Overland construction of incorporating the gearset with the rear axle, possesses the tapered frame; is fitted with Auto-Lite starting and lighting and has 31 by 4 tires.

Flint Is Wilson Sales Manager

DETROIT, MICH., June 26—Herbert J. Flint, well known in the industry, has joined the forces of the J. C. Wilson Co., this city, as general sales manager. He will have full charge of the distribution of the Wilson truck. Flint was eastern sales manager for the Smith Form-a-Truck, and prior to this was with Thomas J. Hay, distributor of Hupmobile and Chandler cars in Chicago.

Smith, Premier Trustee, Moves Office

INDIANAPOLIS, IND., June 24—Frank E. Smith, trustee of the American Motors Co., and the Premier Motor Mfg. Co., has moved his office to the second floor of the Russel M. Seeds Building, this city.

70% Duty on French Imports

Replaces General Prohibition of American and English Automobile Chassis

PARIS, June 27—*Special Cable*—The French Government has replaced the general prohibition from the United States and England of automobile chassis, with or without motor or body, automobile coach work and other automobile parts, with a 70 per cent duty.

The former decree, issued on May 15 last, authorized the Ministers of Commerce and Agriculture to make exceptions and permit, under conditions to be determined by the Minister of Finance, the importation of particular articles.

No official explanation of the new decree has been made, but is thought that the ruling undoubtedly has been put into effect with a view to procuring more space in vessels coming to French ports for supplies the government needs.

England to Curb Motorists

LONDON, June 21—The Government has decided that more effective diminution in the use of automobiles can be obtained by control than by increasing taxes on cars.

According to an announcement made in the House of Commons to-day, the increased taxes are to be rescinded and a central authority created with power to grant permits for the purchase of specified amounts of gasoline, on which a license of 6 pence per gal. must be paid at the time of purchase. For commercial vehicles or those of doctors and veterinary surgeons the permits will be issued at half rates.

National Twelve Price $160 Higher July 1

INDIANAPOLIS, IND., June 24—Due to the high cost of materials and labor, the National Motor Vehicle Co. will raise the price of its twelve-cylinder model $160 on July 1. The car now sells at $1,990 and the new price will be $2,150.

1917 Marmon Unchanged

INDIANAPOLIS, IND., June 26—No changes of any consequence will be made in the Marmon 34 for 1917. The present model will be continued throughout next year with possibly a few minor refinements in detail.

Brown Carriage Co. Enters Automobile and Truck Fields

CINCINNATI, OHIO, June 24—The Brown Carriage Co., this city, which has heretofore concentrated its manufacturing activities in horse-drawn vehicles, will expand and enter the automobile field with a five-passenger car selling at $735, two light delivery cars at $675 and one at $670.

The models will be assembled at its plant and will include parts of well-known manufacturers. A four-cylinder 3⅛ by 4½-in. LeRoi motor will be used. Other features include: constant level lubrication with positive oil pump delivering oil at both ends of motor; thermo-syphon cooling; Atwater Kent ignition; U. S. L. storage battery; Allis-Chalmers electric starter; electric lighting from storage battery; Kingston carbureter; multiple-disk clutch; left drive; 105-in. wheelbase; Walker & Weiss rear axle; Hyatt roller bearings; and one-man mohair top.

Allen Continues Model 37

FOSTORIA OHIO, June 22—The Allen Motor Co., Fostoria, has announced that its present Model 37 touring car and roadster will be continued, with no change. The price of $795 is given in the announcement of the continuation of this model, but while it states that the car will not be changed, it does not guarantee that there will be no raise in price.

Large Four for Argo

JACKSON, MICH., June 24—A larger four-cylinder model is to be marketed by the Argo Motor Co., this city, as a running mate to the present small four-cylinder car. No details of the new model are as yet forthcoming, but they are expected within the next 30 days.

Empire Continues Present Models

INDIANAPOLIS, IND., June 24—The Empire Automobile Co., this city, will make no change whatever in its present models before about the time of the New York automobile show next January.

Ford Blast Furnaces in Detroit to Cost $8,000,000

DETROIT, MICH., June 26—The Ford Motor Co. has made arrangements for the erection, in West Detroit, of blast furnaces and a plant for making parts. This is distinct and apart from the tractor plant and will be built before the tractor plant so as to make the company independent of other concerns in obtaining parts used in the Ford machine.

It is the plan of the company to have the ore brought direct to the new plant and run through to the completed parts with one heating. At least two blast furnaces will be built and possibly four, and the initial cost of the plant will be $8,000,000. With work beginning on the blast furnaces and parts plant this fall, work on the tractor plant will be put aside until next spring.

Mitchell Motors Co. Formed

To Acquire Business of Mitchell-Lewis Concern—Will Finance Expansion

NEW YORK CITY, June 26—The Mitchell Motors Co. will acquire the business of the Mitchell-Lewis Motor Car Co., Racine, Wis., as a result of the forming of a syndicate to underwrite the capital stock of the new company. The syndicate will be composed of Ladenburg, Thalmann & Co. and A. G. Becker & Co., Chicago, and the issue will be 125,000 shares of common stock without par value. The present capital is $10,000,000.

This new financing will enable the company to greatly enlarge its production of cars. It is stated that the company may expend $100,000 in factory improvements so as to bring the production up to 30,000 cars a year.

No change will be made in the directorate, H. L. McClaren remaining president; W. H. Armstrong, secretary; F. L. Mitchell, treasurer, and J. W. Bate, first vice-president and chief engineer.

Elgin Corp. Merges New Era

CHICAGO, ILL., June 26—The Elgin Motor Car Corp., this city, has absorbed the New Era Motor Car Co., Joliet, Ill., thus acquiring the New Era light four and the light delivery wagon. The Elgin corporation is now assured of an ample supply of materials as the New Era concern had made excellent arrangements in this respect with some of the largest material producers in the country. The plant facilities of the New Era company will enable the Elgin firm to greatly increase its production.

The Elgin corporation reports that its entire season's output is oversold.

Saginaw Co. Starts Work

SAGINAW, MICH., June 24—The Saginaw Motor Car Co., which was organized and financed by persons in this city, and which is manufacturing the Yale eight for an exclusive selling agent, is now in its plant and expects to make first deliveries about Aug. 1. The officers, all of Saginaw, are J. A. Cimmerer, president; J. W. Grant, vice-president; W. C. Wiechmann, secretary; H. E. Oppenheimer, treasurer; L. J. Lampke, general manager.

Schebler Co. Changes Name

INDIANAPOLIS, IND., June 26—The firm name of Wheeler & Schebler, carbureter manufacturers, will be changed July 1 to the Wheeler-Schebler Carbureter Co., Inc. There will be no change in the policy or personnel of the organization.

Maxwell Lowers Prices July 1

Touring Model $595—Roadster $580—100,000-Car Output Planned

DETROIT, MICH., June 27—Effective July 1, the Maxwell Motor Co. will market its touring car at $595, a reduction of $60, and will sell the roadster at $580, a drop of $55. The reduction is ascribed to a greatly increased production that offsets any increases in the cost of materials. The schedule now calls for an output of 100,000 cars for the coming selling year.

The 1917 Maxwell is not changed over the present car. The Maxwell management now believes the car to be standardized, and will not alter the product in any way from the regular chassis of 102 in. wheelbase and powered with a 3⅝ by 4½-in. four-cylinder block motor carrying the same five body types, namely, touring, roadster, cabriolet, town car and sedan.

Plants of the Maxwell company at Newcastle, Ind., Dayton, Ohio, and this city are now working to capacity, and the present production is being stepped up to meet the new schedules.

Detroit Seamless Tubes Co. Buys New Plant Site

DETROIT, MICH., June 24—The Detroit Seamless Steel Tubes Co., maker of a wide variety of tubing for motor vehicles, has purchased a 12-acre site in the western part of the city for the purpose of erecting a new factory that will allow four times the present output. It is estimated that the plant, which will be entirely under one roof, will have a length of 700 ft. and a width of about 400 ft., enabling an output of 5000 tons monthly with a payroll of 1000 men. In this business the furnaces must be kept going continuously, making it necessary to work 24 hr. a day.

The Detroit Seamless Tubes concern is now turning out about 300 tons of tubing monthly with a force between 300 and 400 men, about 80 per cent of the product going to the automobile industry and the balance used in locomotive boiler construction. Rear axle tubes, and a great variety of sizes and shapes of tubing for the needs of the modern car have revolutionized the tube business. This company started in 1900 with a 100-ton monthly capacity and 100 men, an indication of the rapid strides that have been made.

Lakeside Foundry Buys Site

MUSKEGON, MICH., June 24—With the intention of trippling its present output, the Lakeside Foundry Co., producer of automobile castings, has purchased a factory site on Western Avenue, between Seventh and Eighth Streets, having a frontage of 270 ft. and extending back a block. It is the intention to build a structure measuring 75 by 225 ft. with a molding floor 60 by 150 ft. The present buildings are 60 by 90 ft. and the working force fifty-five men, which will be considerably enlarged when the new quarters are occupied.

Young Heads Flint Cushion Spring Co.

DETROIT, MICH., June 24—The L. A. Young Corp., a holding company which owns the Detroit Wire Spring Co., and several other large automobile parts plants here, has purchased a 7-acre tract of land at Flint, Mich., on which will be erected a very large plant for the Flint Cushion Spring Co. L. A. Young of this city is president and C. O. Ormsbee, for 17 years with the Durant-Dort Carriage Co. and 11 years in the trimming end of the Buick organization, has been made factory manager.

To Erect Seven Units

Eventually some seven units will be erected on the Flint site, according to Mr. Young, the first of these being under construction at the present time. All will be of the saw-tooth, one-story type, since there is plenty of room to spread out. The first unit is to measure 620 by 100 ft., but if present plans are carried out it will eventually extend for 800 ft. As the plot of land is diagonal in shape, the other units, between each two of which there will be a side track, will taper off from this maximum length to about 450 ft. for the shortest wing. The first unit will employ 240 men. This move will not affect the Detroit plants, but inasmuch as the concern is doing about 60 per cent of the seat spring business of the Flint factories, it was deemed advisable to get closer to them. Besides cushion springs, other small parts for cars will be made at Flint.

The Detroit spring factory, now making 500,000 sets of springs annually, is being enlarged also by a building 400 by 100 ft.

Celfor Plant Nears Completion

BUCHANAN, MICH., June 24—The new factory building of the Celfor Tool Co., maker of automobile parts and internal gear drive axles, is now nearing completion. It is a structure measuring 137 by 300 ft. and is constructed along modern factory lines of brick and steel, one story in height. This will be ready for occupancy in 4 weeks and will permit of a large increase to the Celfor production.

Wagner and Hoyt Combine

Together with Gerald Laugh Form Company to Manufacture Electrical Equipment

NEW YORK CITY, June 26—A. F. Wagner, president of the Wagner Specialties Co., New York, and Frank Hoyt, formerly chief engineer of the Simms Magneto Co., together with Gerald Laugh, formerly connected with the National Cash Register and Burroughs Adding Machine companies, have formed the Wagner-Hoyt Electric Co. and will manufacture complete electrical equipment for automobiles and market it as a unit. Wagner will be president and general manager of the company, Hoyt treasurer and chief engineer and Laugh secretary. For the present, the salesrooms of the Wagner Specialties Co. in New York City will be maintained and an office has been opened in the Woolworth building. A factory somewhere in New Jersey will be occupied though the exact location has not been decided.

The concern has obtained a license under the patents of the late H. Ward Leonard covering the control of electric lighting systems on motor cars and in addition to producing the complete electrical equipment of a car including starting and lighting, ignition and lamps, will also market a new type of storage battery. The concern will market its product as a complete unit for the entire electrical equipment of a motor car.

New Stover Tractor Engine

FREEPORT, ILL., June 24—A new engine has been added to the list of the Stover Tractor Mfg. & Engine Co. It is known as a four-cycle, semi-Diesel crude oil machine, and is an entirely new departure. William F. Freidag, superintendent, is the designer. This type of engine has been manufactured in Europe for several years, but American manufacturers have been chary of it.

Gordon Co. to Start Tire Manufacture Soon

COLUMBUS, OHIO, June 22—Manufacture of automobile tires will be undertaken by the J. P. Gordon Co., Fourth and Naghten Streets, just as soon as machinery can be installed. Owing to the rush in the factories where the machinery is made, Mr. Gordon said that he did not think it would be possible to start this new department before 4 months. A tire expert has been employed and the preparation of the room and the installation of the machinery will be under his direction.

This company was started 16 years ago by Mr. Gordon and he has seen it grow from one man with a machine to a plant employing 500 people. The company formerly was known as the Vehicle Hood and Apron Co. It makes tire covers and a variety of accessories, including a one-man top. Two new buildings in the factory group have just been completed.

The company has disposed of its raincoat and clothing business to the Cleveland Raincoat Co. and all of the finished stock on hand has been shipped to Cleveland.

General Tire & Rubber Co. to Expand Plant

AKRON, OHIO, June 22—Less than 6 months old and already erecting an addition to its present plant is the record of the General Tire & Rubber Co., Akron's newest rubber factory.

This company was formerly located at Kansas City, Mo. Tire accessories and a few rubber specialties were the principal products, the company being in this line for about 7 years. Increased business in this department, together with a growing tire business makes the additional space necessary. Within 10 days the plant will be manufacturing about 150 tires per day.

M. O'Neil, president of the company, states that with the contemplated increased equipment and floorspace, the capacity of the factory will be 500 tires per day.

Detroit S. A. E. to Repeat Noronic Melodrama July 7

DETROIT, MICH., June 26—So much pressure has been brought to bear on the Detroit Section of the Society of Automobile Engineers that it has been decided to again produce the five-act melodrama that was given by the Section on the Noronic during this year's 4-day boat trip of the Society. The little play bears the imposing title of the "Trials of Gwendolyne, or Snatching Victory from the Jaws of Defeat." Arrangement have been made to give the play in the Lyceum Theater on July 7.

It took much rehearsing to put the piece on on the boat, it being a five-act play, and having the following members of the local section in its cast: B. G. Koether, C. M. White, R. T. Middleton, J. W. Stark, R. S. Lane, W. D. Rockwell, J. Dow, W. H. Conant, P. L. Barter, C. I. Stevens, F. R. Bay, L. J. Schneider, K. W. Zimmerschied, G. W. Dunham, Russell Huff, and J. C. Weed. The section invites all out-of-town members of the Society who wish to see the next president of the Society, the present president and the other prominent members go through their capers again.

The play was written by Frank Briscoe, and produced under the direction of N. A. Pabst.

Three Big Parts Cos. in Merger

Steel Products Co. To Consolidate with Mich. and Metals Welding Cos.

DETROIT, MICH., June 26—In order to effect the usual economies of large scale production and with a view to considerably broadening the service offered the car builder, interests headed by C. E. Thompson, president of the Steel Products Co., Cleveland, Ohio, have obtained control of several large plants specializing in manufacturing and engineering work for the motor vehicle makers. With a capital of $4,000,000, the interests that are to be consolidated under the name of the Steel Products Co., with headquarters at Cleveland, are the present Steel Products Co., Cleveland; the Michigan Electric Welding Co., Detroit, and the Metals Welding Co., Cleveland.

The officers of the new Steel Products Co. are C. E. Thompson, president; W. D. Bartlett, vice-president, and J. A. Krider, secretary and treasurer. The plants will continue to operate under their own names as subsidiary plants of the Steel Products Co., and the consolidation will undoubtedly be developed along the same lines as the Steel Products Co. E. C. Reader, manager of the Metals Welding Co., and C. F. Clark, manager of the Michigan Electric Welding Co. will both continue in their present capacities.

The Steel Products Co. makes valves, spring bolts, and other hardened and ground parts; the Michigan Electric Welding Co. produces drag-links, brakes, torsion radius rods and other rod assemblies, head lamp brackets and round stock spring clips; and the Metals Welding Co. makes acetylene welding equipment, high-speed cutting tools, and does a large business in motor vehicle welding work. Each firm is a leader in its particular line, having for some years furnished parts for nearly all the leading car makers. The equipment owned by the new combine covers some of the most important processes in automobile manufacture, such as metallurgical work, heat treating, precision grinding, polishing, electric welding, acetylene welding, and automatic machine and general steel manufacturing equipment. Extensive additions to all the plants affected are now under way.

Three New Menominee Trucks

MENOMINEE, MICH., June 24—The Menominee Motor Truck Co., this city, announces three new models, one of which is a continuation of the previous ¾-ton truck with a worm-drive axle instead of the helical gear drive, another an entirely new worm drive 1½-tonner known as the model H, and a 3½-tonner of new design, selling at $2,775. The price of the new ¾-tonner is $1,295, an increase of $170 over the selling price of the previous model of the same capacity. The chassis price of the 1½-tonner is $1,775. Other models sell at $2,240 for the 2-tonner and a 1-tonner at $1,575.

The new model H, 3000-lb. capacity, embodies several unusual features such as shock-absorbing radiator support, auxiliary springs to prevent overtaxing of the main springs, automatic governor regulating the speed of the trucks, and brake eveners of the universal type designed to eliminate the possibility of rods or yokes binding.

The motor is Continental, three-point suspension unit power plant with 3¾-in. bore and 5½-in stroke. Other features include Stromberg carbureter, Bosch magneto and combination and forced-feed system of lubrication.

The new ¾-ton model EW has a 3¾ by 5-in. motor. The clutches are Brown-Lipe multiple-disk in both models, with gearsets of the same make, three speeds forward and reverse. The smaller model has a 6 to 1 ratio on high and the large truck 9¼ to 1. Timken worm-drive, floating axles with nickel steel shafts characterize both.

Detroit Battery Co. Moves Into Its New Plant

DETROIT, MICH., June 24—The Detroit Battery Co., maker of automobile storage batteries, is now moving into its new factory, which is a three-story plant of modern fireproof construction, each floor measuring 100 by 90 ft., the total floor space amounting to 25,000 sq. ft. It is stated that the new quarters will enable a production of 500 batteries a day, a big jump from the production in the old plant of fifty to seventy-five batteries daily.

The Detroit Battery Co. is now several years old, has a capital of $60,000 and makes its product in sizes to fit any make of car, numbering among its standard equipment customers Briscoe, Argo and other car builders. The officers are S. W. Elston, president; Wm. Petzold, vice-president; Sol Meyer, treasurer; M. G. Pierson, secretary, and Wm. Ducharme, director.

Pratt Enters Truck Field

BUFFALO, N. Y., June 26—The Higrade Motors Co. has been formed here with a capital of $250,000 and will embark in the manufacture of a medium-sized truck. J. Elmer Pratt heads the organization and associated with him are Will J. Loomis and L. W. Coppock. The truck is described as being between the big vehicle and the little one and will have a wheelbase of 115 in., and be mounted on 4-in. pneumatic tires. It will have a four-cylinder 3¼ by 5 motor, equipped with Bosch ignition and an electric lighting and starting system. Other specifications include Sheldon springs and worm axle, Spicer drive, Fedder cellular radiator, Detroit Gear transmission, Borg & Beck disk clutch, Lavine semi-irreversible steering gear. The chassis will weigh about 2200 lb. and the price will be less than $1 per lb. It is stated that $170,000 of the capital already has been taken up.

$300,000 for Armored Trucks

WASHINGTON, D. C., June 26—The House to-day passed the army appropriation bill, the measure carrying approximately $182,000,000; $300,000 of which is allowed for armored trucks as a result of the Mexican situation. This bill will now go to the Senate where action on it will be expedited.

Depleted Horse Market Stimulates Truck Buying by Army

NEW YORK CITY, June 26—A lack of horses and mules in this country will have a stimulating effect on commercial vehicles sales to the United States Army at the present time. This country has exported since the war began 590,452 horses and 154,077 mules and the U. S. Government finds the market depleted as a result.

The equipping of the forces for the Mexican crisis will be a sharp stimulus to the buying of trucks and passenger cars on account of the scarcity of horses and mules. The United States has been steadily building up truck trains since General Pershing started his advance into Mexico, but it is stated that the truck equipment at present is below requirements.

200 Troy Trailers Ordered

TROY, OHIO, June 22—The announcement is made that the Troy Wagon Works has an order for 200 trailers, equipped with brakes, rubber tires and special bodies from the French Government for war purposes. The order calls for $413,000.

Austrian Firms to Make Trucks

VIENNA, AUSTRIA, June 26—Several Austrian companies will start the manufacture of motor trucks when the war is over. Among those reported that will undertake this business are the Skodawerke A. G., of Pilsen, and the Waffenfabrik at Steyr. These companies have large funds available, highly trained technical staffs, mechanics and business administrations. They will start on a large scale.

Government Opens Truck Bids

Proposal on 1½ to 3-Tonners in Numbers of from One to 1000 of Each

WASHINGTON, D. C., June 23—A proposal has been sent out to manufacturers by the U. S. Government asking for bids on trucks from 1½ to 3 tons, in numbers of from one to 1000 of each. Bids are to be opened for these trucks at the New York post on June 30. This order means that the government is preparing now to supply its troops with adequate motor transportation equipment in case it is necessary to raise a large volunteer army for service in Mexico.

Meantime individual shipments of truck fleets continue to be made. One of the most recent of these included twenty-eight 3-ton Peerless transport trucks and five tank trucks on the same chassis. These vehicles were all equipped with bodies and the Peerless company furnished drivers for them. They were shipped on gondola cars on June 19, being routed over a passenger schedule to reach Brownsville, Tex., June 22. One gondola car was used for two trucks, so that the complete train comprised fourteen of these and one Pullman tourist car for the crew. Previous to this ten 600-gal. tank trucks were shipped by the same company.

Repair Trucks Provided

This order is of especial interest in view of the capacity of the trucks. Besides these, thirty 3-ton Rikers and fifty 3-ton F. W. D., four-wheel-driven trucks are being used by our punitive expedition. Fifteen of the F. W. D. trucks are equipped with 600-gal. tanks, used to haul water for the men and cavalry horses.

The deficiency of repair trucks is rapidly being relieved. The Four Wheel Drive Auto Co. of Clintonville, Wis., has delivered most of an order of eight of these vehicles, mounted on 3-ton chassis, each carrying a 13-in. lathe with a 5-ft. bed, a drill-press, a grinder, a portable drill, a cabinet bench, three vises, a forge, three anvils, an oxy-acetylene welding and cutting outfit and a complete set of blacksmithing, machine and carpenters' tools.

Power is derived from a 9-hp. four-cylinder auxiliary engine, driving a dynamo, each machine having direct electric drive. The dynamo also supplies current for electric lights.

Quick-Firers on Quads

Another new wrinkle in truck equipment is that of quick-firing guns which have been mounted on the steel dashes of a number of the Jeffery Quad transport trucks, so that transport trains can be self-defending in case of an attack.

Road conditions, as is well known, are atrocious. Nevertheless, some amazing records have been made by different trains in the service. Packard train No. 3 recently clipped an hour from the record between Casas Grandes, Mexico, and Columbus, N. M., making the 104 miles in 10 hr. actual running time. On this trip it had been away from its base for 14 days, having traveled about 1000 miles in that time.

Improving the Roads

To improve these roads four Phœnix Centiped creeper-driven good roads trucks, four Acme road scrapers and eighteen steel dump wagons have been shipped from Chicago to Columbus for use in improving the road between Columbus, N. M., and Namiquipa, Mexico, so that in the event of more activity in the southern republic, the use of motor trucks will be facilitated.

Recruiting Drivers

Drivers used in Mexico have been recruited from among the workers in truck factories. Some are New York taxicab drivers, others are college men in search of travel and adventure, others miscellaneous chauffeurs out of work who have answered advertisements, many are enlisted men who have been trained to drive their mounts since the crossing of the border by our troops. Some of them are negroes and all reports agree that their behavior has been excellent. Some of the drivers have performed their duties with great credit and others have been very unruly. In practically all cases, there has been a lack either of military discipline, or, in the case of enlisted novices, of mechanical ability. On several occasions civilian drivers have refused to obey the orders of the army officers commanding them. They have even abandoned their mounts. Some of the officers have taken matters in their own hands and compelled the drivers to do their duty. In other cases the men have been arrested and held under guard until they had agreed to return to work.

Trucks in Mexico

Up to May 1, the trucks in Mexico were as follows:

28 Trucks Each

Company 1, Q.M.C	Jeffery
Company 2, Q.M.C	White
Company 3, Q.M.C	Packard
Company 4, Q.M.C	Jeffery
Company 5, Q.M.C	Jeffery
Company 6, Q.M.C	Jeffery
Company 7, Q.M.C	Jeffery
Company 8, Q.M.C	White
Company 9, Q.M.C	White
Company 10, Q.M.C	Packard
Company 11, Q.M.C	Packard
Company 12, Q.M.C	Packard
Company 13, Q.M.C	Riker
Company 14, Q.M.C	F.W.D.

Miscellaneous trucks for work about

posts and camps on border, as follows:

Signal and Aero Corps.
Fourteen F.W.D.'s.
Seven White tank trucks.
Six Velies.
Two Packard repair trucks.
Two Peerless 4-tonners.
Two Rikers, 3-ton.
Two White radio-telegraph trucks.
Two White 1½-tonners.
One Federal 3½-tonner.
One Kelly-Springfield.
One Lippard-Stewart.
One Mais.
One Peerless.
One Republic.
One White 3-ton.
One White, Signal and Aero Corps.
Jeffery Quads.

Cortland Car & Carriage Co. Busy

SIDNEY, N. Y., June 24—The Cortland Car & Carriage Co., this city, manufacturer of the Hatfield roadster and suburban cars and for nearly 30 years builders of finished carriages, has entered the automobile field. The company will produce a moderate-priced car.

It is now devoting all its factory space to automobile manufacturing and to take care of this production is increasing its capital from $75,000 to $225,000 by issuing 7 per cent accumulative preferred stock, also common stock, both of which are sold at par. The preferred stock will be sold separately but subscribers to the common are required to take an equal amount of the preferred.

Canadian Registrations Gain

WINNIPEG, MAN., June 24—Out of 8616 licensed automobiles in Manitoba, for the year 1915, 3425 were Fords, 1004 were McLaughlin-Buicks and 622 Overlands. In Saskatchewan, where there is about the same number of licensed cars as in Manitoba, there are 3514 Fords, 742 McLaughlins and 304 Overlands. In Alberta, 5586 cars bear license plates. Of this number there are 2695 Fords, 583 McLaughlins and 312 Overlands. Also Chevrolet, Dort, Hudson, Scripps-Booth and others are establishing sales records every day.

According to statistics recently compiled, Toronto leads all other cities in Canada in number of automobiles registered. Toronto at the end of 1915 had 8915, a gain of over 1400 over the preceding year. Montreal comes next with 3917, an increase of less than 100 over 1914. On the whole the Western cities of Canada show themselves to be the heaviest purchasers. Vancouver registered 3719, as against 2578 in 1914.

C. A. A. Wins Interclub Run

CHICAGO, ILL., June 23—The Chicago Athletic Assn. won the Interclub Reliability Contest from the Chicago Automobile Club in the 2-day run to Indianapolis and return, the score standing 277 points penalty for the C. A. A. and 605 points penalty for the C. A. C.

Militiamen Backed by Industry

Car, Truck, Parts and Accessory Concerns to Continue Pay and Positions

NEW YORK CITY, June 27—That the automobile industry is doing its share in helping to swell the list of enrollments in the army for work on the Mexican border is manifested by the number of companies agreeing to compensate their workers who join the army.

The large tire factories in Akron are in the van in their announcement of compensation and open position for all employees who are enrolled in the State militia or who enlist for service on the border in Mexico. The Goodrich company is to give soldier employees, who are married or single and supporting dependents, two-thirds of their average pay, based on their earnings during the past 3 months, after making deductions of the amounts received from the government. Single men and married men not contributing to the support of dependents will receive one-half of their salaries. Payment will be made to their dependents of held in trust until the return of the employee. Absence for military duty will not affect the pension and insurance funds, but employees will be continued on the rolls. The men will be considered on leave of absence and their places will be held open. These conditions apply for 1 year.

Various Companies' Arrangements

The Firestone plan is to give all employees, who have been with the company for 3 years, who have enlisted prior to June 20, full pay, less the government allowance. Employees of 1 to 3 years, two-thirds pay, less the government allowance. The arrangements will hold good for 1 year and will also apply to all employees who enlist hereafter, down to 6 months' service with the company.

The Goodyear company makes a similar announcement, agreeing to give all its employees a large part of their pay, less the government allowance.

The Studebaker Corp. will place all men who go to the Mexican border on full pay for the balance of the year. This applies to men employed at both the Detroit and South Bend plants, who have enlisted to go to the front. At the present time the payroll numbers about 7000 men, and some forty-five to fifty have already gone to the training camps. The Equitable Life Assurance Society has agreed to continue in force the life insurance policy which each of the employees hold under the Studebaker insurance plan.

The U. S. Rubber Co. gives full pay to all called on active service and their positions will be held open for them pending their return.

Packard employees will receive their full pay for the 2 weeks' period immediately following the mobilization order.

The Vacuum Oil Co., New York City, will grant all employees leave of absence and full pay continued until further notice. In addition the firm announced that employees desiring to join the military training camp at Plattsburg would receive 2 weeks with full pay in addition to the regular 2 weeks' vacation.

The Paige-Detroit Co. of New York, through E. M. Dalley, the president, announces that families of its employees who have answered the call to colors will be cared for.

The Pyrene company will give full pay to those employees enlisting.

Ford to Keep Jobs Open

Henry Ford has denied the rumor that he would discharge any of his employees who enlisted in the National Guard. Those men who enlist can return to employment without prejudice, states Mr. Ford.

The following list shows those companies which are taking care of their employees during their enlistment in the army:

Auto Supply Mfg. Co., N. Y. C.
Firestone Tire & Rubber Co., Akron, Ohio.
B. F. Goodrich Co., Akron, Ohio.
Goodyear Tire & Rubber Co., Akron, Ohio.
General Electric Co., Schenectady, N. Y.
H. W. Johns-Manville Co., N. Y. C.
Paige-Detroit Co. of N. Y., N. Y. C.
Packard Motor Car Co., Detroit, Mich.
Pyrene Mfg. Co., New York City.
Studebaker Corp., Detroit, Mich.
R. E. Taylor Corp., N. Y. C.
U. S. Rubber Co., N. Y. C.
Vacuum Oil Co., N. Y. C.

$60,000 Plant for Dort

FLINT, MICH., June 24—To take care of increased business, the Dort Motor Car Co., which has been building motor cars for about 1 year now, and which is the outgrowth of the motor vehicle building operations of the Durant-Dort interests, has purchased several large pieces of land here, on which a $60,000 plant is to be begun immediately. All the buildings formerly utilized by the Durant-Dort Carriage Co. have also been taken over for the manufacture of cars. Besides, several lots adjacent to present factory buildings have been acquired for expansion of these plants.

198,150 Ohio Registrations

COLUMBUS, OHIO, June 22—According to Registrar of Automobiles W. H. Walker, up to June 21, 194,000 licenses have been issued to owners of gasoline cars and trucks. The number of electrics is 4150. Manufacturers and dealers to the number of 2750 have been registered in that period. It is estimated that more than 230,000 cars will be registered by the department if the present rate is maintained.

Paige Earning at 150% Rate

$1,500,000 Per Year Is Present Earning Rate—Assets $1,504,497

NEW YORK CITY, June 26—The Paige-Detroit Motor Car Co., Detroit, is earning at the rate of $1,500,000 per annum, which compares with actual earnings in 1915 of $654,000 and in 1914 of $123,000. With the recent 80 per cent stock dividend and the additional $100,000 stock sold, there is now outstanding $1,000,000 capital stock, par value $10. Earnings this year are at a rate equivalent to 150 per cent on the stock.

The net tangible assets of the company as of June 1, with the full $1,000,000 stock outstanding, were $1,504,497, or $15 per $10 share. The balance sheet as of that date follows:

Assets	
Plant	$158,733
Inventory	742,421
Service station accounts	154,914
Notes and accounts receivable	120,161
Prepaid expenses	4,825
Cash and Detroit bonds	682,808
Total	$1,863,990
Liabilities	
Capital stock	$1,000,000
Current accounts	354,668
Surplus	509,821
Total	$1,863,990

The earnings record and production figures for 1916, estimated, and 2 preceding years follow:

	Production	Earnings	Per Cent on Stock
1916, estimated	16,000	$1,500,000	150
1915	7,749	654,000	65.4
1914	5,262	123,000	12.3

The stock is now on a dividend basis of 3 per cent per month.

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Westcott Adds to Staff

SPRINGFIELD, OHIO, June 23—With the removal of its factory and general offices from Richmond, Ind., to Springfield, where it has facilities for a largely increased production, the Westcott Motor Car Co. announces several additions to its organization. A. H. Frost, formerly factory manager of the Detroit Wire Spring Co., has become manager of the Westcott service department. He formerly was connected with the service divisions of the Packard and Oakland companies. J. M. Rehe, who has been chief clerk to the general auditor of the Ohio Electric Railway Co. at Springfield, has been appointed auditor of the Westcott company. J. B. Boyle, who has been in the employ of the Westcott company for several months, has been placed in charge of the traffic and order department. He was formerly in the offices of the Pennsylvania lines at Richmond, Ind.

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May Exports from New York Total $8,501,163

NEW YORK CITY, June 23—May exports from this city of automobiles and parts and tires totaled $8,501,163, as compared with $8,120,672 in April. Automobiles and parts, valued at $7,146,232, were exported in May, while the exportation of tires totaled $1,354,931.

Up to the week ending June 17, exports from this port amounted to $6,934,264, divided into $2,917,517 for commercial vehicles, $1,700,239 for passenger cars, $1,251,161 for parts, and $1,065,347 for tires.

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Metal Prices Lower

NEW YORK CITY, June 27—A drop in metal prices featured the activities in the automobile materials market last week. Bessemer steel dropped to $42 per ton, a loss of $3; copper went down to 26½c. a pound, just 1c. lower than last week; and tin closed at a loss of $4 per 100 lb., its quotation being $39.50. Open-hearth steel rose to $42 per ton, a gain of $2; lead gained 13c. per 100 lb., its quotation being $6.88. The rest of the stocks remained unchanged and steady.

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Disco Capital Now $350,000

DETROIT, MICH., June 24—The capital stock of the Disco Electric Starter Corp. has been increased from $250,000 to $350,000, providing for plant expansion and increase of production. At present fifty Disco starters are being made per day, of which three-fifths are of the two-unit variety and the balance of the single-unit type. Considerable new machinery is to be installed to add greatly to this output.

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Garford Adds $2,500,000 to Stock

LIMA, OHIO, June 20—The capital stock of the Garford Motor Truck Co., this city, has been increased from $2,500,000 to $5,000,000. The common stock is increased from $1,250,000 to $2,500,000 and the preferred on the same basis.

The increase was made to take care of the enlarged business. Preparations are being made for a 40 per cent increase in the capacity of the plant.

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Stewart-Warner to Retire Preferred

CHICAGO, ILL., June 23—The Stewart-Warner Speedometer Corp., this city, will call for retirement, Aug. 1, its $700,000 of preferred stock at about 110.

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Rollin White Interested in Wilcox Motor & Mfg. Co.

SAGINAW, MICH., June 24—A concern to manufacture automobile motors has been incorporated here under the name of the Wilcox Motor & Mfg. Co., with a capital stock of $150,000, all of which is said to be subscribed for. The organizers are Rollin H. White of Cleveland, Ohio, and M. L. and M. M. Wilcox of this city.

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M. & M. Buys Out Two Companies

CLEVELAND, OHIO, June 22—The M. & M. Co., this city, recently closed two large deals in the purchase of the entire business and stock of the Wright Wrench & Forging Co., Canton, Ohio, and the Sprague-Waldo Mfg. Co., Detroit, Mich. The former company makes wrenches and other tools, while the latter concern manufactures lamps.

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Burke Is Buick Chicago Mgr.

CHICAGO, ILL., June 24—D. A. Burke has been appointed local branch manager of the Buick company, succeeding E. T. Strong. He has been with the company since 1913 and was manager of the Cleveland branch until he disposed of this branch to the Ohio Buick Co. He has specialized in organization work at the Buick plant and has also assisted Mr. Strong in the work of organizing the southern portion of the Chicago territory.

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Enricht's Fuel Substitute to Be Ready in Three Months

BROOKLYN, N. Y., June 23—Louis Enricht's gasoline substitute will be on the market inside of 3 months and will sell for 5 cents a gallon, according to a

Daily Market Reports of the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum, lb.	.63	.63	.63	.63	.63	.63	...
Antimony, lb.	.18½	.18½	.18½	.18½	.18½	.18½	...
Beams & Channels, 100 lb.	2.67	2.67	2.67	2.67	2.67	2.67	...
Bessemer Steel, ton	45.00	45.00	45.00	42.00	42.00	42.00	—3.00
Copper, Elec., lb.	.27½	.26½	.26½	.26½	.26½	.26½	— .01
Copper, Lake, lb.	.27½	.26½	.26½	.26½	.26½	.26½	— .01
Cottonseed Oil, bbl.	10.98	11.00	10.90	10.80	10.80	10.90	+ .15
Fish Oil, Menhaden, Brown, gal.	.55	.55	.55	.55	.55	.55	...
Gasoline, Auto, bbl.	.24	.24	.24	.24	.24	.24	...
Lard Oil, prime, gal.	1.05	1.05	1.05	1.05	1.05	1.05	...
Lead, 100 lbs.	6.75	6.75	6.80	6.85	6.85	6.88	+ .13
Linseed Oil, gal.	.65	.65	.65	.65	.65	.65	...
Open-Hearth Steel, ton	40.00	40.00	40.00	40.00	42.00	42.00	+2.00
Petroleum, bbl., Kansas, crude	1.55	1.55	1.55	1.55	1.55	1.55	...
Petroleum, bbl., Pennsylvania, crude	2.60	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.92	.92	.92	.92	.92	.92	...
Rubber, Fine Up-River, Para, lb.	.63½	.63½	.63½	.62½	.62½	.63½	...
Rubber, Ceylon, First Latex, lb.	.62	.61½	.60	.60	.60	.62	...
Sulphuric Acid, 60 Baume, 100 lb.	3.00	3.00	3.00	3.00	3.00	3.00	...
Tin, 100 lb.	43.50	39.75	39.75	40.75	40.75	39.50	—4.00
Tire Scrap, lb.	.05¾	.05¾	.05¾	.05¾	.05¾	.05¾	...

statement made by the inventor recently.

Enricht stated that the Maxim company is building two laboratories in Farmingdale, L. I. He also stated that there was nothing in the theory that he decomposed water and used the hydrogen from it for his motive power. The water is only the carrier which takes the explosives through the motor. It has nothing to do with the fuel properties.

A chain of laboratories all over the country is planned to market the chemical, and of this chain the two buildings now being put up in Farmingdale, are numbers 4 and 5.

13th Year for Ford

DETROIT, MICH., June 24—This is birthday week for the Ford Motor Co., which is now 13 years old. Organized June, 1903, the Detroit factory employed 311 men, and completed a fiscal year's production with 1708 cars to its credit. June this year finds the Detroit organization employing 31,000 men and turning out 500,000 cars. There are twenty-eight branch factories in the United States, besides the Ford Motor Co. of Ford, Ont., which employes 2500 men, and the Ford Motor Co., Manchester, England, with 2000 on its payroll.

Ford has fifty-one branches in this country and 9000 agents; nine branches and 100 dealers in Canada; a branch in London, England; one in Paris; another in Bordeaux, France; one at Buenos Aires, and one at Melbourne, Australia.

Dividends Declared

Standard Screw Co.; semi-annual of 3 per cent on common and an extra of 3 per cent. Regular semi-annual dividends of 3 per cent on the Class A preferred and 3½ per cent on Class B have also been declared. All dividends payable July 1 to stock of record June 23.

Decline in Security Prices

Suffer Setback on Weak Market—Few Gains Made—Losses Are Many

NEW YORK CITY, June 27—Automobile security prices declined last week as a result of the unsettled conditions in this country in regard to the Mexican situation. The market yesterday sold steadily downward on account of the growing imminence of war with Mexico and the general feeling that the United States is as yet unprepared. Publication of the fact that the Government is in the field for 4000 trucks, while it would ordinarily be a bullish argument, because of the increase business to be derived by the automobile trade, did not have a bullish effect this time.

United Motors dropped 11¼ points. Announcement in regard to this stock has been made that the Guaranty Trust Co. has deposited 67,274 shares of Perlman rim stock, which 6 months from May 25 will be exchanged on the basis of one share for two shares of United Motors. The remaining 32,724 shares of Perlman retain their original status, but may not be exchanged, as the time limit has expired and not been extended.

Overland Makes Gain

Willys-Overland common was one of the few stocks to record a gain, amounting to 2 points. In regard to the recent merger failure, in which J. N. Willys figured prominently, it has come to light that the real cause of the failure of the merger was the refusal of Mr. Willys to proceed with the merger because the manager feared to let him have a free market for his stock in the new company. Mr. Willys asked for 2,500,000 shares or more cash than could be raised, in return for selling out. His holdings in stock would have been in the neighborhood of four sevenths of the total stock, and the other members of the financing committee were quite willing to give this in exchange for the Willys-Overland, provided he would agree to withhold it from the market for a stated time. This he refused to do, and the merger was called off.

The Saxon Motor Car Corp. last week made application for listing its stock on the Stock Exchange. The Packard company is offering through William A. Read & Co. at 104 and accrued dividend a block of the 7 per cent cumulative preferred stock, of which the total amount authorized and outstanding is $8,000,000.

Edmunds & Jones Common Pays 4%

DETROIT, MICH., June 25—The common stock of the Edmunds & Jones Corp., which in March took over the Edmunds & Jones Mfg. Co., Detroit, the Canadian Lamp & Stamping Co., Ford City, Canada, and the Chicago Electric Mfg. Co., Chicago, was to-day placed upon a dividend basis of $4 per share. The combination ranks as the largest maker of electric, acetylene and oil lamps for automobiles and trucks.

Now Monarch Governor Co.

DETROIT, MICH., June 24—The name of the Kramer Governor Co., maker of a speed-controlling device for trucks, has been changed to the Monarch Governor Co. The concern's plant remains at Twelfth and Bethune Streets, at which the output is now about 150 instruments a day.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new)	..	..	64	66	—2
Chalmers Motor Co. com	92	93½	160	175	..
Chalmers Motor Co. pfd	95	97	99	103	—1
Chandler Motor Car Co	..	..	108	109	+ ¾
Chevrolet Motor Co	..	..	214	216	—8
Electric Storage Battery Co	..	..	61¾	62½	—1¾
Firestone Tire & Rubber Co. com	503	510	880	114	..
Firestone Tire & Rubber Co. pfd	111	..	112	541	..
General Motors Co. com	152	154	470	114	—6
General Motors Co. pfd	101	102½	112½	73¼	—1
B. F. Goodrich Co. com	51½	53½	73	73¼	—1⅛
B. F. Goodrich Co. pfd	101	102	113½	114	—1⅞
Goodyear Tire & Rubber Co. com	268	274	230	234	—3
Goodyear Tire & Rubber Co. pfd	105	106¼	106½	107¼	..
International Motor Co. com	13	14	..	12	..
International Motor Co. pfd	35	37	18	23	—2
Kelly-Springfield Tire Co. com	159	162	69	71	—3
Kelly-Springfield Tire Co. 1st pfd	86	87	95	96¾	+ ½
Maxwell Motor Co. com	39	41	80⅜	80½	—2⅜
Maxwell Motor Co. 1st pfd	84	86	85	85½	—2⅜
Maxwell Motor Co. 2d pfd	34	35	54	55	—3¼
Packard Motor Co. com	104	..	190	200	..
Packard Motor Co. pfd	96¼	100	100	104	..
Paige-Detroit Motor Car Co	..	..	55	56	+2
Peerless Motor & Truck Corp	..	..	24	26	+ ½
Perlman Rim Corp	..	..	..	..	..
*Reo Motor Truck Co	15⅛	15¾	37¼	37¾	— ¼
*Reo Motor Car Co	..	31	40½	41½	—3
Saxon Motor Car Co	..	..	78	84	—2
Stewart-Warner Speed. Corp. com	68	68⅜	96½	98	+3½
Stewart-Warner Speed. Corp. pfd	105	..	..	..	..
Studebaker Corp. com	78	80	137½	138	+1
Studebaker Corp. pfd	98½	100	107	111	+ ¼
United Motors Corp	..	..	62½	62¼	—10½
U. S. Rubber Co. com	51	53	52	53	—1¼
U. S. Rubber Co. 1st pfd	106	107	108½	109½	— ½
White Motor Co. (new)	..	..	53	55	—3
Willys-Overland com.	128	129	277	280	+2
Willys-Overland pfd.	102½	103½	106¼	106¾	—2¼

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Auto Body Co	..	..	42	46	+6
Chalmers Motor Co. com	90	95	170	180	..
Chalmers Motor Co. pfd	93½	97	96	..	..
Continental Motor Co. com	180	..	37	38	—1
Continental Motor Co. pfd	82	86	9½	10½	— ¼
Ford Motor Co. of Canada	1000	..	..	385	..
General Motors Co. com	151½	153	475	545	..
General Motors Co. pfd	101½	103½	112	116	—1
Maxwell Motor Co. com	39	42	80½	83⅓	—4½
Maxwell Motor Co. 1st pfd	84½	87	86	89	—2
Maxwell Motor Co. 2d pfd	35	38	55½	58½	—2½
Packard Motor Car Co. com	106	..	..	193	..
Packard Motor Car Co. pfd	97¼	100	..	104	..
Paige-Detroit Motor Car Co	..	..	..	54	..
*W. K. Prudden Co	19½	21	41	44	—1½
*Reo Motor Car Co	..	30½	40¼	41¼	—1
*Reo Motor Truck Co	15⅛	15¾	..	37	..
Studebaker Corp. com	78	80	136	138½	—2
Studebaker Corp, pfd	98	100½	105	..	+4
C. M. Hall Lamp Co	..	..	..	33½	..

INACTIVE STOCKS

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
*Atlas Drop Forge Co	26	26	..	40	..
Kelsey Wheel Co	200	..	..	350	..
Regal Motor Car Co. pfd	..	25	17	..	..

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*Par value $10; all others $100.

De Palma First at Des Moines

Covers 150 Miles in Mercedes at 92.66 m.p.h—Lewis Wins 50-Mile

WINNERS OF 150-MILE RACE

Car	Driver	Time	Prize
Merecedes.	De Palma	1:36:36.23	$3,000
Maxwell	Henderson	1:38:13.72	1,500
Maxwell	Rickenbacher	1:39:18.72	750
Crawford	Lewis	1:40:00.01	600
Stutz	Cooper	1:40:08.96	500
Hudson	Mulford	1:45:27:15	450
Sunbeam	Galvin	1:46:44.40	400
Stutz	Chandler	Flagged 141 Lap	400

Des Moines, Iowa, June 24—Ralph De Palma won the second annual Des Moines Speedway classic here to-day when he covered 150 miles in 1:36:36.23, or at the rate of 92.66 m.p.h., a speed nearly 6 m.p.h. faster than that of the Des Moines race last year, for a distance of 300 miles in which De Palma was nosed out of first place by Ralph Mulford in a Duesenberg.

Next to De Palma's Mercedes came the two Maxwells which captured second and third places. Rickenbacher, who was the only man to head De Palma during the entire race and who pushed him for the lead during the entire first 140 miles of the race, was robbed of his apparently sure second by a series of tire troubles late in the grind. But his team mate, Pete Henderson, was at his heels and picked up Rickenbacher's place just in the wake of the Mercedes. Henderson, driving a great race throughout, was second in 1:38:13.72, 1 min. and 48 sec. behind De Palma. Rickenbacher, in spite of his troubles, got the checkered flag 1 min., 5 sec. behind Henderson when he finished in 1:39:18.72. Dave Lewis and his Crawford took fourth honors when he finished in 1:40:00.01. Joe Cooper and his Stutz were fifth and Ralph Mulford, Des Moines winner last year with a Duesenberg, could not get better than sixth this year with the Hudson Super-six which he is now driving. Galvin in his Sunbeam was seventh and Chandler, Joe Cooper's teammate, was eighth.

Two Accidents

Two spills, almost coincident and the second directly resultant from the first, failed to mar the race which Starter Wagner declares to have been an ideal contest under ideal conditions. Wilbur D'Alene, one of the Duesenberg team, had his right rear wheel collapse on the last turn of his thirtieth lap. The car leaped into the outer guard rail, rebounded, struck the rail again and then tore downward into the safety apron, where it landed right side up with neither D'Alene nor his mechanician, Ed Miller, injured, except for a slight cut suffered by the latter. Tom Milton, another of the Duesenberg pilots, was just back of D'Alene and took to the safety apron at high speed to avoid mixing with his troubled comrade ahead. His car spurned the rough earth of the apron and turned over several times. Milton and his mechanician, E. Rathbun, were both under the cowl and both came out unscathed. The accident, however, took all of the Duesenberg contenders from the field, except for Eddie O'Donnell, who was out in the 86th lap when his steering gear went wrong.

De Palma won by master work at the wheel and was more fortunate than usual for him in the matter of tire changes. He was called to the pit but once and that was in the 129th lap when his right front tire gave out. The change was made in 20 sec. Rickenbacher was not so fortunate with his tires. His first trouble sent him to the pits in the 108th lap after he and De Palma had driven almost a neck and neck race up to that time. His second tire change came in the 136th lap and he went in for a new tire for the third and last time in the 142d mile. De Palma gained two laps and a half when Rickenbacher went in for the first change and he held a margin over his rival during the entire remainder of the race even though he himself was forced to the pits once during that time.

De Palma Regains Lead

De Palma led with Rickenbacher pushing him at every turn of the race until "Rick" pushed his Maxwell into the lead in the 87th mile. He held the leadership for a short time only, however, for De Palma soon pushed his Mercedes into the head position again on the lower turn of the 94th mile. During the early stages of the race Galvin and his Sunbeam alternated with Henderson and his Maxwell for the third and fourth places except during the time before D'Alene was put out of the race when he held the fourth place.

Twelve cars went away when Starter Wagner waved the red flag at 1.50 with 20,000 people assembled for the event. De Palma and Rickenbacher at once took the lead and the great race between them was fought out mile after mile with honors almost even but with De Palma always in the lead until the race was half over.

Quick work was the rule at the pits. Dave Lewis and his Crawford got a new tire in 30 sec. Chandler, driving the other Crawford was more seriously delayed by spark plug trouble.

Eddie Rickenbacher turned the tables on De Palma in the 50-mile event which followed the main race. He went the entire distance without a call at the pits and his time was 31 min. and 9.17 sec. or an average of 96 m.p.h. De Palma was only seconds behind, 9 of them in fact, although he had lost 18 sec. in a tire change. Rickenbacher's margin, however, would have been much larger except for the fact that he had a bad skid in the back stretch. This thrill was missed by the crowd but was observed by De Palma who knew that Rickenbacher lost time by reason thereof, and who thought he had won the race until it was all over. A rechecking of the tape showed that Rickenbacher was the winner. When he had the bad skid in the back stretch he could not keep his car from the rough and he cut a figure eight but managed to right himself and swing back into his wonderful speed, although the delay caused him a drop from the first to the fourth position, a drop which spectators were at loss to understand because they had not seen his trouble.

The 50-mile event was, if possible, even a more exciting and satisfying spectacle than the longer race. Three, instead of two, drivers, were fighting for the first place in every mile of the grind. Rickenbacher and De Palma were at it again and they were both being fought at every stage of the game by Joe Cooper and his Stutz who took the third place and who was a leader at one stage of the game until tire trouble put him back. Lewis and his Crawford registered again when they won the fourth position in the shorter race and Henderson, second man in the 150-mile race, was fifth, with Galvin and his Sunbeam registering in for the sixth position.

Of the $10,000 given in prizes for the winners of the two races, De Palma carried away the largest share with $3,000 for first in the long race and $500 for second in the 50-mile event. Henderson and Rickenbacher won $1,500 apiece and the rest of the money was divided among contenders who won thirds, fourths, and minor positions.

A. A. A. Temporarily Lifts Ban on Grand Rapids Track

Grand Rapids, Mich., June 24—The A.A.A. contest board, through Chairman Kennerdell, having raised the ban on the local track for 1 day, it ordinarily being an outlaw track, the Automobile Business Assn. has promoted a 100-mile race for July 8 for cars under 450 cu. in. displacement. It is said that Ralph de Palma will drive his Mercedes, Ralph Mulford will pilot his Hudson and Gil Anderson will compete in a Premier.

There will also be a 5-mile amateur free-for-all elimination race, and an invitation Ford race with a final heat of 5 miles, this under Class E, non-stock classification.

Benton Harbor, Mich., is also to have a sanctioned ½-mile meet on July 4.

Saxon 300-Mile Non-Stop Run

2000 Dealers All Over Country To Start Car and Motor Test on July 1

DETROIT, MICH., June 24—The Saxon Motor Car Corp. has laid plans for the staging of what is said to be one of the largest non-stop runs ever held, this to be a test conducted in all parts of the country by the 2000 Saxon dealers who will each run 300 miles without stopping his motor.

The tests will be conducted individually by the dealers, and in each car an official observer who is a newspaper man. A large silver loving cup is to be presented to the dealer who attains the best mileage record per gallon of gasoline.

In addition to keeping an accurate record on all the gasoline and oil used on his run, each entry will also check up on whatever mechanical attention or adjustment is necessary. The run is to take place on July 1.

Buick Wins Canadian Reliability

OTTAWA, ONT., June 20—The reliability tour from the Canadian capital into the State of New York which took place last week-end, excited a great deal of interest all along the route. It not only gave motorists a chance to sample the terrible roads between Ottawa and Prescott, which was the first leg of the journey, and conditions were made worse than ordinary by a heavy rainfall of 18 hr., directly before the start, following on several weeks of more or less continuous rain, but it also enabled an impetus to be given to the Good Roads movement in Ontario, as well as permitted the celebration of the exchange of licenses between Ontario and New York State by a large body of motorists. McLaughlin-Buick cars carried off the first four prizes, the winner being G. B. McKay, who finished the run to Gouverneur with a perfect score of 1000 points, this car not even losing a point on the secret schedule run. The fifth prize went to a Dodge car, and the sixth to an Overland, while the McLaughlins were the next three in order to finish on points, followed by a Russell, Ford, Chevrolet and Brisco.

Dealers See New Buick Four

FLINT, MICH., June 24—This week has been a sort of get-acquainted meeting at the Buick factories here. Buick dealers from various sections have been brought to the city, some sections coming by special trains, others by boat, etc. One of the objects of the gathering was to meet the new general sales manager, E. F. Strong, who succeeded B. H. Collins, resigned. Another was to get a view of the new Buick four-cylinder car, that is to be put on the market both as a touring car and roadster. The convention was addressed by W. C. Durant, president of General Motors, and the selling organization was also informed of the election of W. P. Chrysler to the general managership of the Buick company.

Chalmers Branch in Salt Lake City

DETROIT MICH., June 27—With the intention of erecting a branch and warehouse to take care of the district, the Chalmers organization has incorporated the Chalmers Motor Sales Co. at Salt Lake City, Utah, with a capital of $200,000. W. P. Kiser is secretary.

Allen 4-Day Convention July 17

FOSTORIA, OHIO, June 24—The Allen Motor Co., this city will hold its annual convention of distributors on July 17 and the following 4 days. Monday will be spent at the main factory in Fostoria, Tuesday at the motor plant in Bucyrus, Wednesday and Thursday will be devoted to a tour taking in points of interest in northern Ohio, including Cleveland and Put-in Bay.

Eight New Contracts for Bosch

NEW YORK CITY, June 26—These companies have signed contracts to use Bosch magnetos for the coming season: Mercer Automobile Co., Trenton, N. J.; Diamond T. Motor Car Co., Chicago; Thomas Evarts Adams, Inc., New York; Detroit-Wyandotte Motor Truck Co., Wyandotte, Mich.; Autocar Company, Ardmore, Pa.; Rochester Carriage Co., Rochester, N. Y.; Stegeman Motor Car Co., Milwaukee, Wis.; Republic Motor Truck Co., Alma, Mich.

Texas Dealers Get Army Business

EL PASO, TEX., June 26—Accessory and tire concerns of El Paso are breaking business records every week. Sales have been unusually heavy this year, even leaving the army business out of consideration. Last week one army contract called for $35,000 of solid rubber tires. It is believed that the average amount spent weekly in El Paso for motor supplies for Uncle Sam is in excess of $25,000.

Deaco Creditors' Final Dividend

DETROIT, MICH., June 27—Final dividend to the creditors of the defunct Detroit Electric Appliance Co., maker of the Deaco starting and lighting equipment, has been paid by the Detroit Trust Co., trustee. The final payment checks amount to a little over 3 per cent, bringing the total received by the creditors to about 23 per cent, they having previously received 20 per cent of their claims.

Henning Wins at Galesburg

Ogren Pilot Covers 100-Mile Course at 58.5 m.p.h.—Duesenberg Second

GALESBURG, ILL., June 22—Following two postponements, caused by rain, the third annual 100-mile race was held on Galesburg's mile dirt track and Otto Henning, driving an Ogren car, won first money. Owing to the condition of the course the time was slow, 1:42:34.60, an average of 58.5 m.p.h.

Second to the winner came George Buzane in a Duesenberg. His time was 1:43:15.05, an average of 58.2 m.p.h. Andy Burt in a Stutz was third in 1:44:20.75, or at 57.5 m.p.h., while Art Klein in a Klein Special was fourth in 1:45:22.25, an average of 57 miles per hour. Klein was the hard-luck driver of the contest, for he lost the race after leading the field for 87 miles. Ralph Mulford and Ira Vail, both driving Hudson Super-sixes, were put out of the race early by mechanical troubles. Mulford broke a valve spring and piston and Vail burned out a bearing. Other drivers who competed but who failed to get inside the money were Jack Gable in the Burman Special, Harry McNay in a Cino, Tommy Milton in a Mercer Special and C. R. Parker in a Duesenberg.

Henning went in as a post entry, reached Galesburg after a hard drive of 2 days over muddy roads and then had failed to show up when the field was lined up for the start. The race was held 5 min. and just as the motors had been cranked for the getaway Henning appeared. Without time even to visit his pit the Chicago driver got away in last place.

Then Klein was forced to make a short stop at his pit to fix a broken terminal and Henning gained a half lap. It was neck and neck for another 15 miles, with Henning steadily gaining. Then when Klein had to stop for a tire change that took but 31 sec., Henning went into the lead and was not again headed. Klein's hard luck stuck with him, for he ran out of gasoline near the finish of the race and dropped back to fourth place.

100 Tractor Firms in Demonstration

ST. LOUIS, MO., June 24—The St. Louis Tractor Farming Association, organized to give the National Farming Demonstration here July 31 to Aug. 4, announces that 100 firms have signed exhibition agreements for the demonstration and that a 2000-acre tract of wheat land has been obtained for the tractor contests.

Separator Ordinance Sustained

Suit Between Garagemen and N. Y. City Settled—Law To Be Enforced

NEW YORK CITY, June 26—The gasoline separator ordinance against which the dealers and garagemen of New York City have fought for years has been sustained by the courts. Prosecutions under the ordinance have been held up by the authorities depending on the issue, and it is stated that enforcement of the law will now be required. This ordinance requires the installation in every garage of a device which is designed to separate from the floor sewage any escaping oil or gasoline.

The devices have proved expensive, costing from $200 up, and the automobile interests have maintained that the separators will not do the work and are a needless expense. Exhaustive tests have been made by both sides in the controversy.

The dealers succeeded in having the ordinance repealed by the Board of Aldermen, but their repeal was vetoed by the Mayor and an attempt to pass the repeal over his veto failed.

The Bronx Garage then brought a mandamus action to require the issuance of a garage permit in the garage which had no separator. A jury trial was secured and the decision was favorable to the dealers, but the city carried an appeal to the Appellate Division of the Supreme Court and the latter has decided that the jury trial was improper and that the ordinance is essential to the welfare of the city. The motor car interests are considering further steps in the matter. The Court of Appeals is the only remaining higher court in the State of New York and any further step likely would constitute an appeal to this tribunal.

Receiver for Star Motor Car Co.

ANN ARBOR, MICH., June 24—Judge E. D. Kinne in the Circuit Court here has appointed A. D. Groves of this city receiver for the Star Motor Car Co., which produces a light truck. The receiver will determine whether or not it is advisable to continue the concern as a going business or sell it.

Creditors Wind Up Affairs of Detroit Body Co.

DETROIT, MICH., June 20—At a final meeting of the creditors of the defunct Detroit Body Co. before Referee Lee E. Joslvn here to-day, the affairs of the bankrupt were wound up. This concern, which was adjudicated a bankrupt on April 20, 1915, owned a large body factory in the northeastern manufacturing center of the city. The total indebtedness was $329,650, and the trustee realized by sale of the assets, $260,983. Of this amount, $242,195 was paid to secured creditors, and a dividend of 8 per cent has already been paid to the unsecured creditors. It is understood that a further dividend of from 3 to 4 per cent will go to the latter when the estate is finally closed up.

International Automobile League President Arrested

WASHINGTON, D. C., June 24—Following a hearing before W. H. Lamar, solicitor-general of the Post Office Department, Alfred C. Bidwell, president of the International Automobile League, Inc., of Buffalo, was arrested by Federal authorities. The hearing was upon an application by Richard H. Lee, of Cleveland, chairman of the legislative committee of the American Automobile Assn. for a fraud order refusing the league and the International Automobile, Tire & Rubber Co., of California, a further right to use the mails on the ground that they were making promises they could not keep. It is claimed that many thousand persons joined the league on a promise they would obtain automobile supplies at reduced or wholesale prices, the annual assessment being $10. Bidwell furnished bond in the sum of $5,000 for his appearance before United States Commissioner Taylor here on July 18. It is stated that a fraud order was issued against the league and that counsel for Bidwell has until July 18 to file a brief in the case. A warrant alleging violations of sections of the penal code respecting the use of the mails was sworn out and Bidwell's arrest followed.

Chalmers Sub-Dealers Convene in Detroit

DETROIT, MICH., June 24—More than fifty sub-dealers of the Chalmers Michigan organization, operating under the Michigan distributor, the L. J. Robinson Co., were in the city this week for a 2-day convention to view the 1917 Chalmers cars and to formulate plans for a furtherance of business for the coming season.

Talks were given by President Hugh Chalmers, C. A. Pfeffer, vice-president; Paul Smith, vice-president of the selling division; L. J. Robinson and Harry Newman of Chicago. A big drive-away of new models closed the meeting, and took many of the new cars away from Detroit.

Overland Opens New Branches

TOLEDO, OHIO, June 27—In line with its sales expansion policy, the Willys-Overland Co. has taken steps to facilitate distribution by the opening of new branches at Denver, Col., Jacksonville, Fla., and Omaha, Neb., in addition to increasing its facilities at Columbus, Ohio, Springfield, Mass., and in its home city of Toledo. Buildings have been acquired in the first three named cities, and remodelling and other expansion is being carried on in the latter three. At Toledo, the Atwood Automobile Co., which was the dealer, has been purchased outright to be hereafter conducted as a factory branch, and A. A. Atwood and C. T. Atwood who conducted the local agency have been taken into the Overland organization, the management of the Toledo branch being now under G. C. Morgan.

C. T. Dunkle has been put in charge of the Columbus branch, following the acquiring of the business of O. G. Roberts, former Overland distributer here, the conversion of this location into a service plant, the acquiring of another site for salesroom, and the leasing of the plant formerly occupied by the Columbus Buggy Co. as a storage space. Calvin Eib will be in charge of the Denver branch; and J. R. Jamison is to operate the Omaha branch, having been the dealer there prior to the factory representation. G. H. Johnson, from the Toledo offices, goes to Jacksonville to manage that branch. M. T. White, former Stevens-Duryea official, takes charge of the newly erected branch at Springfield.

$6,000 for Krit Creditors

DETROIT, MICH., June 24—The creditors of the defunct Krit Motor Car Co. will get final dividend checks this week from Referee in Bankruptcy Lee E. Joslyn, the total amount to be distributed being $6,000, bringing the total paid to 5 per cent on $850,000 of allowed claims. The Krit concern was adjudicated bankrupt in December, 1914, and prior to that time had been operating for several months under a creditors' agreement, whereby they were paid about 30 per cent of their claims.

To Sell P. R. Assets Separately

DETROIT, MICH., June 24—Following the placing of the P. R. Mfg. Co., maker of automobile parts and accessories and electric bells, in the hands of a receiver last fall as a result of a disagreement among the directors of the company as to the financial policy to be followed by the management, and the subsequent operation of the plant as a going concern under the receivership of the Security Trust Co., this city, it has now been decided by the Trust company that it will be more advantageous to the creditors and stockholders to sell the real estate of the corporation separately from the tools, equipment and stock. It was the original intention to dispose of the property as a whole as a going business, but the parcel plan was adopted later.

Factory Miscellany

To Make Spark Plugs—The Long Distance Spark Plug Co., Birmingham, Ala., has been incorporated with a capital stock of $10,000 by Solon Jacobs, H. C. Pogue and others. Its factory, located at another point, will be removed to Birmingham.

Barberton Tire Co. to Build—The Punctureless Auto Tire Co., Akron, Ohio, is planning to build a factory at Barberton, Ohio.

Studebaker to Build in St. Paul—The Studebaker Corp., Detroit, is planning to build a plant in St. Paul, Minn.

Firestone Power Plant Burns—Fire practically wiped out the powerhouse of the Firestone Tire & Rubber Co. plant in Akron. An electric transformer blew up, burning out all electric wiring and rendering the plant powerless.

Resilient Wheel Starts Work—The Resilient Auto Wheels Co., organized recently at Wausau, Wis., has started manufacturing operations in the factory building at Ninth Avenue and West Street. Shortage of steel supplies has delayed the company in getting started, but production is now well under way. Fifty skilled men are employed at this time and the force will be increased to eighty and 100 as rapidly as competent help is available. J. E. Berglund is general manager.

Continental Truck to Build—The Continental Motor Truck Co., Superior, Wis., has awarded all contracts for the erection of its new motor truck factory, which will be 80 by 200 ft. in size, and of reinforced concrete, brick and steel construction. The company has been operating in leased quarters for several years, but these now are entirely inadequate.

American Brass Foundry to Move—The American Brass Foundry Co., 198-202 Milwaukee Street, Wilwaukee, Wis., which has been engaged in the manufacture of motor car accessories in connection with its casting business, will move July 1 to larger quarters at 1916-1920 St. Paul Avenue. Hereafter the company will devote its attention exclusively to motor car parts and accessory work and will discontinue the foundry business. The Allis Fire Extinguisher Co., 434 Jefferson Street, has leased the old quarters on Milwaukee Street and will take occupancy as soon as an additional story is erected.

Third Goodyear Stack Finished—The last brick in the third stack which for 2 weeks has been in the process of erection at the Goodyear Tire & Rubber Co., Akron, Ohio, was cemented in place recently. The stack just completed is 21 ft. 6 in. in diameter at the bottom, tapering to 15 ft. 6 in. at the top, which is 250 ft. above floor level.

About 1585 tons of brick entered into the construction of the big shaft, each one of which was placed in position without the use of plumbline or other instrument to determine perpendicularity of the stack.

Through the use of specially designed radial blocks of refractory red clay, so constructed as to fit together to give the proper degree of taper, the stack was built up with no other instruments than the brick mason's trowel and level. It rests on a solid rock foundation, leveled over with concrete, and is equipped with both inner and outer steel ladders, with rungs 18 in. apart.

Goodyear now has the three highest stacks in the State, all of which have been built to withstand a wind velocity of 100 m.p.h. The erection of a fourth stack of the same height will be commenced soon for the new mechanical goods and chemical plant, about a mile up the Little Cuyahoga River from the main Goodyear Tire & Rubber plant in Akron.

To Make Bodies—Commercial Auto Body Co., St. Louis, has been incorporated with $50,000 capital stock; the holders are Hugh F. Cartwright, 498 shares; M. E. Cartwright and X. F. Wilfey, one each. Mr. Cartwright has been conducting a factory at Sixteenth and Pine Streets and during the last year turned out 10,000 bodies. The capacity will be enlarged.

The Automobile Calendar

ASSOCIATIONS

July 9-13 — Detroit, Mich., World's Salesmanship Congress, Detroit Board of Commerce Bldg.
Sept.—Indianapolis, Convention for Formation of Indiana Automobile Trade Assn., under auspices of N. A. T. A., Hotel Claypool.
Oct. 2-5—St. Louis, Fall Meeting Assn. of Automobile Accessory Jobbers.
Dec. 2-9—Electricians' Countrywide Celebration.

CONTESTS

July—La Grande, Ore., Track Race, LaGrande Motor Club.
July 4—Coeur d'Alene, Idaho, Race Meet, Hiller-Riegel Co.
July 4—Tacoma, Wash., Speedway Race, Tacoma Speedway Assn.
July 4—Minneapolis 300-Mile Speedway Race.
July 4—Sioux City Speedway Race.
July 4—Newark, N. J., Track Race, Olympic Park, Auto Racing Assn.
July 4—Visalia, Cal., Road Race, Tulare Co. Auto Club.
July 4—Spokane, Coeur d'Alene, Track Race, Reigel-Hiller Co.*
July 4—Benton Harbor, Mich., Track Race, F. E. Fitzsimmons.
July 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
July — Burlington, Iowa, 100-Mile Track Race, Tri-State Fair.
July 15—Portland, Ore., Track Race, Northwest Auto Assn.
July 15—Omaha, Neb., Speedway Race.
July 15—North Yakima, Wash., Track Race, Hiller-Riegel Co.
Aug. 5—Tacoma Speedway Race, Tacoma Speedway Association.
Aug. 11-12—Pikes Peak, Col., Hill Climb, Pikes Peak Auto Highway Co.
Aug. 12—Portland, Ore., Track Race, Hiller-Riegel Co.
Aug. 18-19—Elgin Road Race, Chicago Auto Club.
Aug. 26—Kalamazoo, Mich., 100-Mile Track Race.
Sept. 1-2—New York, N. Y., Sheepshead Bay Speedway, 24-Hour Race, Trade Racing Assn.
Sept. 4—Elmira, N. Y., Track Race, Elmira Auto and Motorcycle Racing Assn.
Sept. 4—Cincinnati, Ohio, Speedway, Cincinnati Speedway Co.
Sept. 4—Newark, N. J., Track Race, Olympic Park, Racing Assn.
Sept. 4—Indianapolis Speedway Race.
Sept. 4—Des Moines Speedway Invitation Race. Limited to six entries.
Sept. 4-5 — Spokane, Wash., Track Race, Inland Auto Assn.
Sept. 16—Providence Speedway Race.
Sept. 18—North Yakima, Wash., Track Race, Washington State Fair.
Sept. 29—Trenton, N. J., Inter-State Fair. H. P. Murphy, Racing Sec.
Sept 30 — New York City, Sheepshead Bay Speedway Race.
Oct. 7 — Philadelphia Speedway Race.
Oct. 7—Omaha Speedway Race.
Oct. 14 — Chicago Speedway Race.
Oct. 19—Indianapolis, Ind., Race, Indianapolis Motor Speedway.
Oct. 21 — Kalamazoo. Mich., Track Races. Kalamazoo. Motor Speedway.
Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

GOOD ROADS

Sept. 6-7—St. Paul, Minn., Good Roads Congress, Auditorium.

SHOWS

Sept. 2-9—Columbus, Ohio, Fall Show, Ohio State Fair, Columbus Automobile Show Co.
Sept. 10-16 — Milwaukee, Wis., Show, Wisconsin State Fair, Machinery Bldg.
Aug. 2-9—Hollywood and West End, N. J., Show, Atlantic Exhibition Co.

TRACTOR

July 17-21—Dallas, Tex., Tractor Demonstration.
July 24-28—Hutchinson, Kan., Tractor Demonstration.
July 31-Aug. 4—St. Louis, Mo., Tractor Demonstration.
Aug. 7-11—Fremont, Neb., Tractor Demonstration.
Aug. 14-18—Cedar Rapids, Iowa, Tractor Demonstration.
Aug. 21-25—Bloomington, Ill., Tractor Demonstration.
Aug. 28-Sept. 1—Indiana Tractor Demonstration.
Sept. 4-8—Madison, Wis., Tractor Demonstration.
Sept. 11-16 — Milwaukee, Wis., Fall Show. Wisconsin State Fair, Milwaukee Automobile Dealers.

The Week in the Industry

Minneapolis News—Bohn Fawkes, distributor for the Oldsmobile, has moved to a new building at Hennepin Avenue and Harmon Place.

The Brice Auto Co., representing the Grant, has moved to a new building at 1641 Hennepin Avenue.

E. A. Zolle, representing the Hupmobile retail, has moved to a new building at 1639 Hennepin Avenue.

The R. C. Smith Auto Co., distributor for the Velie and truck, the Regal and the Stewart truck, has moved to a new building at 1601-1603 Hennepin Avenue.

The Shattuck Trailer Co. has opened a general office and showroom at 1408-1410 Hennepin Avenue.

A. R. Curtis has opened a display of Curtis trailers and camp outfits at 1411 Hennepin Avenue.

The Twin Bed Trailer has opened a display in the Murphy Building at 1305-1309 Hennepin Avenue.

The Gray Motor Co. has opened a Studebaker service building at Fifteenth Street and Laurel Avenue.

Mich. Items—C. M. Johnson, Alma, Mich., Ford and Overland distributor for Gratiot County, has purchased the garage, supplies and equipment of A. C. Wyant, Reo and Chalmers distributor, on East Superior Street.

E. C. Seale and C. C. Van Veen, Detroit, have purchased the Acme Tire & Repair Co. business at 226 Jefferson Avenue. The company is to be renamed the Acme Tire & Supply Co. and headquarters will be at 1745 Woodward Avenue. The firm will do a general repair business and will handle tires of all popular makes.

Ill. News Items—Judd Seacord & Son, Galesburg, have opened a used-car department on the public square, leasing the building formerly occupied by the Square Garage Co., and will hereafter utilize this structure for second-hand cars exclusively. Lack of room in the North Kellogg Street main building necessitated additional quarters. A separation of the new and old cars was also thought to be an advantage. The Square Garage Co. has removed to a new building on North Cherry Street. Hereafter repair work alone will be given attention.

R. S. Bassett, Elgin, has disposed of his stock in the Elgin Motor Sales Co. to C. E. Heslet and C. C. Gale, both of Michigan City, Ind., and the new owners took possession this week. The business will be continued under the same corporate name. S. S. Bassett, who has been manager, will be retained in the same capacity. Various improvements are planned and the business will be expanded in several ways.

Luckey New Orleans Edison Mgr.—The Edison Storage Battery Supply Co. has established a new sales office at New Orleans and has appointed C. A. Luckey as resident manager.

Mr. Luckey is a graduate of Franklin Military Academy, Franklin, N. Y., 1899, and Bliss Electrical School, Washington, D. C., 1900-1901. He was connected with the Western Electric Co., New York city, during 1901-02, leaving there to go with the Safety Car Heating & Lighting Co., where he remained until 1911, spending the first 4 years in its electrical laboratory and then going with the Chicago branch.

In 1911 Mr. Luckey was with the Railway Utility Co., Chicago. In 1912 he joined the sales force of the Edison Storage Battery Co., Orange, N. J., and was attached to the sales office in Chicago, where he has been until his present appointment.

Mr. Luckey's new address will be Edison Storage Battery Supply Co., 201 Baronne Street, New Orleans, La.

Ohio News Items—The King Sales Co., Toledo, northwestern Ohio agent for the King, will soon move into new quarters on Motor Row. E. A. Wilkinson, president of the company, recently purchased the stock and business of the Madison Garage, conducted by M. M. Mull. The United Garage Co. of Toledo, Ohio, agent for the Reo, has added a line of accessories to its sales and garage business.

The E. F. Loeffler Rubber Co., 85 East Gay Street, Columbus, has been succeeded by the Central Tire & Repair Co., with T. O. Pickering as manager.

C. M. Logan has been made president of the Logan-Fischer Motor Co., 1900 East Nineteenth Street, Cleveland, agent for the Chalmers. C. F. Fischer is vice-president. Paul Smith will be in charge of advertising.

Louisville Items—O. R. Crutcher, distributor for the McFarlan car, has opened an office and salesroom at 206 East Broadway.

The Peoples Motor Co. has acquired the agency for the Inter-State and established headquarters at 951 South Third Street.

The Winklemann-Schade Motors Co. has organized and opened a temporary office and salesroom at 949 South Third Street. The concern has been appointed Maxwell distributor in this territory. W. F. Winklemann, head of the company, was formerly sales manager of the Southern Motors Co.

The Louisville Tire Co., distributor for the Empire, has opened an office and salesroom at 407 East Broadway.

New England Trade News—The Bunker-Bancroft Co., agent for the Elcar at Springfield, Mass., has added the Apperson to its line.

The Peckham Brothers Co., Providence, R. I., has bought a large lot of land on which it will erect a salesroom and service station.

J. W. Cobb, formerly with the Cadillac company of Boston, Mass., has gone to Greenfield, where he has taken the agency for the Cadillac for Franklin County.

The Richmond Garage & Motor Co. of Boston, Mass., has petitioned the supreme court to allow it to wind up its business.

Philadelphia Items—D. K. Moore, formerly of the Weston Motor Co., the Federal Mfg. Co. and the American Distributing Co., has been made assistant general manager of production of the Vim Motor Truck Co., Philadelphia.

The Gorson Automobile Exchange, 238-240 North Broad Street, Philadelphia, purchased the building at Broad and Melon Streets, and will build a four-story building containing four stores on the site. The purchase price was $70,000.

T. W. Simpson has resigned as sales manager of the Philadalphia branch of the Oakland Motor Co., 227 North Broad Street, to become district manager for the New England States of the Grant Motor Car Co. S. K. Patteson, one of the oldest men in point of service with the Oakland here, succeeds Mr. Simpson.

The Buick Motor Co., 235-237 North Broad Street, Philadelphia, has leased the six-story concrete building now being built at the northwest corner of Broad and Poplar Streets, which will be used exclusively by the local branch for wholesale and retail purposes. The present quarters will be vacated Sept. 1, when the transition will be made. The new building has a frontage of 65 ft. on Broad Street and a depth of 160 ft. on Poplar Street.

Seeback N. Y. Chevrolet Mgr.—L. J. Seeback, formerly manager of the Brooklyn branch of the C. T. Silver Motor Co., New York City, and later of the Newark branch, has been appointed manager of the New York City sales of the Chevrolet Motor Co.

EVERY Industry has its accepted leader, the manufacturer whose name carries instant conviction of supreme attainment.

When we buy his goods all thought of price is lost in Pride of Possession; the purchase of other makes calls for explanation—almost apology.

Such leadership comes not by chance. Only long years of unremitting effort enable us now, by reason of the present state of perfection of

GURNEY BALL BEARINGS

with their inbuilt superiority an actually demonstrated and determined quantity, safely to assert that

FROM THE STANDPOINT OF EFFICIENCY THEIR EQUAL DOES NOT EXIST

GURNEY BALL BEARING COMPANY

"Conrad Patent Licensee"

JAMESTOWN - - - - NEW YORK

"In planning our models for the coming year it has been decided to accept your recommendation that

"I have studied this question thoroughly and am convinced that the four types of New Departures afford a bearing suited to every requirement of light or heavy duty.

NEW DEPARTURE BALL BEARINGS

American Made for American Trade

be used throughout every car we build," said the Manufacturer to his Chief Engineer.

"Take for instance the Double Row Type. It will carry the heaviest axle loads and resists the severest shocks and stresses that occur in all parts of the car mechanism. I know that to be a fact.

"Moreover, the Double Row needs no adjustment, no auxiliary bearings to assist it in the full performance of its functions, it is, therefore, the simplest of all bearings, the easiest to install.

"I have visited the New Departure plants at Bristol and Hartford and am satisfied that no better material and workmanship exist in any bearing.

"I am satisfied that New Departure Ball Bearings in these new models will reduce our manufacturing costs and enable us to offer cars, practically frictionless in operation and hence economical throughout a lifelong service.

"Before going ahead it would be well to consult with the New Departure Engineering Department. I find the company always ready to make recommendations for the proper use of its bearings."

New Departure Single Row

A lightly perfected anti-friction Bearing for use where radial loads only are to be carried.

The NEW DEPARTURE MFG. CO.

BRISTOL, CONN., U. S. A.

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Distributors in Trade Centers Throughout the United States

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New Departure Double Row

A single, self-contained, "fool-proof" unit carrying *all* the loads and stresses simultaneously from *whatever* direction they may come, with equal efficiency, and reducing friction to the vanishing point.

The AUTOMOBILE
THE CLASS JOURNAL COMPANY
231–241 W. 39th STREET NEW YORK CITY

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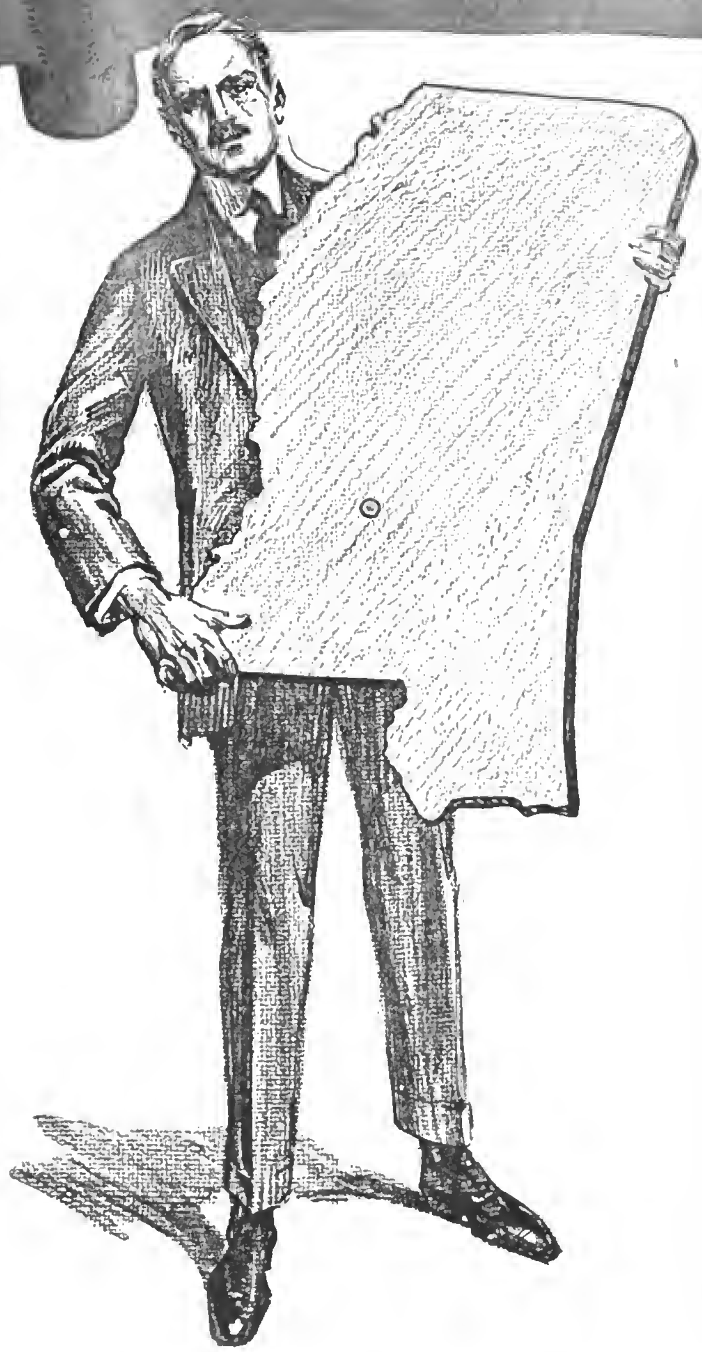
Opportunities

Studebaker



Look at this one in Mississippi—

The second largest city in the State both in population and industrial importance offers a big opportunity for a Studebaker dealer.

Five prominent railroads of the South make this city a terminal point. It is one of the recognized industrial centers in that section of the country. Cotton growing constitutes its chief agricultural occupation, while the manufacture of cotton seed oil, fertilizers and lumber supplies sufficient and well-salaried employment for this city of over 25,000 people.

Studebaker opportunities such as this are rarely offered. Usually there is strong competition among dealers on an occasion like this—so if you are interested write for the facts immediately.

STUDEBAKER

South Bend, Ind. **Detroit, Mich.** **Walkerville, Ont.**

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"AGATHON" is a Greek word for quality—it was chosen as our trademark because it exemplifies the best of everything.

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Every known improvement in advanced steel plant construction has been provided.

We have backed up our facilities with the best ability—every man from the General Superintendent down is of mature experience.

Our raw materials are selected for quality—we must have the best.

We have set up a high standard—"AGATHON" is the word that will insure you of this. "AGATHON" guarantees your satisfaction.

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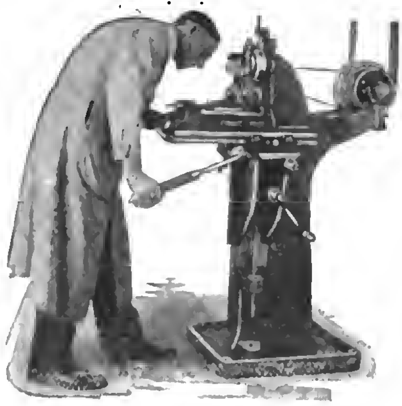
"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon

Shipping Facilities—3 Railroads

The Central Steel Company, Massillon, Ohio

Detroit Office, 326-27-28 Ford Bldg. **F. Walter Guibert, Sales Manager**



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For Second-Hand Cars, Surplus Parts, Accessories, Tires Machinery & all other Special Announcements of a Similar Character

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ALL SEASON'S RECORDS
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SCHEBLER EQUIPMENT

Why not get a Schebler Model R Carbureter for your car? Our exchange proposition makes it easy.

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SLIGHTLY USED CARBURETORS
Stromberg, Rayfield and Model L. Schebler in nearly all sizes, $8 each. Condition guaranteed. Terms C. O. D. or cash with order. When cash accompanies order goods are shipped prepaid. **Henry A. Currier**, 5 Harmony St., Salem, Mass.

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AUTOMOBILE CARPETS
Best grade hand made Wilton and Saxony Auto Carpets

Ford	Chevrolet	Overland, Model 88
$3.00	$3.50	$4.00

All shades and colors to match your car. Carpets for other cars. Prices mailed on request.

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High Grade Carpet and Rug Specialist
1087 3rd Ave. New York City

Cars for Sale—Wanted

Late Model 5-pass. 4-cyl. Cole
fully equipped in every way. A bargain.
CONDON
2635 Wabash Ave.—Calumet 5311, Chicago.

Matheson
Cars and Repair Parts
Frank F. Matheson Wilkes-Barre, Pa.

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We have openings for
Automobile and Mechanical Draftsmen, Layoutmen, Checkers and Detailers.
Also Factory Executives. Write us.
The Toledo Engineering Agency,
Toledo, Ohio.

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Charging Generators For Sale

Battery Charging, Set Mounted on Iron Base and Driven by 5 H.P. Alternating Current Motor, Complete with Switchboard and Meters.

INDUSTRIAL MACHINERY COMPANY
90 West St., New York

PLANTS BOUGHT AND SOLD

The buying and selling of Automobile Plants our specialty. High-class Machine Tools, new and used, for immediate delivery.

New Jersey Machinery Exchange
21 and 23 Mechanic Street, Newark, N. J.

IMMEDIATE DELIVERY

"Not Overhauled"—But Practically New

Baker High Duty Drills with Chuck.
36 inch Fellows Gear Shaper, late pattern.
½ in. Pratt & Whitney Auto Screw Machine.
No. 1 Cincinnati Uni. Tool Room Grinder.
No. 1 Nutter Barnes Cold Saw.
Dwight Slate Auto Pinion Cutter.
Large assortment of new and used tools in stock.
We are always in the market for good used machinery and will buy complete plants for cash.

SHOW ROOMS:
MANHATTAN MACHINERY EXCHANGE
West B'way & White Street, New York City

Machine Tools—For Sale

1—19-38 x 10 LeBlonde HD Extension lathe, geared head, motor drive, 220-440 V., 60 cycle, 3 phase, New.
2—18" swing x 8' bed Ciaco lathes QCG, HS, PCF.
1—14" swing 6' bed Reed lathe, HS.
1—22" swing x 12' bed American QCG, CR, chuck.
1—40" swing x 14' bed Harris lathe. CR, PCF.
1—60" swing x 10' bed New Haven Boring-Facing lathe. CR, HS, PCF.
1—14" swing x 6' bed Carroll-Jamieson, CR, HS, PCF.
1—20" swing x 8' bed Pond lathe, CR, PCF, chuck.
1—14" swing x 6' Porter lathe, HS, CR, PCF.
1—10" swing x 4' Reliable lathe, Screw-cutting, PCF,
1—10" x 5' Bed Star lathe, PCF, complete.
1—14" swing x 6' bed Putnam lathe, CR, HS, PCF.
1—34" swing x 22' New Haven, CR, PCF, raising blks. to 44". 34" chuck, complete.
1—28" swing x 20' New York Steam Co. face plate drive, PCF, CR, complete.
1—30" swing x 16' New Haven, P. Rest, PCF, 5" belt.
1—22" swing x 12' bed Fifield CR, PCF, Grinding attachment.
3—14" swing x 8' bed Monarch QCG. New lathes.
3—No. 1½ American Plain Millers, gear box feed, same as No. 1½ Cincinnati (New), boxed.
3—No. 7 Becker-Brainard Lincoln Type Mills, Cab. legs.
1—Bement Miller, Lincoln type.
1—No. 1 Steptoe Hand Miller, used 3 months, index head.
1—No. 5 Brown-Sharpe Vert. Miller, fine condition.
1—52" Bement-Miles Vert. Boring Mill, 2 swivel hds.
1—16' American H. D. Shaper, motor drive, 220-440 V. 60 cycle, 3 phase, (New).
1—18" Juengst Shaper, vise, fine condition.
10—New No. 6 Standard Universal Tool-Reamer Grinders.
1—24 x 24 x 6 Cincinnati H. D. Planer Motor Drive, 220-440 V., 60 cycle, 3 phase (New).
1—20 x 20 x 5 Putnam Planer, heavy type, complete.
1—36 x 36 x 12 New Haven Planer, good condition.
1—Pratt-Whitney Turret Lathe, 1 7/32" hole, double cutting off slide.
1—15" Bement Slotter, good condition.
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Such a condition now confronts us.

Advertisements have recently appeared in which certain concerns have purported to supply a full line of Krit repairs. One concern even asserted that it had purchased the Krit Motor Car Company and was now furnishing replacement parts from original patterns.

We therefore issue a warning to Krit owners against the misleading statements which have appeared. The warning applies as well to those who have made these statements. In the future we will take prompt and decided legal action whenever and wherever like offenses occur.

Here are the true facts:

The Krit Motor Car Company is still in operation and will continue in operation indefinitely.

The Krit Motor Car Company has sole possession of all its own jigs, dies, tools, patterns, forms and the engineering records from which its parts are made. It is absolutely impossible for any other individual or company to have access to them or to furnish Krit repairs with any degree of accuracy.

Further, the Krit Motor Car Company alone is obligated to Krit owners. Our service consists not only in supplying repairs but also in furnishing counsel and assistance in the operation and care of every machine.

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Pistons, Rings and Wristpins made to fit. All work guaranteed. Write for information and quotations.

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New Pistons and Rings Fitted Correctly.
GEARS
and other parts to order. Prompt and reasonable.
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LARGEST BECAUSE BEST

Send for Price List

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Special Light Alloy Pistons

Our special facilities enable us to do highest grade work.

Over 225 Piston Patterns

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New Magnalite or Cast Iron Piston with Rings to Fit—Oversize Wrist Pins—of All Models.
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CYLINDER GRINDING
We make new pistons, rings and pins. Regrind crankshafts. Fully equipped Machine Shop with Hydraulic Press. Expert workmen. All work guaranteed.
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C-Y-L-I-N-D-E-R G-R-I-N-D-I-N-G
By experts on Heald Grinder. All pistons, rings and wrist pins ground mechanically perfect. All patterns and sizes in stock. Write for quotations.
SAUCKE BROS., 47 Franklin Street Rochester, N. Y.

CYLINDERS REBORED

We Rebore Cylinders and equip with our **Eclipse** rings and extra high quality pistons, insuring a correct fit and giving extra efficiency to your motor. Give us a trial. Prices interesting.

HOPE MACHINE COMPANY
Mfrs. Eclipse Piston Rings
2310 N. 2nd Street, Philadelphia, Pa.

CYLINDERS REBORED AND GROUND
fitted with light pistons and LEAKLESS RINGS.
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CYLINDERS REBORED

Including new pistons and rings, $7 to $11 per cylinder. General overhauling and repairing.

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Cylinders, crankcases and crankshafts welded.

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ALUMINUM ALLOY PISTONS

Will increase speed and power, reduce vibration and eliminate carbon trouble. We are the first in New York to offer these pistons to motorists. **Get our prices on regrinding cylinders and for ALUMINUM ALLOY PISTONS.**

Oversize Pistons, Pins, Rings and Bushings.

PRECISION AUTO PARTS CO.
44 West 49th Street New York City

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including new pistons and rings, $4.75 to $13.75 per cylinder. Write for our prices on **Abcilium** pistons (⅓ weight of cast iron).

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IF YOUR FORD LACKS POWER

We'll rebore cylinders, supply new pistons, wrist pins and rings for $10, making it good as new.

Auto Parts and Repair Co.
101 Liberty St. Springfield, Mass.

SCORED CYLINDERS reclaimed with our new silver process, without over-size pistons and rings. All castings welded. Work guaranteed or money refunded. **Oxy-Acetylene Welding.**

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All Makes and Types Replaced

Fully charged batteries to fit any car, shipped from stock.

LOWEST PRICES

on thoroughly **guaranteed** batteries.

Magnetos, Starting Systems Repaired, Exchanged.

General Lead Battery & Elec. Co.
1675 Broadway, New York

STOP That Knocking and Vibration
LOOK To The Saving of GASOLINE
LISTEN TO YOUR MOTOR

Your **auto cylinder** may need **reboring and new pistons and rings** made. We **weld and braze** any metal that melts.

Hercules Welding and Machine Co.
216 N. 16th St., Philadelphia, Pa.

WE REGRIND CYLINDERS

furnish our heat-treated piston rings and pistons. First class equipment; 15 years' experience. Write for our prices.

Bridgeport Piston Ring Co.
Bridgeport, Conn.

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FREE BOOKLET

"How to Succeed in the Automobile Business," on application—$40,000 equipment—eight instructors—actual work, repairing and driving—Day and evening classes. **Greer College of Motoring,** 1456 Wabash Ave., Chicago.

Largest and best school in U. S. 20 men as instructors and mechanics. Individual road lessons. Practical shop work. Arrangements for out of town men. Booklet on request.

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Automobiles Boxed for Export

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Trucking and Storage. Automobiles and Bodies Stored. Automobiles boxed for Export.

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Shadbroco—the world's greatest cleanser and polish for automobiles and furniture—new and different than all others—**State and County Agents wanted at once**—Big Profits—Only small order required—Territory going fast—Write at once for details.

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ABSOLUTELY GUARANTEED
FUEL REDUCTION

"KARBONOID"

will do it

Or Your Money Back

The Autocar Sales & Service Co. of Boston, Knox Motor Car Co. of Hyde Park, Mass., and many others are saving 6c. to 10c. per gallon, are eliminating CARBON with the resulting increase in motor efficiency.

Sold in the following sizes:

75c treats 90 gals. $1.00 treats 135 gals. $1.25 treats 180 gals.

Avoid substitutes and imitations; demand the genuine

DEALERS—*Write or wire for available territory.*

NEW ENGLAND KARBONOID CO.
46a Tennyson St., Boston, Mass.

BURNLEY SOLDERING FLUX

Paste Form—Stays where it is put. For all metals except aluminum. Solder flows quick and even. Small can 15 cents, larger 25 cents—prepaid.

Burnley Battery Mfg. Co.
North East, Pa.

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Watch our bargain bulletins issued in this paper every week.

We are the World's Largest Automobile Supply House. Buy from us and save money.

This week's specials are:

Mecca 8-Day Cowl Dash Clock..........$2.60
Handsomely designed and finely finished in black; an excellent timekeeper.

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Made of solid steel; noted for its simplicity; one of the most practical on the market.

2-Inch Channel Bar Bumper............$4.80
Can be easily attached to any car; bar is handsomely finished in nickel; fittings are black enameled.

Stewart Vacuum System................$7.75
This system will save each month in gasoline its original cost. Can be installed in any car.

Spring Leaf Spreaders..................$0.25
Fits any size spring; makes it possible to thoroughly lubricate each leaf.

Style "C" Handy Tire Tool.............$0.14
One of the most satisfactory tire tools made. Used with any type clincher or Dunlop casing.

Triple Action Tire Pump................$3.50
Powerful, compound, quick-acting, labor-saving pump. Most satisfactory in emergencies.

J & B Master Vibrators for Ford Cars..$3.95
Specially made for Ford Cars. Increases power of engine and makes starting easy.

Oil Gauge for Ford Cars................$0.18
Most useful accessory for Ford Cars; very easy to attach.

Robe Rail for Ford Cars................$0.25
This rail is especially made for Ford Cars; inexpensive and durable.

The above is but a partial list of our big bargains. Send for a copy of our "Price Wrecker" Catalogue, which shows and describes thousands of supplies and accessories—everything pertaining to the automobile.

Send for a copy of our PRICE WRECKER to-day!

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Largest Automobile Supply House in the World.

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HAND-I-WASH
COMBINATION
WATER—SOAP—TOWEL
INDISPENSABLE TO THE
AUTOMOBILIST

Washing liquid and full roll of best quality, absorbent paper towels contained in handy receptacle. Instantly removes dirt, grease and oil without injury to the most delicate skin. Compact—can be stowed in tool kit.

AT YOUR DEALER'S OR DIRECT $1.00 Prepaid

Refiller complete, Towel, Roll and Tube of Liquid price 50c. Antiseptic and Sanitary.

TAY-MILLER MFG. CO., Inc.
Mfg. Chem., 1712 Cherry St., Phila., Pa.
Special terms to dealers and agents.
Write or wire for territory.

KARBON KLENE

Eliminates all Carbon Deposits. Gives complete Combustion. Engine will start better, run smoother and last longer. Will save 25 to 40% Gasoline. Contains no acid or chemicals. Analyzed by Expert Analytical and Consulting Chemists. Name on request. Use 1 ounce to each 5 gallons of gasoline. Will mix without stirring. Price $1.50 quart. DEALERS—Write or wire for special proposition.

THE KARBON KLENE CO.
227 S. Front Street Philadelphia, Penna.

Old Tops made like new and Waterproof by using **RUB-R-TITE**
Easily applied. Small car size, 60c.; large car size $1.00.

Auto Products Mfg. Co.
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30c FAN BELTS FOR FORDS 30c

Just think of it! 30 cents will buy one of our special made fan belts for your Ford Car. Shipped promptly on receipt of order.

The Geo. R. Carter Co., Connersville, Ind.

WHY DON'T YOU SAVE ON YOUR GASOLINE BILL?

If you could be convinced that you could undoubtedly you would have done so before this, but you were skeptical.

WILL YOU PROVE IT TO YOURSELF AT OUR EXPENSE?

Send for a $1.00 tube of

C-A-R-B-O-N-V-O-I-D

which will treat 200 gallons of gasoline, 1 teaspoonful to each 5 gallons. If after using 5 teaspoonfuls to 25 gallons you are not convinced that you are getting from 5 to 7 miles more per gallon of gas, and that your carbon deposits are disappearing, send back the tube and we will cheerfully refund your money.

COULD WE DO MORE?

CARBONVOID SALES CO.
215 Parkman Bldg., Boston, Mass.

Tires

A SAVINGS FOR YOU

In Standard Guaranteed and Used Tires

Size	Used	New	Size	Used	New
30x3	$4.50	$ 6.00	34x4	$ 8.00	$12.00
30x3½	6.00	7.80	34x4½	10.00	17.00
32x3½	6.00	7.00	36x4½	10.00	17.90
33x4	9.00	11.85	37x5	12.00	21.00

10% deposit with order, balance C. O. D. subject to examination. Add 10% for Non-Skid Tires

SPECIAL

200 32x3½ Straightside Plain Tread......$0.75 ea.

WRITE FOR OUR PRICE LIST ON ALL STANDARD GUARANTEED TIRES

ACORN TIRE CO., Inc.
1547 Michigan Ave. Chicago, Ill.

A Guarantee of 4000 Miles

adjustable on that basis in accordance with guarantee as offered by leading tire companies, WITH EVERY TIRE LISTED BELOW:

These tires are Double Tread Tires, method of construction of which is brought down to such perfection that it absolutely SAFEGUARDS YOUR INNER TUBE, as well as give you far more mileage than new ones.

THIS IS NO IDLE BOAST: A TRIAL WILL CONVINCE YOU.

HIGH TIRE COST SHOT TO PIECES.

28 x 3	$4.75
30 x 3	5.25
30 x 3½	6.50
31 x 3½	6.80
32 x 3½	7.35
34 x 3½	8.00
31 x 4	8.25
32 x 4	8.75
33 x 4	9.20
34 x 4	9.50
35 x 4	9.85
36 x 4	10.50
34 x 4½	10.95
35 x 4½	11.20
36 x 4½	11.75
37 x 4½	12.20
35 x 5	12.65
36 x 5	13.00
37 x 5	13.45
38 x 4½	14.60

NO PUNCTURES, BLOW-OUTS, NO ANNOYANCE NOR INCONVENIENCE WHEN YOUR CAR IS EQUIPPED WITH ABOVE TIRES.

One Dollar or deposit sufficient to defray express charges required with each order. Shipments sent promptly C.O.D. SUBJECT TO YOUR INSPECTION.

Empire Double Tread Tire Co.

1622 So. Wabash Ave.,

Chicago, Ill.

Before Buying Double Tread Tires

send us your old Tire and we will Double Tread it at the following prices:

Size	Price	Size	Price
30x3½	$4.50	34x4	$6.00
32x3½	5.00	36x4½	3.00
33x4	6.00	37x5	9.00

LEON JAFFESS, INC.

252 West 55th St., New York City

DOUBLE SERVICE TIRES
Guaranteed 3500 Miles

Size	Plain	Tubes	Size	Plain	Tubes
30x3	$5.00	$2.05	36x4	$9.00	$3.80
30x3½	6.00	2.40	36x4½	10.00	4.60
33x4	8.00	3.45	36x5	11.00	5.45
34x4	9.00	3.60	37x5	11.00	5.55

Non-skid Tires, all sizes, $1.00 Extra.
State if Q. D. straight bead or clincher type
10% Deposit required on all C. O. D. orders.
Discount of 5% when cash accompanies order.
I. Jaffess, 1319J Fifth Ave., New York.
Branch—282J Halsey St., Newark, N. J.

NEW BLEMISHED TIRE BARGAINS
(3,500-Mile Guarantee)

30x3	$6.00	34x4	$12.50
30x3½	7.50	36x5	17.00

We Double Tread your old tires and guarantee perfect satisfaction. Give us a trial.

For recovery, 30x3......$4.00 30x3½....$4.50
34x4......$6.00

Non-Skid 10% Extra.

UNEEDA TIRE CO.
262 Halsey St. Newark, N. J.

A Great Saving
On 4000 Miles Guaranteed Tires and Tubes

Our tires are guaranteed to give service up to 4000 miles under fair usage, and claims for insufficient mileage will be adjusted on a mileage basis when casings are returned by prepaid express.

Our casings are not guaranteed against bottle cut, rock cuts of being run flat.

Prices will soon be forced to rise.

ORDER NOW

NEW, GUARANTEED FIRSTS, TIRES AND TUBES AT SACRIFICE PRICES
For a short time only.

	Tires	Tubes		Tires	Tubes
28x3	$4.95	$1.55	34x4	$12.60	$3.15
30x3	0.50	1.90	36x4	13.30	3.10
30x3½	8.00	2.10	37x4	13.75	3.20
31x3½	8.05	2.20	34x4½	15.45	3.40
32x3½	8.55	1.95	35x4½	16.35	3.30
34x3½	0.03	2.10	36x4½	16.15	3.90
36x3½	10.20	2.35	37x4½	16.65	4.20
32x4	10.85	2.90	36x5	17.55	4.55
33x4	12.10	2.95	37x5	18.90	4.65
35x4	12.85	3.10	37x5½	23.50	5.10

Add 10% for non-skid.

Our used tires listed below GUARANTEED 1500 MILES and adjustable on that basis in accordance with the above guarantee. This gives you an opportunity to equip your car with used tires and be protected.

	Tires	Tubes		Tires	Tubes
30x3	$3.50	$1.20	36x4	$7.35	$1.35
30x3½	4.25	1.30	32x4½	6.65	1.60
32x3½	4.05	1.40	34x4½	7.60	1.65
30x4	4.75	1.40	35x4½	7.65	1.60
31x4	6.15	1.60	36x4½	7.95	1.70
32x4	6.65	1.05	37x4½	9.05	1.90
33x4	6.90	1.55	35x5	8.10	1.90
34x4	7.35	1.60	36x5	9.05	1.95
35x4	7.15	1.70	37x5	9.25	2.10

Add 10% for non-skid.

These prices for new and used tires tell the story.

NO SALESMANSHIP NECESSARY

One dollar or deposit sufficient to defray express charges required with each order. Shipments made promptly C. O. D. SUBJECT TO YOUR INSPECTION.

AUTO SALES & PARTS CO.

1602 So. Michigan Ave., Chicago, Illinois.

No Advance in our Tire Prices

DOUBLE TREAD TIRES
GUARANTEED 3500 MILES

We save you 33⅓% to 50%.

Size	Plain	Non-Skid	Size	Plain	Non-Skid
30x3	$4.90	$5.90	33x4	$7.85	$8.85
30x3½	5.75	6.75	34x4	8.75	9.75

Other sizes. 10% Dep. Required.

JAFFE BROS. CO. 260 W. 54th St. New York City

PERSONAL ATTENTION

is given by

COWANS BROS.

to the RECLAIMING of your

worn or blown-out tires.

GREAT SAVING, SMALL COST

average 3000 miles

Send for literature.

150 West 55th St., New York City

Protect Your Inner Tubes
WITH
Hampton's Inner Liner

when you Double Tread your tires. This liner, made of two pieces of highest grade tire fabric with a layer of chrome leather vulcanized between, keeps the heavy stitching, used to Double Tread your tires, from cutting or puncturing your inner tube.

PREVENTS BLOW-OUTS

Write for our price-list and pamphlet explaining the Right Principle.

Straight Side

HAMPTON-CAMPBELL CO.
501-503 No. Illinois St. Indianapolis, Ind.

TIRES
AKRON AND STANDARD

Buy your tires from us and save money. Compare our prices with others.

Size	Plain	Non-Skid	Tubes
28 x 3	$5.25	....	$1.80
30 x 3	5.50	$6.75	1.90
30 x 3½	6.95	7.50	2.15
32 x 3½	7.95	8.75	2.25
34 x 3½	8.85	9.75	2.35
30 x 4	9.45	10.50	2.85
31 x 4	9.65	10.60	2.95
32 x 4	9.75	10.75	3.05
33 x 4	9.85	10.85	3.10
34 x 4	9.95	10.95	3.20
35 x 4	10.45	11.45	3.30
36 x 4	10.95	11.95	3.35
34 x 4½	12.45	13.45	4.00
35 x 4½	12.95	13.95	4.10
36 x 4½	13.50	14.50	4.15
37 x 4½	14.45	15.45	4.25
35 x 5	15.00	16.00	4.90
36 x 5	15.45	16.45	4.95
37 x 5	15.95	16.95	5.05

Deposit required on C.O.D. orders

AKRON TIRE CO., Inc.

Authorized Capital, $300,000.00

1789 Broadway, Corner 58th Street
NEW YORK

A BIG SAVING IN

TIRES AND TUBES

All Fresh Selected Stock—Standard First

GUARANTEED

The quality and service features in these tires and tubes are the same as featured in the tires you are now paying high prices for. The following price list buys fresh selected stock that is positively guaranteed:

Size	New Tires	New Tubes	Size	New Tires	New Tubes
28x3	$ 6.00	$1.25	34x4	$13.25	$3.35
30x3	6.50	2.00	35x4	13.50	3.45
30x3½	8.00	2.25	36x4	14.00	3.50
31x3½	8.50	2.50	34x4½	16.25	4.00
32x3½	9.00	2.50	35x4½	17.00	4.15
34x3½	9.50	2.55	36x4½	17.50	4.25
36x3½	10.75	2.75	37x4½	18.00	4.85
31x4	11.75	2.90	35x5	17.50	5.00
32x4	12.50	3.20	36x5	18.50	5.00
33x4	12.75	3.25	37x5	20.00	5.20

Add 10 per cent to the above prices for non-skid.

Special bargains in slightly used and demountable tires.

Size	Used Tires	Used Tubes	Size	Used Tires	Used Tubes
30x3	$3.50	$1.35	35x4	$7.50	$1.75
30x3½	4.25	1.45	36x4	7.50	1.75
31x3½	4.50	1.50	34x4½	8.00	1.75
32x3½	5.25	1.50	35x4½	8.00	1.80
34x3½	5.50	1.60	36x4½	8.25	1.85
31x4	6.25	1.65	37x4½	9.50	1.90
32x4	7.00	1.60	35x5	8.50	2.00
33x4	7.25	1.70	36x5	9.50	2.00
34x4	7.75	1.70	37x5	9.75	2.20

All goods shipped C. O. D. subject to examination on receipt of 10 per cent of order.

All shipments made promptly. To avoid delay, kindly mention style of your rim when ordering tires, as we have them in straight side, clincher and Q. D. clincher.

TIRE REPAIR & SUPPLY CO.
1463 Michigan Ave. Chicago, Ill.

TIRES

Let us quote you our prices on
TIRES and TUBES
of every
Well Known Make
When writing us please mention size, type and name of tire desired and we will send you
Confidential Prices

EATON & CO.
755 Boylston Street Boston, Mass.

A GREAT TIRE AND TUBE SALE
100 Makes—15,000 Tubes and Shoes. New and Al Stock at Ridiculously Low Prices. Saving from 40% to 70%. "Cheapest House in the City."
Jandorf Automobile Co.
1764 Broadway New York City

Reduce Your Tire Bills
by using our
DOUBLE TREAD TIRES
30 x 3½........$6.00 34 x 4..........$8.00
36 x 4½........$10.00
Write for Illustrated Catalogue and Price List to
B. Liben & Co., 261 W. 54th St., New York.

Welding

A wonderful new welding compound for aluminum, copper and brass. SO-LUMINUM does work in ¼ time and cost of acetylene and **saves parts heretofore scrapped by welders.** No flux or tools required. Use gasoline torch. Sample bar, $1.00; per pound, $3.50. Booklet 33.
So-Luminum Mfg. Co., 1790 Broadway, N. Y.

ATLAS WELDING CO., 42 Elis. Ave., Rahway, N. J., guaranteed to repair parts pronounced impossible or spoiled by others. Broken Crankcases, Axles, Pistons, Flywheels, scored or cracked Cylinders. Stripped Gears rebuilt equal to new. Lost pieces supplied. Crankshafts welded, true to original diameter of bearings.

FINISHED WELDING

Our Oxy-Acetylene welded jobs seldom show repairs. Parts machined to original shape and painted.
HOBBIE WELDING PLANT, HAMPTON, IOWA

WE WELD Cylinders, Crank Cases, Gear Cases, also weld and straighten Auto Frames. Blacksmithing, Leaf Spring, etc. All our work guaranteed.
Crown Welding Works, Inc.,
157 West 54th St. New York

¶ The Automobile "Want" and "For Sale" columns bring quick results.

We are the biggest dealers in Chile

¶ We can do more for manufacturers of automobile accessories than any other concern in the rapidly growing South American market.
¶ We want the agency for *good* products. Best bank references in Chile, fine United States references.
¶ We're *alive*—are *you?* Write us before somebody else does.

AHUMADA & COMPANY
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Auto Top Roof Cover
Roadster, $5.95; Touring, $7.95

Parcel Post paid; Others up to $14; easy to apply; you save ⅔ price of new top. We also build new and repair old auto tops and wheels. Send for catg. and samples of the goods we use in our top roof covers. Dealers wanted.

Split Hickory Wheel & Top Co., 1192 Sycamore Street
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Don't Discard Worn Bearings
We Regrind Them As Good As New
At about 1/5th List Price of New Bearings
AHLBERG BEARING CO.
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BRANCHES:
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The only Clamp that is a real protection against a leak. Quantity prices to manufacturers.

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Sprockets and Differentials
In stock and to order. Send for Catalog.
CULLMAN WHEEL COMPANY
1347 Altgeld Street, Chicago

AUTOMOBILE
Body Sheets
Also materials for Tanks, Hoods, Guards, Fenders, Radiators, Frames, Etc. "THURITE" Deep Drawing Stock, Enameling and Japanning Stock, Electrical Sheets, Roofing.
AMERICAN SHEET AND TIN PLATE COMPANY, - Pittsburgh, Pa.

TUBE BENDING
and BENDING MACHINES for every requirement
MAKERS OF WORLD'S BEST CRUDE OIL BURNERS
FOR FURTHER PARTICULARS WRITE
T. FILLMORE COX
ENGINEERING & TUBE BENDING MACHINE WORKS
BAYONNE, NEW JERSEY

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Scientifically heat-treated Genuine electric furnace alloyed steels. Experts in Spring suspension.

THE E. R. MERRILL SPRING CO.
526-532 W. 28th Street Established 1863 New York City

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In this hot weather use a lubricant that will not melt—use

TRADE MARK NON-FLUID OIL REGISTERED IN UNITED STATES PATENT OFFICE

Summer temperatures alone sometimes cause common grease to melt. Besides, grease melts at bearing temperatures, becomes too thin and leaks out proving its unfitness as a lubricant for your car.

Non-Fluid *always* retains its original density, is *always* ready to lubricate and has 3 times as much lubricating value as grease.

Sold only in orange-colored cans at *your* dealer's.

Write for samples and literature

NEW YORK & NEW JERSEY LUBRICANT CO.
165 Broadway New York

DETROIT PLANT FOR SALE

We offer the plant, known as the P. R. Manufacturing Company, located at 621 Bellevue Avenue, Detroit, Michigan, for sale.

The land has a frontage of 416 feet on Michigan Central Belt Railroad and on Bellevue Avenue. The depth is 163 feet. The location is one of the most desirable in the City on account of its railroad connection and its position in the center of a labor residential district.

Not quite one-fourth of the land is at present occupied by buildings, giving ample room for expansion. The present buildings (two-story) provide about 33,000 square feet of floor space, and are brick, mill construction, and equipped with sprinkler system.

For further particulars address

SECURITY TRUST COMPANY, Receiver
P. R. Manufacturing Company, Detroit, Michigan

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STEEL OR BRASS

NICKEL PLATED OR RUST PROOF

STAMPINGS

THE WINKLEY CO., Detroit, Mich., U. S. A. The Canadian Winkley Co., Windsor, Ont., Canada.

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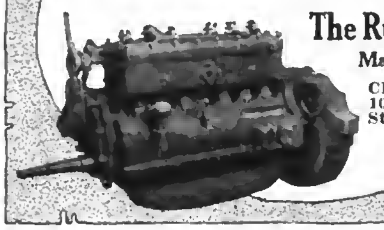
Nothing is more satisfying than the willingness of the Model 25 RUTENBER Motor to respond to each fractional thrust on your accelerator pedal.



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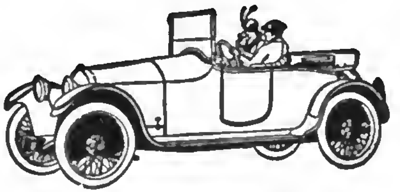

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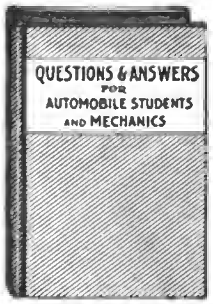

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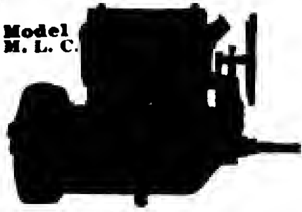

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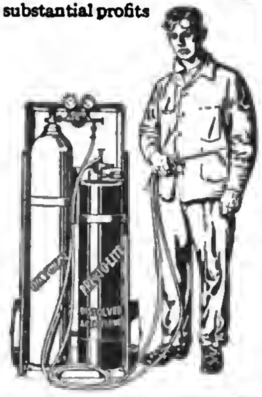

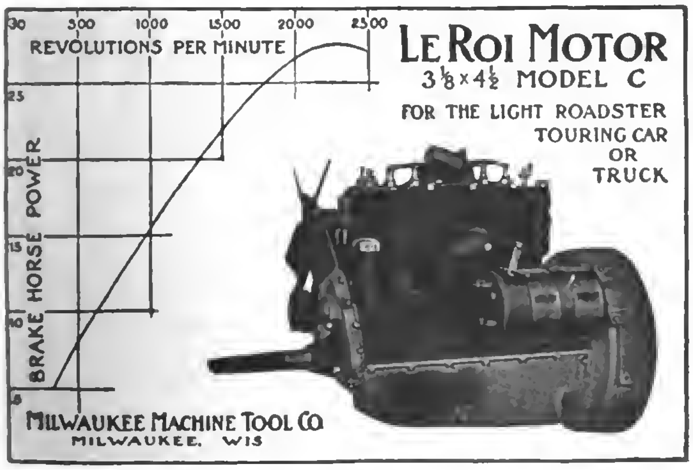

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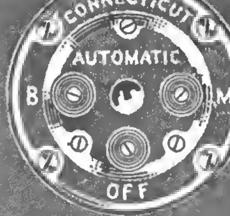
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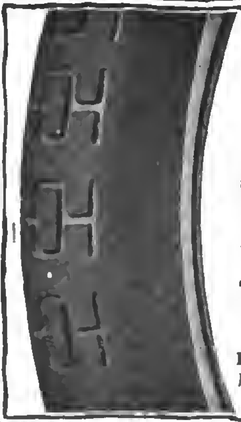

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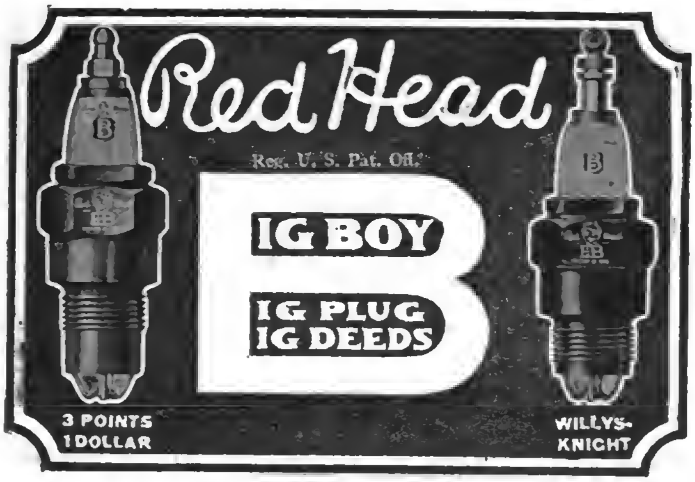

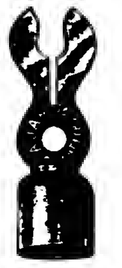

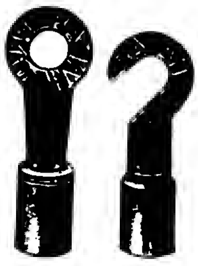


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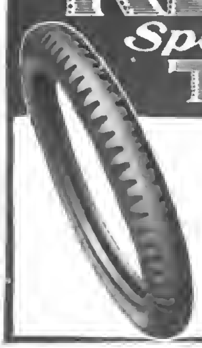

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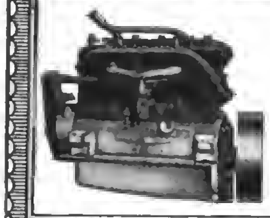

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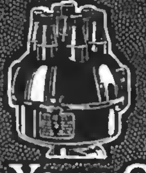

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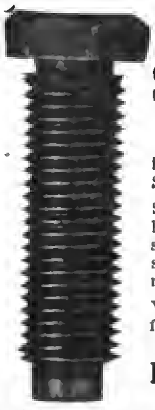

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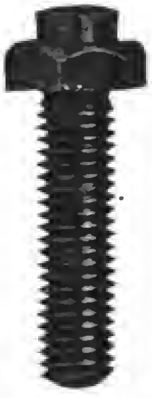

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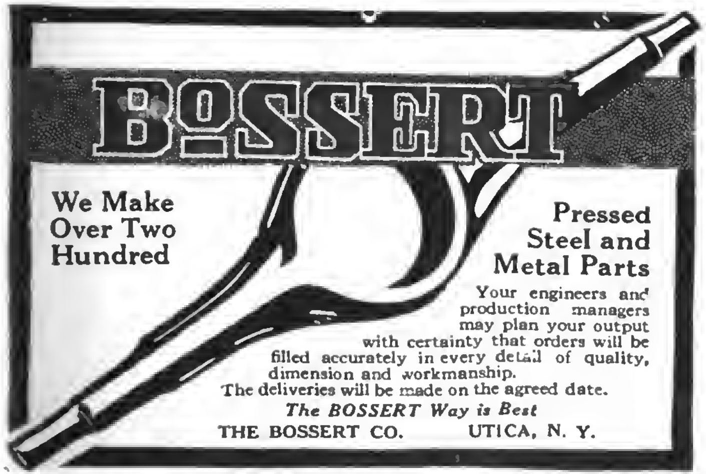

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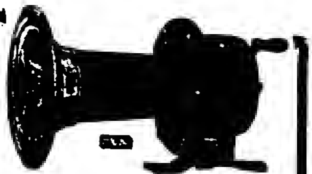

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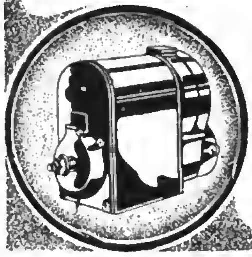

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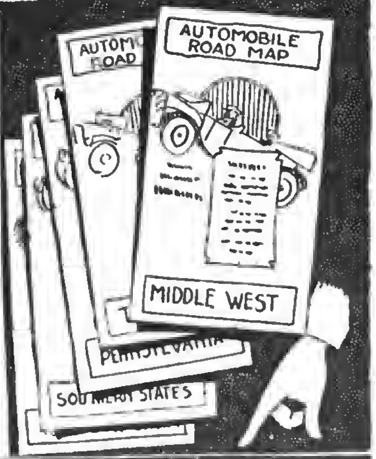

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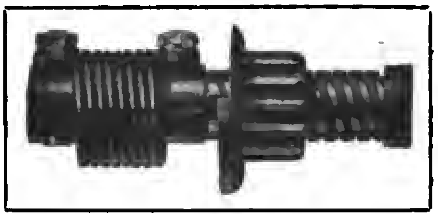

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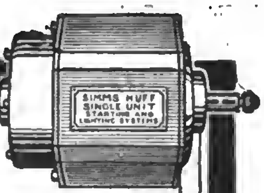

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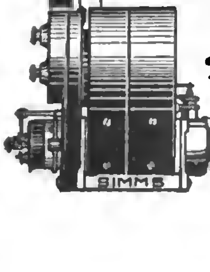

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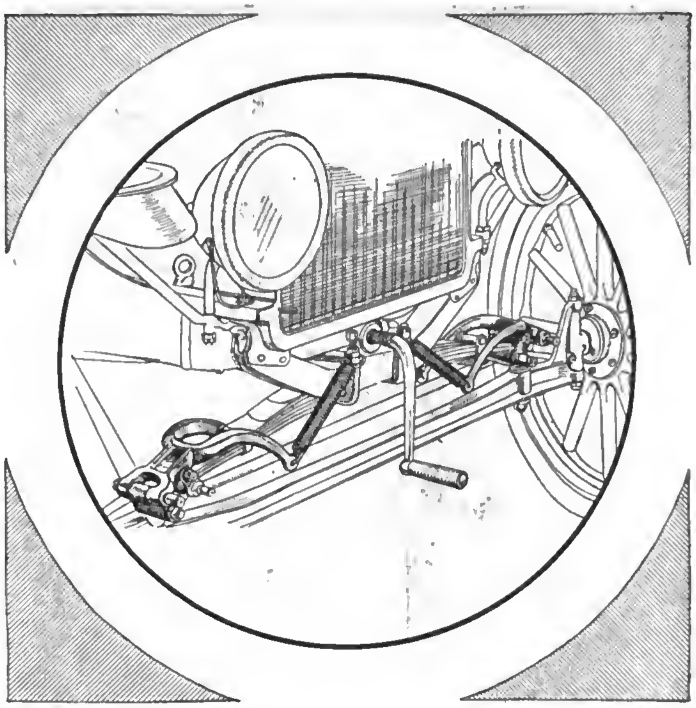

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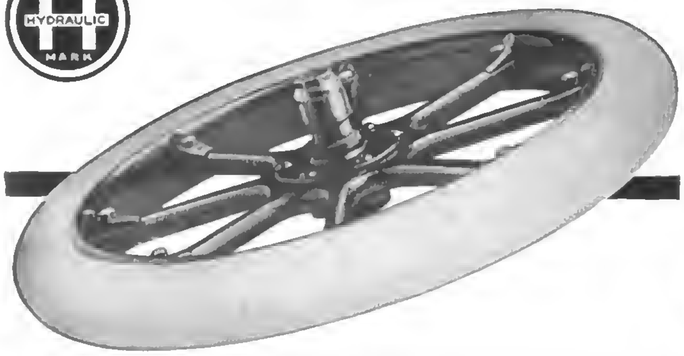

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10% off until July 15. After that date full list.

Prices on Ford SafTsteer, Front radius rod brace, Rear Axle brace and Air Press Pump not increased.

The sharp increase in prices of all materials entering into the manufacture of windshields makes it necessary to increase our list prices. The large item of Plate Glass, of which we use only the best quality, is very high in price and very scarce. This country is now supplying the world with glass. Prices for materials have advanced 100 to 300%. We shall maintain our high standard of materials and workmanship. Until July 15th we will allow a discount of 10% on the above list prices, and after July 15th prices will be full list.

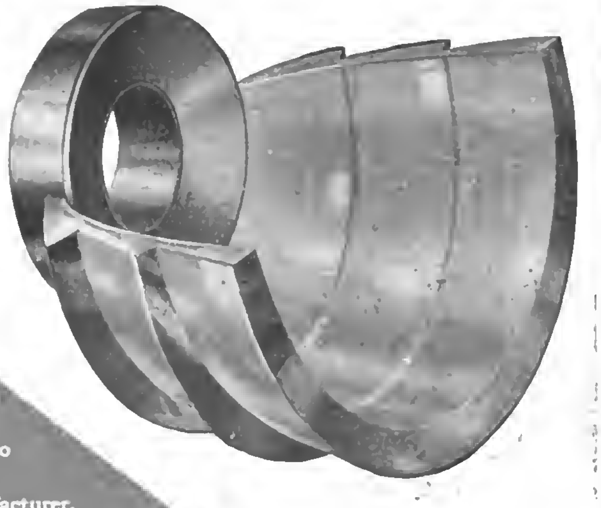
Page Woven Wire Fence Co.

Accessory Division ADRIAN, MICH.

Dealers and Jobbers, write for discounts.

"FRACTO"

$2.75 PER PAIR



Comply with the law without losing the lighting value of your headlights — Equip your lamps with "Fracto."

"Fracto" equipped lamps show every depression, bump, stone and obstruction on the roadway long before you reach them. You get brilliant illumination without the glare which blinds, confuses and endangers approaching motorists and pedestrians.

"Fracto" is a little 2-oz. glass, cup-shaped lens which magnifies and intensifies the light of the bulb under which it is easily and simply attached. It governs the light rays and directs them along the road surface, giving better service than is possible to obtain from any light and ordinary reflector.

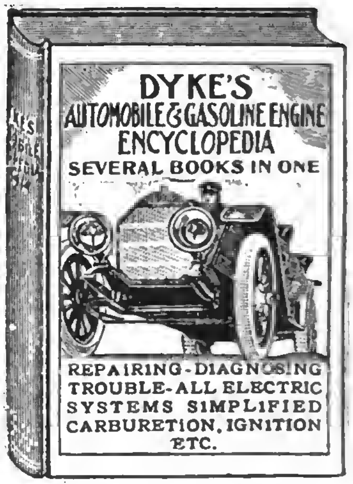
If your dealer can't supply you promptly, send direct to the manufacturer, enclosing price.

FRACTO SPECIALTY CO. 356 Newbury Street BOSTON, MASS.

DYKE'S AUTOMOBILE AND GASOLINE ENGINE ENCYCLOPEDIA—$3.00

FOURTH EDITION—SEVERAL ORDINARY BOOKS IN ONE—

The SIMPLIFIED Book on REPAIRING, TROUBLES, ELECTRIC SYSTEMS, Etc.



Teacher, guide and reference on everything pertaining to motoring,—simple as the a, b, c's. —worth ten times its cost if only used as a reference. Nearly 1750 illustrations, 696 pages in all (large size 6x9). 49 instructions.

The instructions on electric starters, generators and lighting systems, not only deal with the **principle** and **construction** of all leading systems, but the methods for **testing,** such as testing for grounds, short circuits, testing the armature, fields, coils, etc., are thoroughly covered with simplified illustrations.

The Delco and all leading electric systems are thoroughly simplified.

The storage battery is explained in detail; how it is constructed, different connections; how to charge; how to **repair** storage batteries—burning connections, overhauling, etc.

The repair subject is an ordinary book in itself—hundreds of illustrations simplify the text so anyone can understand at a glance. **The repair subject is broad**—it not only covers repairs, adjustments of every part of the car and engine, but such subjects as **equipping a garage for home or business, overhauling cars from the ground up, increasing power of the engine, valve timing, ignition timing, adjusting and relining brakes, differentials, etc., etc.**—every detail is **simplified**—also how to start into the auto repair business.

The 6, 8 and 12 cylinder engine instruction is simplified.

Lack of space prevents a lengthy description of this book. Order the book and see for yourself.

FREE WITH ENCYCLOPEDIA OR AUTO INSTRUCTOR—a Supplement on the detail of construction, principle, operation and care of PACKARD TWIN SIX—KING EIGHT—FORD. Fully illustrated and part printed in two colors.

THEY ACTUALLY WORK BY HAND DYKE'S 4 & 6 CYLINDER ENGINE MODELS ALL MOVING PARTS REAL METAL

Size of 6 Cylinder Model, 11½x11 inches. 4 Cylinder Model, 9¼x11 inches.

At a glance you will learn—the name, purpose and principle of operation and relation of one part to another—firing orders, valve timing, etc.

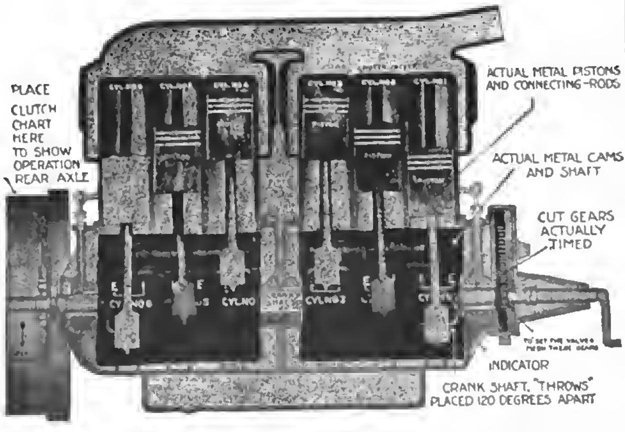
If you had a real engine before you—it would not give you the detail information you would obtain from the models—because you could not see the **inside** operation as you do with Dyke's Models. Each and every part is lettered and full instructions cover every detail.

For instance, when the starting crank is turned, the crank shaft gear turns the cam shaft gear which operates the cam shaft. The cam shaft with its eight or twelve cams are actually turned, and lift the valves at the proper time. As an example; the student can place piston in cylinder No. 1 on power stroke, then refer to chart alongside of engine and see just what all other valves, cams and pistons are doing.

In addition to learning all about the parts of an engine and their purpose; such subjects as valve timing, firing orders of 4, 6, 8 and 12 cylinder engines will be made perfectly clear. **The "eight" and "twin six" engine principles** can be easily understood with these models. The eight uses the same crank shaft as the four, and the twelve the same crank shaft as the six.

Another feature; with the four and six cylinder engine model, we send along charts of **different parts, such as the clutch, gear box, drive shaft, rear axle, the electric starting motor, electric generator, a modern ignition system, inlet and exhaust manifold, etc.** With these charts you can see just how they are applied to the regular engine.

Price of the 4-cylinder engine model (add 35c if to be prepaid)—**$2.50.** Price of 6 cylinder model (add 38c to be prepaid)—**$3.00.**



Crank Shaft, Piston and Connecting Rod side of the 6 Cylinder Engine Model. The opposite side is the valve side. The valves, cams, etc., actually operate and are accurately timed.

DYKE'S AUTO INSTRUCTOR

We combine, the 4 and 6 cylinder models and the Dyke's Auto Encyclopedia, and call this combination the Dyke Auto Instructor. **Price $8.50.** This outfit will enable anyone to become a real expert.

You can learn **quicker** with the book described above and the models, than you can by actual practice, because, with the instruction, you start at the beginning and advance step by step and learn just what you **ought** to know. The models provide the actual practice. You can see the actual **inside** operation, something impossible to see with the real engine. The outfit is worth ten times its cost in actual commercial value to anyone who is not thoroughly posted—and you are your own teacher—during spare time.

A. L. Dyke is the originator of this new idea method of teaching by mail with working models, charts, manikins, etc.

Mr. A. L. Dyke is a pioneer, he originated the first automobile supply business; published the first practical treatise on automobiles; (Dr. Dyke's Diseases of a Gasoline Automobile, 1900); manufactured and marketed the first float feed carburetor in America (1900). In addition he designed and built several early experimental automobiles—both gasoline and electric.

Address Book Dept., THE AUTOMOBILE, 239 W. 39th St., New York, N. Y.

The 1917 Model

Madison

Seven Passenger "Six"

$1150 F. O. B.
ANDERSON,
INDIANA

—A remarkable example of moderate price combined with sterling quality, style and appearance. Unsurpassed by cars selling for $1500 or over. The new Madison Six gives you luxury without extravagance.

Read these specifications—they tell the story.

Wheel base—124 inches.
Motor—Six cylinder Rutenber high speed type, 40 H. P., L head; cast en bloc.
Starting, Lighting and Ignition—Remy.
Carbureter—Rayfield.
Axles—American Gear and Machine Co.'s pressed steel full floating rear, with Gurney annular bearings and Brown-Lipe noiseless nickel steel spiral cut gears, I-beam front.
Clutch—Muncie Gear Works, multiple disc, dry plate.
Gasoline Feed—Stewart-Warner vacuum system.
Wheels—34x4.
Rims—Stanweld demountable. One extra.
Tires—Goodyear 34x4. Non-skid on rear.
Springs—English Manganese double heat-treated steel. Front, semi-elliptic; rear, ¾-elliptic, 56 inches long—underslung.
Upholstering—Genuine long grain, brilliant finished, machine buffed leather, stuffed with real hair.
Color—Richelieu Blue.
Top—One-man type covered with famous NEVERLEEK material, guaranteed.
Equipment—Electric horn, speedometer, ventilating rain vision windshield, tire carrier, foot and robe rails, tools, pump and jack.

Show cars of this new model Madison Six are now on the sales floors of our distributors.

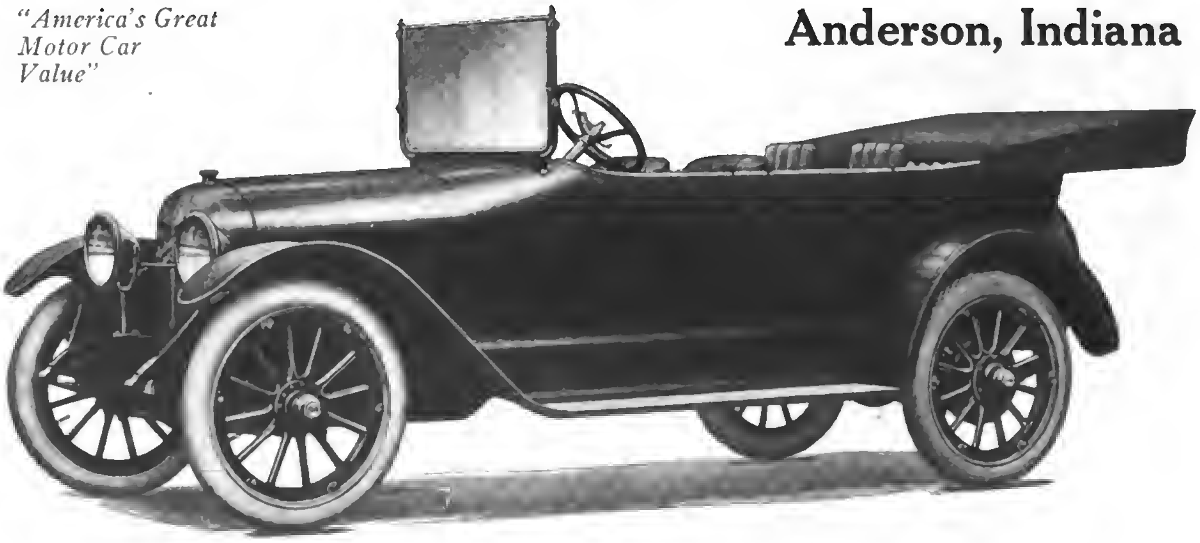
We require a few more distributors for the season of 1917. Get in touch with our sales department if you are in open territory, because every Madison dealer is making good.

Five Passenger Touring Car or Two Passenger Roadster—$1050.

MADISON MOTORS COMPANY

*"America's Great
Motor Car
Value"*

Anderson, Indiana



26 Extra Features

Mitchell MID-YEAR MODEL

$1325
F. o. b. Racine

John W. Bate's Surprise

To Motordom in general, this latest Mitchell came as a great surprise. And the place it has gained is amazing.

The efficiency which this car typifies has been a slow result. John W. Bate, the genius behind it, has done his work in quiet. And the facts you know now were never told until his work was done.

His 17th Model

The Mid-Year Mitchell is the 17th model built under Mr. Bate. It represents the result of 700 improvements.

The Mitchell factory is a John W. Bate creation. Its 2092 up-to-date machines are all of his design or selection. But this model plant, covering 45 acres, is a many-year development.

So what seems now a sudden result has been really a slow evolution.

The Right Basis

What we have aimed at is to get the right basis. We have aimed to build a high-grade car for less than anyone else could build it.

We now have the plant to do that. Here we build 98 per cent of the Mitchell under Bate efficiency methods. And no other plant in existence can build a similar car at our cost.

The result shows clearly in extra value. In a price below any other car of like size, grade and power. And in 26 costly extras which other cars omit.

$1325 **F. o. b. Racine**
For 5-Passenger Touring Car or 3-Passenger Roadster
7-Passenger Touring Body $35 Extra
High-speed economical Six. 48 horsepower; 127-inch wheelbase; complete equipment, including 26 extra features.

A Lifetime Car

But Mr. Bate's efficiency doesn't stop with that. He has stood for a lifetime car.

He insists on big margins of safety, on Chrome-Vanadium steel, and for oversize parts to meet strains.

The New Mitchell has hardly a casting. But 440 parts are either drop forged or stamped from toughened steel.

There are six Bate-built cars which have averaged 164,372 miles each, or over 30 years of ordinary service.

Extra Attractions

He has also stood for extra attractions. Before completing this Mid-Year Mitchell he had experts examine 257 Show models. Then he combined in this single car all the best of the new conceptions.

He has made the Mitchell the most complete car on exhibit. It has 26 features which rival cars lack.

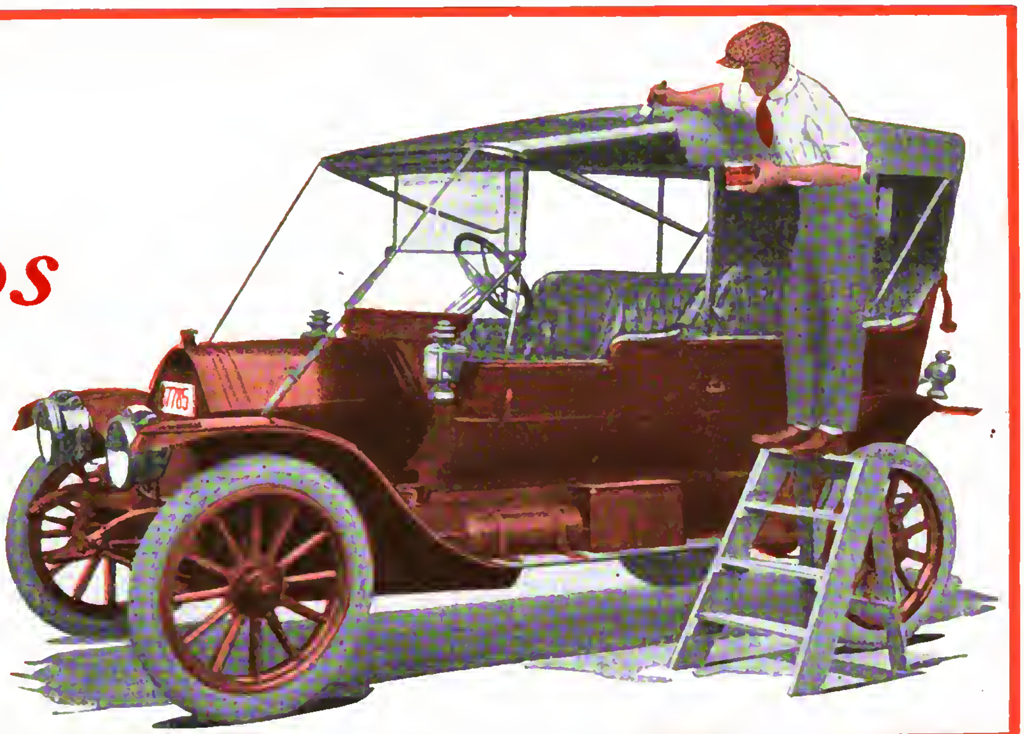
Now we are making these facts known to every motor car buyer. This season alone we spend $500,000 in national advertising.

The demand for the Mitchell has trebled in one year. And the facts behind it are just becoming known.

There are still many chances for dealers who deserve such an opportunity. And we want to hear from them.

MITCHELL-LEWIS MOTOR CO.
Racine, Wis., U. S. A.

"New Tops for Old"



THOUSANDS of automobile owners all over the country who are using Johnson's Prepared Wax and Johnson's Cleaner with such wonderful results will be glad to know about our new product—

JOHNSON'S BLACK-LAC

It is unequalled for touching up **leather cushions—side curtains—tire covers—auto trunks—pantasote** and **mohair tops** and **linings.**

One coat of Johnson's Black-Lac gives a rich, black surface—just like new. It is easy to apply—dries in fifteen minutes—does not rub off on the hands or clothing—is permanent—waterproof and inexpensive.

Do not hesitate to use Johnson's Black-Lac on the finest leather—it acts as a preservative and renders the leather soft and flexible.

For Worn Metal Parts

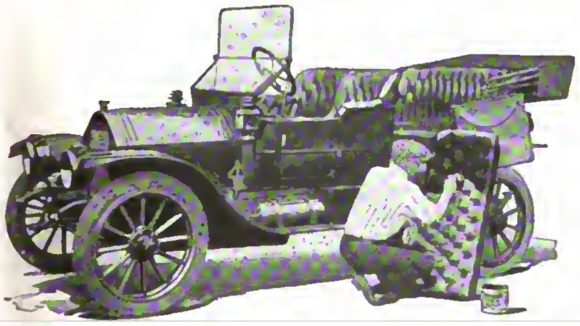
Johnson's Black-Lac is unequalled for blackening **fenders—rims—running boards—hoods—radiators--guards—lamps**—and in fact all worn metal parts. One coat covers. Prevents rust and keeps your car in a high state of repair.

It is no longer necessary to purchase three or four different products for dressing-up your car. Johnson's Black-Lac is six products in one:

1—It is a mohair top dressing.
2—It is a leather top dressing.
3—It is a lining dye.
4—It is a cushion dressing.
5—It is a metal enamel.
6—It is a rim paint.

Use **Johnson's Cleaner** and **Prepared Wax** to keep the body, hood and fenders shining like new Be sure to ask for

JOHNSON'S—"They make old cars New motor stars."



For Sale by Garages and Accessory Dealers

S. C. JOHNSON & SON, Racine, Wis. A7

I am interested in Johnson's Black-Lac—please send me complete information and advise where I can purchase it.

NAME..

ADDRESS...

CITY & STATE..

MY DEALER IS..

The "Fountain of Youth" For Your Tires

DON'T neglect the small cuts and punctures. Your tires will have a new lease of life if you give them immediate attention with

Firestone Accessories

Take Firestone Cementless Tube Patches—for example. They are so easy to put on, are full of "give" and stick indefinitely.

Other helps in the line are Firestone Hook-On or Lace-On Boot, Inside Blowout Patch, Cure Cut, etc. Get complete list from any dealer.

Dealers: Our proposition helps you serve the public and makes money for you. Write

Firestone Tire and Rubber Company
"America's Largest Exclusive
Tire and Rim Makers"
Akron, Ohio
Branches and Dealers Everywhere

Firestone Cementless Tube Patch Free

Easy to put on; sure to stay tight. To prove the success of Firestone patches we will send one free to any car owner or dealer. Ask for Book "Mileage Talks."

TRADE MARK
HB DWF
HESS-BRIGHT
THE INIMITABLE BEARING

TRADE MARK
HB DWF
HESS-BRIGHT
THE INIMITABLE BEARING

HESS-BRIGHT BALL BEARINGS

are a quality product exclusively—the first cost is high.

It is but natural, then, that the manufacturers of one of America's finest automobiles, who insist upon the best, should prefer to use them.

THE HESS-BRIGHT MANUFACTURING CO.
PHILADELPHIA, PA.

HESS-BRIGHT'S CONRAD PATENTS ARE THOROUGHLY ADJUDICATED

The Big Point in Any Car!

Cuts Gasoline Cost!

WHAT have you been doing toward reducing your gasoline expense? What are you *going* to do?

A lot of you car owners have calmly accepted the tremendous rise in gasoline cost, made a few complaints, then let it go at that.

You think gasoline expense cannot be reduced. But it CAN! It IS being reduced!

Since the rise in gasoline prices the sales of the New Stromberg Carburetor have taken phenomenal leaps. Because thousands of car owners realized that the New Stromberg is one absolutely *sure* way to reduce gasoline consumption.

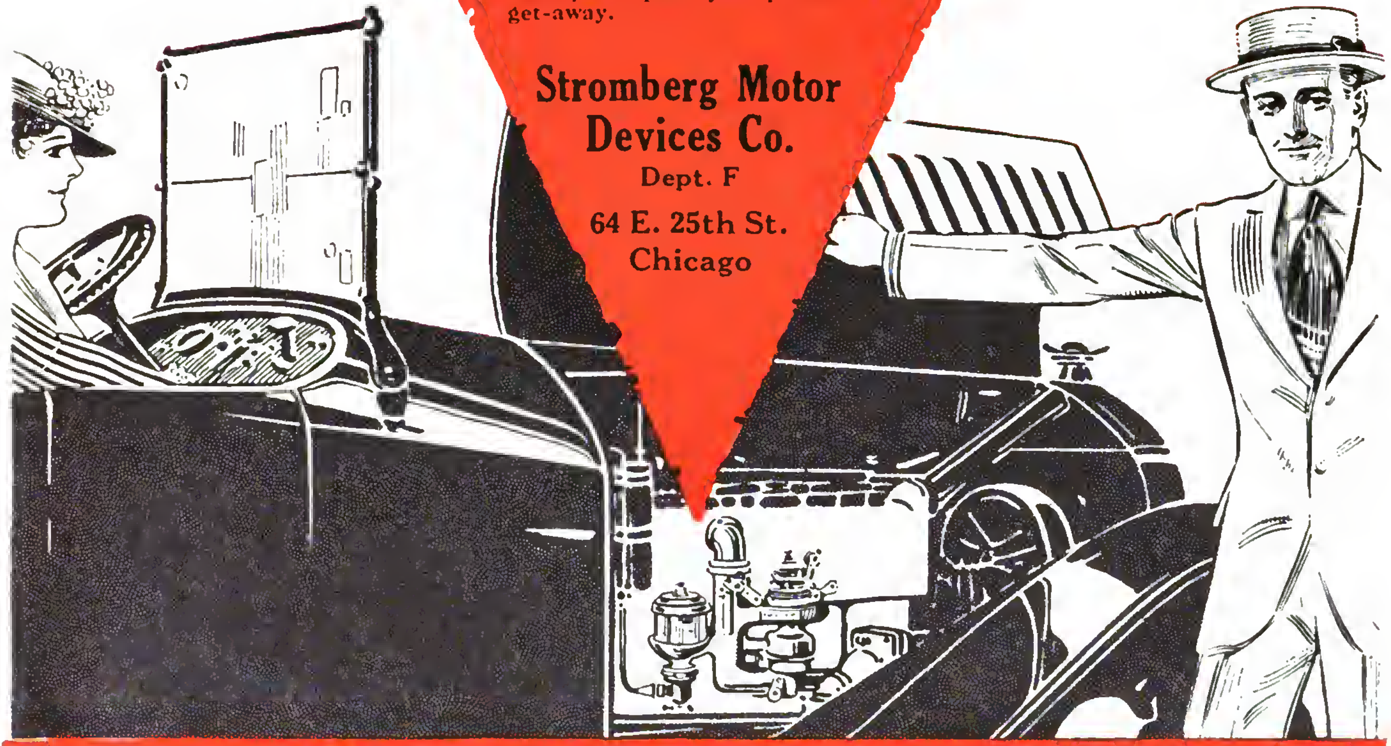
They have watched it make new world's economy records during the past few years on all kinds of cars in all sorts of tests.

We will send you records to prove that the New Stromberg is positively the world's Economy King. Then figure out the amount of gasoline it will save you and you'll find it a mighty profitable investment for you. It is certainly worth your while investing a few dollars now to save many dollars.

There have been numerous investigations into the high price of gasoline, but no real *action*. The *only* consumers who got results were those who were wise enough to install the New Stromberg Carburetor.

Gasoline prices will not come down. So why wait longer for some one to help you? Help yourself! You are wasting real money every day you delay equipping your car with the New Stromberg Carburetor.

Send name, model and year of your car now and we'll *prove* how the New Stromberg will save you money, increase your speed, your power and get-away.



Stromberg Motor Devices Co.
Dept. F
64 E. 25th St.
Chicago

New STROMBERG Does it!
CARBURETOR

Please mention The Automobile when writing to Advertisers


ELECTRIC
LIGHTING
AND
STARTING
as applied to
AUTOMOBILES

Elgin Six

"CLASS"

BUILT LIKE A WATCH ELGIN

The ELGIN SIX has grace and beauty of design that instantly appeals to the most exacting. The racy, yacht-line body and the full five-passenger roominess make it a car of character and distinction.

The mechanical construction throughout is of the highest standard—from the powerful 35 H. P. Six Cylinder valve-in-head motor, down to the smallest detail.

The ELGIN SIX performs like a thoroughbred under the most adverse conditions. It has abundant power and speed. It has perfect balance. Its riding qualities are unexcelled. Its average is twenty to twenty-five miles to the gallon of gasoline.

$845

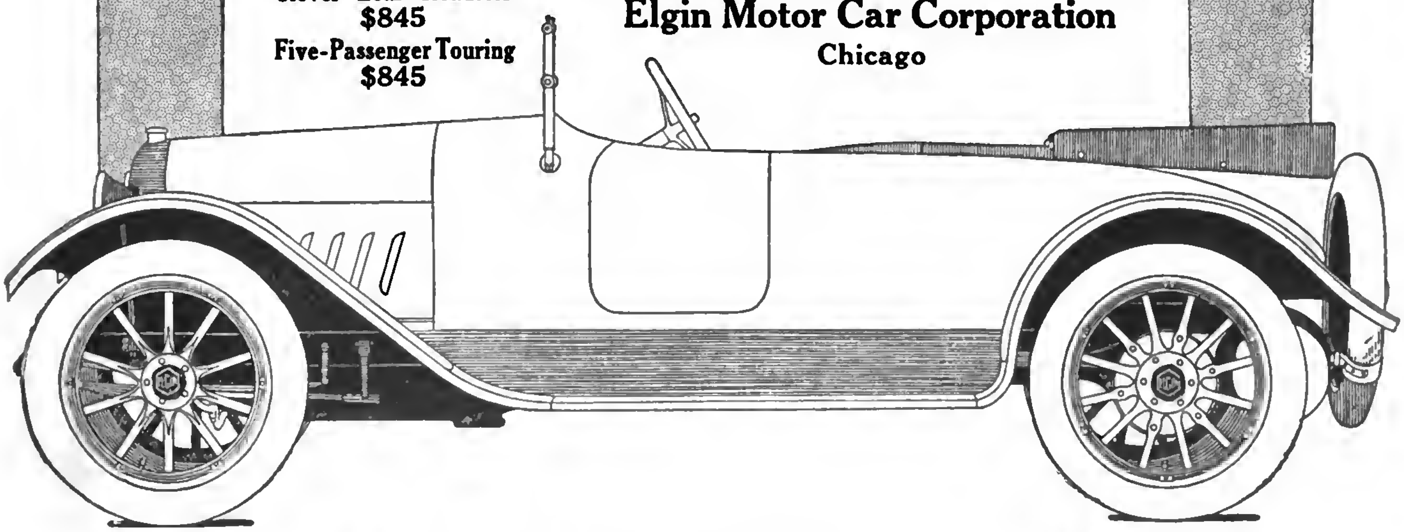
Dealers Will Appreciate These High-Grade Features

- Six-Cylinder Valve-in-Head 35 H. P. Motor.
- Unit Power Plant. Three-Point Suspension.
- V-Type Radiator. Thermo-Syphon Cooling.
- Combination Force Feed and Splash Lubrication.
- Two-Unit Dyneto Electric Starting and Lighting System.
- Delco Ignition System.
- Rayfield Carburetor. Stewart Vacuum Feed.
- Three-Quarter Floating Rear Axle. 12½" Brake Drum.
- Springs, Semi-Elliptic Front, Self-Oiling Cantilever Rear.
- Multiple Disc, Dry Plate Clutch—Steel on Raybestos.
- True Yacht-Line Body. Concealed Hinges and Door Locks.
- Deep Upholstering on Resilient Springs.
- One Man Top—Jiffy Curtains.
- Heavy Stamped Crown Fenders.
- Quick Detachable and Demountable Rims.
- 32" x 3½" Black Tread Tires. Non-Skid Rear.
- 114" Wheel Base. Standard Tread. Clearance 10".
- Price $845 f. o. b. Factory.

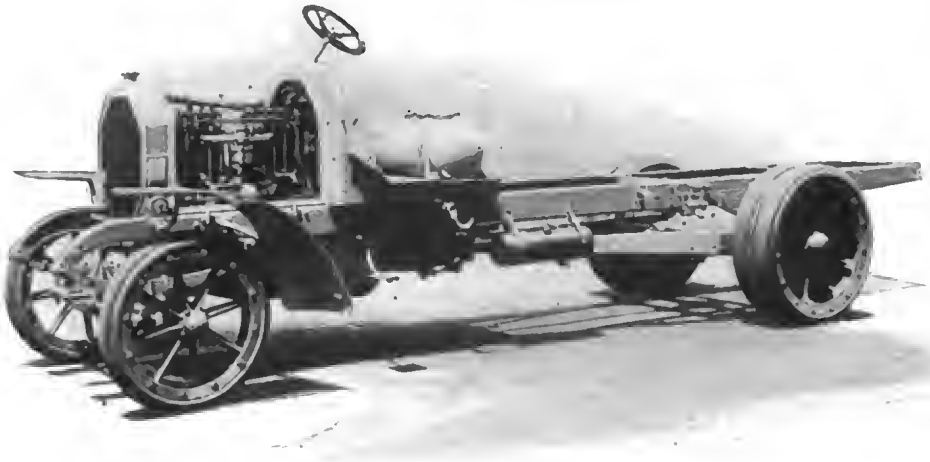
There is still some desirable territory open for responsible dealers. Write or wire us today.

Clover Leaf Roadster
$845
Five-Passenger Touring
$845

Elgin Motor Car Corporation
Chicago



HERE IS THE
"JASCO TANK" MOUNTED



"JASCO TANK"
IS USED ON
General Vehicle Trucks

The "Jasco" Tank is used and indorsed by the following prominent manufacturers:

PLEASURE CARS

Biddle Motor Car Company, Simplex Automobile Company, Mercer Automobile Company, Lozier Motor Company, Stanley Motor Carriage Company, James Cunningham Son & Company, Murray Motor Car Co.

TRUCKS

Baldwin Locomotive Works, Autocar Company, General Vehicle Company, H. G. Burford Company, Peerless Motor Car Company, Garford Motor Truck Co., Gramm Motor Truck Co.

MOTOR BOATS AND NAVAL ARCHITECTS

William H. Hand, Jr., Mathis Yacht Building Company, Gas Engine & Power Company.

The makers of this truck—whose name has been synonymous with Automobile quality for many years—equip their product with the "Jasco" Tank because:—

They have thoroughly investigated and tested it, and they *know* positively that it will consistently "stand up" in service; never springing a leak under the most severe conditions; they believe it is the tank most worthy of being presented to General Vehicle customers on the product of that company.

Have *you* looked into the important question of fuel receptacles? Do you recognize the value of a tank that protects every drop of your gasoline, saving it from leakage, fire or explosion? The "Jasco" Tank is seamless, tinned and tested; it is made of the finest quality drawn steel and it positively cannot leak.

Look carefully at that car you intend purchasing—if you find a "Jasco" Tank as part of the standard equipment you'll know beyond question that the manufacturer is building his product on a consistent quality basis.

JANNEY, STEINMETZ & CO.

Main Office: PHILADELPHIA

New York Office: Hudson Terminal Building

WITH THE POSSIBLE EXCEPTION OF ONE OR TWO POPULAR CAR AGENCIES THE "CARSPRING" EXCLUSIVE DISTRIBUTOR PROPOSITION OFFERS YOU GREATER PROFITS THAN ANY AUTOMOBILE OR ACCESSORY IN ALL MOTORDOM.

A strong statement in view of the fact that over one hundred tire manufacturers are burning the midnight oil to perfect their sales organizations.

Maybe it is presumptuous on our part to match our conservative production (500 Carsprings every twenty-four hours) against the big two and three thousand per day manufacturers, but it is just this difference that places the Carspring Distributor miles in front of the usual tire dealer.

> Carspring Dealer profits are just as positive as the market for new tires, and the Carspring demand is continually increasing in proportion to our production at the rate of 100% every month.

We did not create a new sales plan to merchandise "CARSPRINGS." On the contrary, we continued our fifty-year-old policy of allotting exclusive territory to one good distributor and protecting each distributor to the extent of guaranteeing a liberal profit on every sale from his territory.

Far beyond the immediate "profit point" we enter into a permanent arrangement that will continue uninterruptedly for many years. You can appoint your own sub-agents and you can deal with your customers on a factory branch adjustment basis that offers you sufficient latitude to maintain a healthy, profitable and pleasant business.

Under this sales plan a comparatively limited number of Distributors handle our entire production, and in direct co-operation with our Distributors we confine our publicity to each individual territory.

IN A FEW WORDS

——the best tire that fifty years' rubber experience and unlimited capital can produce.

——a liberal working agreement and a permanent territorial arrangement protecting your profits for years to come.

——concentration of selling co-operation and publicity in Distributor's Territory.

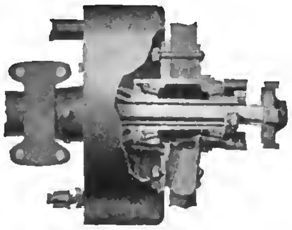
——absolute and unbounded belief in our distributors and authority to appoint sub-dealers and control their business.

We repeat—Carspring Distributors have an unmatchable profit opportunity. One good Distributor in each territory—will you qualify?

New Jersey Carspring & Rubber Co.

Jersey City, N. J.


Columbia
Columbia
Records
TRADE MARK
Note the Notes



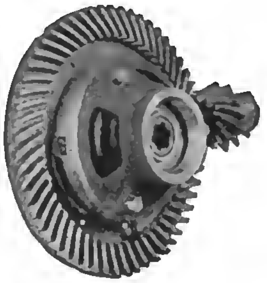
Removable Axle Shafts drive the wheels. One-piece nickel steel Axle Tubes support *entire* weight of car. Hub is of *steel;* Driving Clutch is quickly removable and of *nickel steel.*

Five Features

of Superiority found only in The Full-Floating

American Axle

Equipped with Spiral Bevel Gears and Bock Taper Roller Bearings



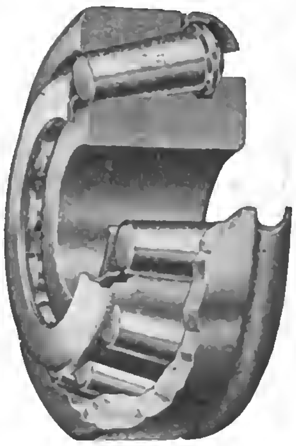
The Spider carrying small differential pinions is free to float—equalizing all strains in the differential.

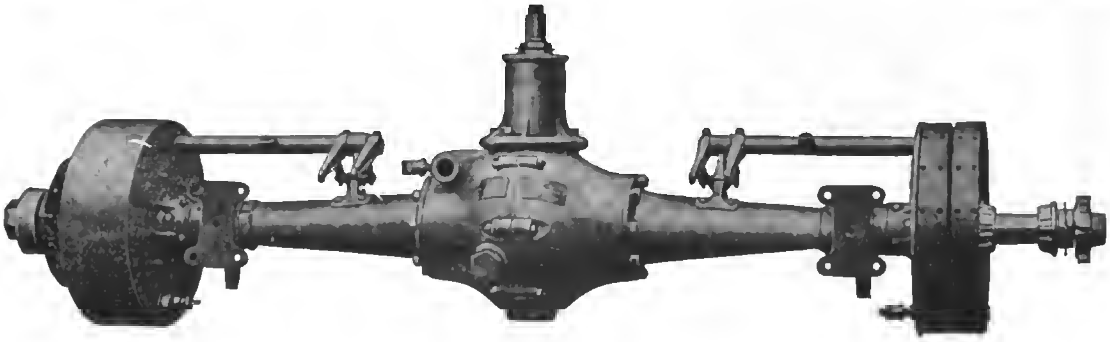
Note the Ball-Shaped Head

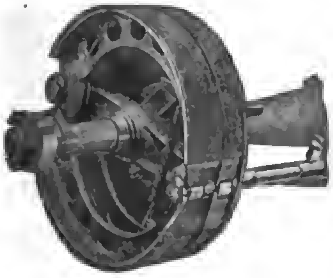
The design of this roller differs from all others in that it has a ball-shaped head which takes the end thrust like a ball thrust bearing, and without the slippage and friction so destructive to other taper roller bearing assemblies.

This design also relieves the tapered roll of having to withstand the jamming caused by end thrust.

Furthermore, the rolls, cones and races of the Bock Bearing are made—*not of ordinary carbon steel*—but of the finest alloy steels obtainable, giving tremendous strength and wear-resisting qualities.







The Twin Internal Brakes do not grab, but exert a brake action always in direct ratio to effort exerted by driver.

Licensed under The Kardo Company Patents

The American Ball-Bearing Co.

Pioneer Axle Builders of America

Cleveland, Ohio

Axle Tubes support *entire* weight of car. They are of *one-piece* construction and made of 3½% *nickel steel* for strength and safety.

MOON
REG. U.S. PAT. OFF.
MOON MOTOR CAR CO.
ST. LOUIS, MO. U.S.A.

The New 1917 Models

Last spring we adopted the double-cowled body on the Moon Six-44. So quickly did it find favor with both dealers and owners, that we have selected this design for the new 1917 models—the Six-66 and the Six-43. In addition to this feature, the 1917 body design (Delauney-Belleville type) exhibits still further refinement. Speed and power are expressed by its long, straight lines—and this impression is heightened by the smart, slanting windshield.

(We venture a prediction: So well has this design been received by the public that we believe by the end of 1917 every car of any moment will have followed our lead in the adoption of this double-cowled body.)

Moon 1917 models will challenge attention and admiration in any company and under any conditions.

But we have not stopped with the improvement of the body design. You will see in this further list of the principal 1917 features many other reasons for Moon desirableness.

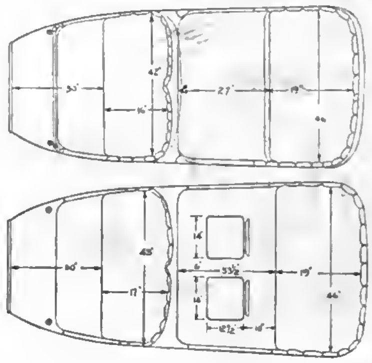
Six-43

Actual Brake Horsepower

AND

Six-66

Actual Brake Horsepower



MOTOR—New Continental-Moon high-speed efficiency type, developing, in the Six-66, full 66 horsepower (actual brake test). The Six-43 develops 43 horsepower (actual brake test). In each case tremendous power in proportion to its weight.

STARTING, ETC.—New two-unit Delco-Moon starting, lighting and ignition system. Bendix automatic drive in connection with starting motor.

UPHOLSTERY—Genuine tan Spanish leather, adding both to the beauty and the comfort of the car.

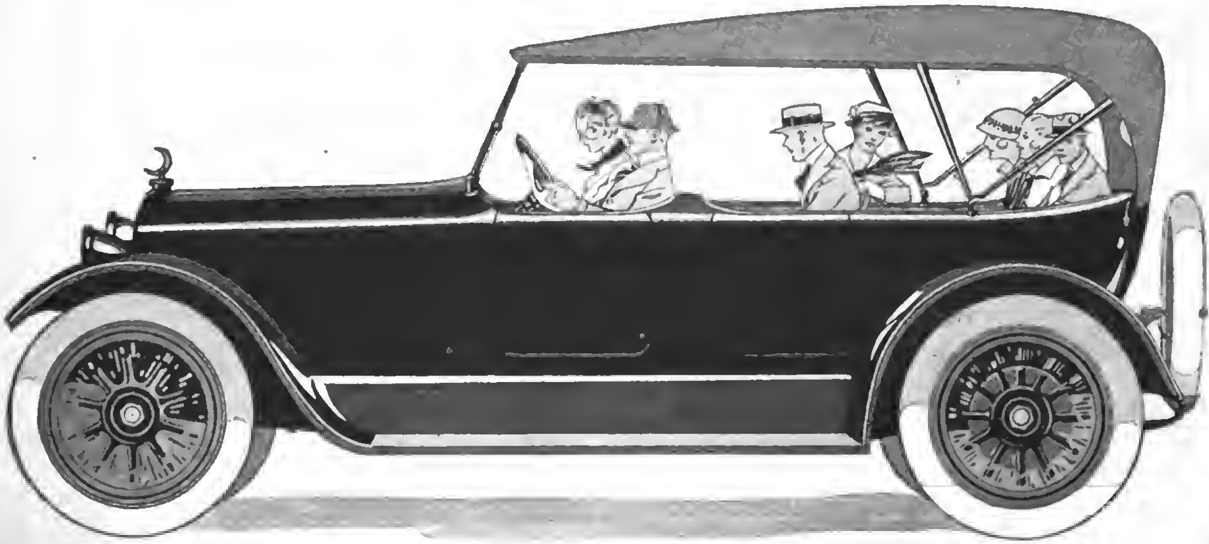
BODY—Delauney-Belleville type, with double cowl and slanting windshield. Big and roomy (Moon cars have always been noted for their roominess in both front and rear compartments). The seats are especially designed to *fit and rest the body.* The Six-43 body is not quite so long as the Six-66, as space is not needed for the extra seats.

REAR AXLE—Of course the spiral gear *noiseless* rear axle.

WHEELBASE—On the Six-66, 125 inches; and on the Six-43, 118 inches. It will be readily seen from this that these are *big sixes*—as big or bigger than many other sixes selling $500 to $600 more.

PRICE—Six-66, seven passenger, fully equipped, $1575; Six-43, five passenger, fully equipped, $1250.

MOON MOTOR CAR COMPANY, St. Louis, Mo.



"The World's Best Carburetor"

In a contest recently appearing in "*Horseless Age*," asking for the name of the World's Best Carburetor, 430 replies were received.

Of this number 300 contestants selected for this honor

RAYFIELD CARBURETORS

Owners who equip their cars with Rayfields solve the problem of high fuel cost; for a saving of 10 to 50 per cent is guaranteed in every instance; a *fact* with which dealers are familiar—a *reason* why dealers substitute Rayfields on demonstrators originally equipped with other carburetors.

A dealer in Tacoma states that the Rayfield installed on his four-cylinder demonstrator increased his mileage from 12 to 20, and on his six-cylinder the increase was from 10 to 18 miles per gallon. The dealer also states that the Rayfield added wonderful flexibility and power. A private owner says: "twice as much mileage out of my gasoline, and no carbon trouble."

Car owners will enjoy reading our book, "A Spoonful of Sugar." Ask us for a copy.

Absolute satisfaction or you money back. Order thru any dealer

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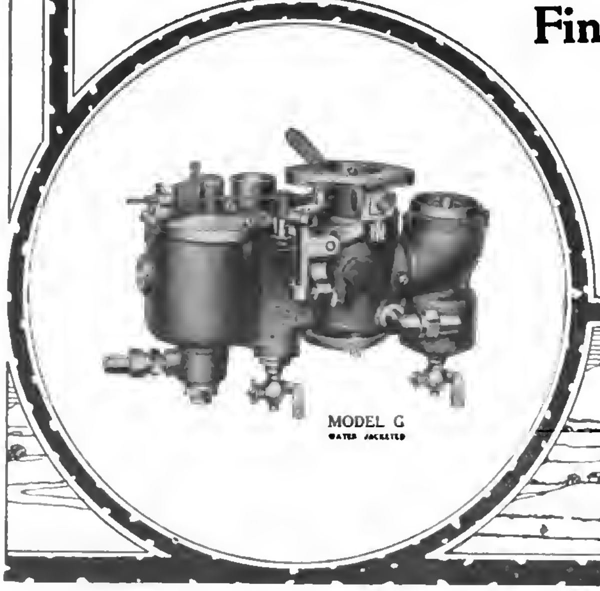

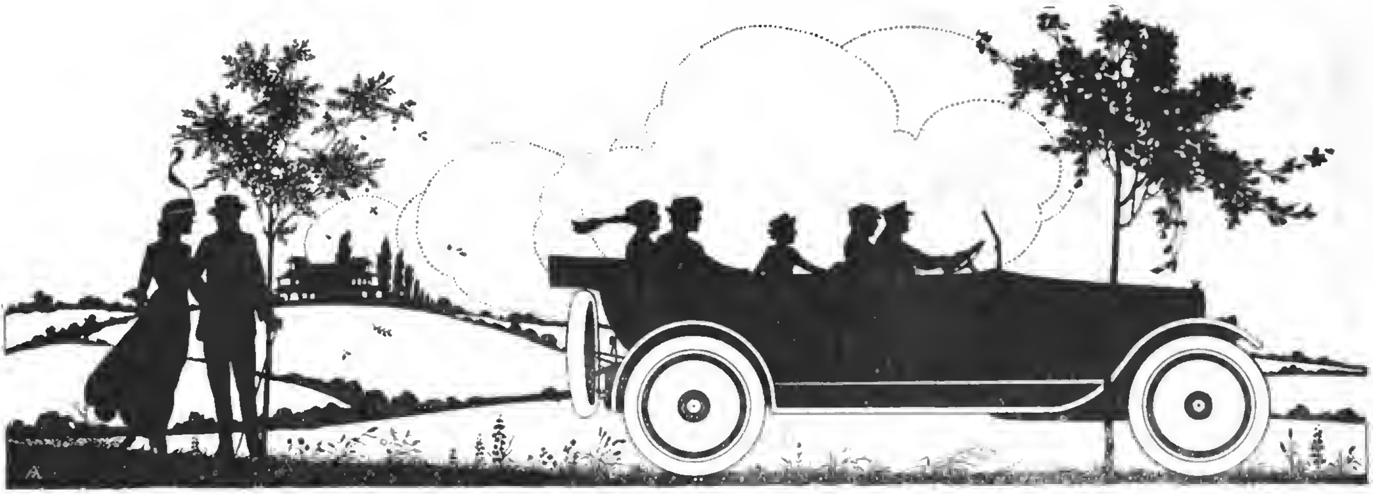

IN THE PARK WITH THE CHANDLER SIX

BOSCH

MAGNETOS ARE MADE TO FULFILL A SERVICE—NOT TO MEET A PRICE

THAT in a nutshell is the reason for the wonderful success of Bosch Magnetos, the reason why more than Two Million Bosch Magnetos are in use today, the reason you should insist that a Bosch Magneto be on the motor car you sell, if an agent, or buy, if an owner.

Not "How Reasonable" nor "How Cheap," but "How Good" is the watchword at the Bosch Works. It is your guarantee that your Bosch Magneto will serve faithfully and efficiently without asking for a minute of your time for adjustments or replacements or for battery attention.

Look at any Bosch Magneto, inside and out, compare its material and workmanship with any other ignition device you may have considered—the decision as to Bosch Superiority is left with you.

BE SATISFIED The motor car you buy or sell can be Bosch-Equipt—insist. SPECIFY BOSCH

Service stations in every state. Correspondence invited.

BOSCH MAGNETO COMPANY

220 WEST 46th STREET NEW YORK CITY

KisselKar

Hundred Point Six

$1095

The Stampede to the *Hundred Point Six*

A RUSH of buyers followed the announcement of Kissel's Ultimatum to the automobile world. They instantly recognized that here was a new standard of value by which all other cars will be judged.

Car buyers everywhere were forcibly impressed with the Hundred Quality Features in Kissel's great *Hundred Point Six*.

Have your KisselKar dealer explain the Hundred Quality Features—compare them—and order early for immediate delivery.

The ALL-YEAR Car

Kissel originated the "two-in-one" idea—the one perfected removable top by which others acknowledge leadership by imitation. The new ALL-YEAR models for the *Hundred Point Six* chassis are way ahead of anything attempted before, showing what the originator can do to maintain his leadership. Don't fail to see them.

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KISSEL MOTOR CAR CO., Hartford, Wisconsin, U.S.A.

This Regal Has the Most Rugged Chassis Ever Built for a Light Car

REGAL MOTOR CAR CO.
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$695

¶ 32 h.p. High Speed Motor, Bore 3½", Stroke 4¾". Has detachable head and three bearing Crank-Shaft. 4 point suspension. Motors built in our own Shops.

¶ Two unit Starting and Ignition System. Magneto type. Starter motor engages fly wheel through Bendix Drive.

¶ Extra deep frame with wide side members furnish great strength and maximum support to chassis. Cantilever Springs, shackled at both ends, directly under frame, make Regal one of the easiest riding cars on the market. Brakes equalized—external contracting and internal expanding.

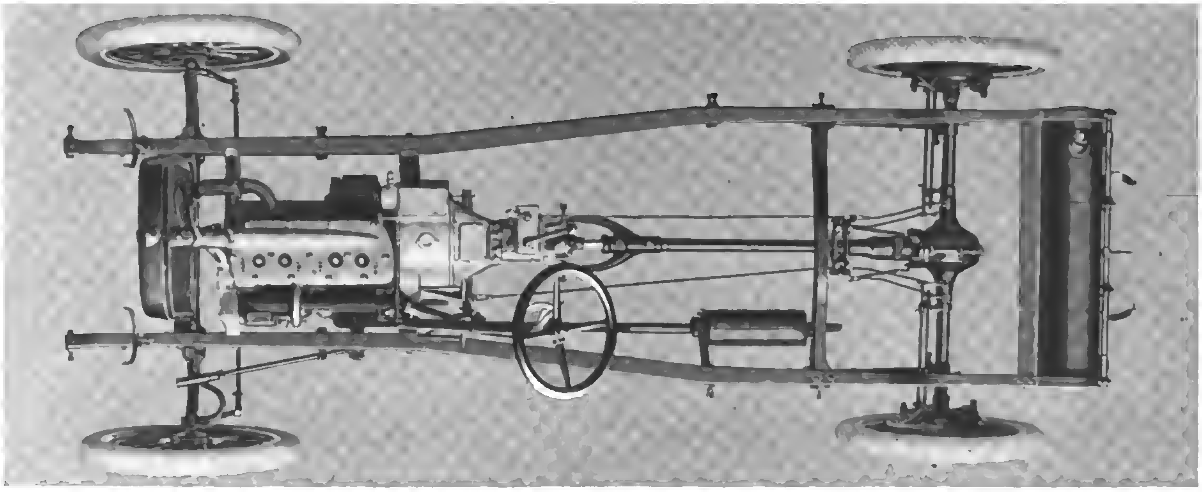
¶ Full floating rear axle. This allows the weight of the car to rest entirely on the axle housing. Front axle, I-Beam, drop forging.

¶ Gasoline tank at rear. 14 gallons. Vacuum feed to Motor.

¶ Add these features to the cruiser type of body design of the Regal 4 Thirty-two, and you have a motor vehicle that will make instant appeal to your prospects.

¶ Complete information as to dealer possibilities and illustrated catalogue on request.

REGAL MOTOR CAR CO. (Dept. C) DETROIT, MICH.



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Where the family purse cannot afford a big, expensive car—

Where the family pride cannot afford an unsightly, little, uncomfortable car—

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Here is the small, comfortable car—a beauty—complete to the last detail—inexpensive—economical—another and greater Overland success.

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But you must ride in it to appreciate its comfort.

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No other car at anywhere near its price can compare with this one for beauty, performance, comfort, completeness and economy.

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